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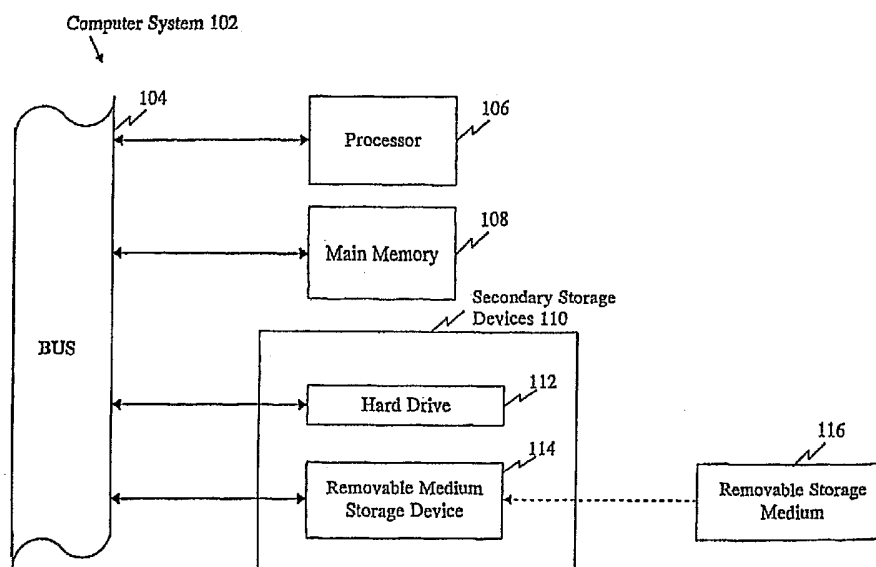
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(54) Title: GENETIC POLYMORPHISMS ASSOCIATED WITH CARDIOVASCULAR DISORDERS AND DRUG RESPONSE, METHODS OF DETECTION AND USES THEREOF



(57) Abstract: The present invention is based on the discovery of genetic polymorphisms that are associated with cardiovascular disorders, particularly acute coronary events such as myocardial infarction and stroke, and genetic polymorphisms that are associated with responsiveness of an individual to treatment of cardiovascular disorders with statin. In particular, the present invention relates to nucleic acid molecules containing the polymorphisms, variant proteins encoded by such nucleic acid molecules, reagents for detecting the polymorphic nucleic acid molecules and proteins, and methods of using the nucleic acid and proteins as well as methods of using reagents for their detection.

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**GENETIC POLYMORPHISMS ASSOCIATED WITH CARDIOVASCULAR
DISORDERS AND DRUG RESPONSE, METHODS OF DETECTION AND USES
THEREOF**

5 FIELD OF THE INVENTION

The present invention is in the field of cardiovascular disorders and drug response, particularly acute coronary events and statin treatment of acute coronary events. In particular, the present invention relates to specific single nucleotide polymorphisms (SNPs) in the human genome, and their association with acute coronary events and/or variability in the responsiveness to statin treatment (including preventive treatment) between different individuals. The naturally-occurring SNPs disclosed herein can be used as targets for the design of diagnostic reagents and the development of therapeutic agents, as well as for disease association and linkage analysis. In particular, the SNPs of the present invention are useful for, for example, identifying whether an individual is likely to experience an acute coronary event (either a first or recurrent acute coronary event), for predicting the seriousness or consequences of an acute coronary event in an individual, for prognosing an individual's recovery from an acute coronary event, for evaluating the likely response of an individual to statins for the treatment/prevention of acute coronary events, for providing clinically important information for the prevention and/or treatment of acute coronary events, and for screening and selecting therapeutic agents. The SNPs disclosed herein are also useful for human identification applications. Methods, assays, kits, and reagents for detecting the presence of these polymorphisms and their encoded products are provided.

25 BACKGROUND OF THE INVENTION

**CARDIOVASCULAR DISORDERS AND RESPONSE TO STATIN
TREATMENT**

Cardiovascular disorders include, for example, acute coronary events such as myocardial infarction and stroke.

Myocardial Infarction

Myocardial infarction (MI) is the most common cause of mortality in developed countries. It is a multifactorial disease that involves atherogenesis, thrombus formation and propagation. Thrombosis can result in complete or partial occlusion of coronary
5 arteries. The luminal narrowing or blockage of coronary arteries reduces oxygen and nutrient supply to the cardiac muscle (cardiac ischemia), leading to myocardial necrosis and/or stunning. MI, unstable angina, or sudden ischemic death are clinical manifestations of cardiac muscle damage. All three endpoints are part of the Acute Coronary Syndrome since the underlying mechanisms of acute complications of
0 atherosclerosis are considered to be the same.

Atherogenesis, the first step of pathogenesis of MI, is a complex interaction between blood elements, mechanical forces, disturbed blood flow, and vessel wall abnormality. On the cellular level, these include endothelial dysfunction,
monocytes/macrophages activation by modified lipoproteins, monocytes/macrophages
15 migration into the neointima and subsequent migration and proliferation of vascular smooth muscle cells (VSMC) from the media that results in plaque accumulation.

In recent years, an unstable (vulnerable) plaque was recognized as an underlying cause of arterial thrombotic events and MI. A vulnerable plaque is a plaque, often not stenotic, that has a high likelihood of becoming disrupted or eroded, thus forming a
20 thrombogenic focus. Two vulnerable plaque morphologies have been described. A first type of vulnerable plaque morphology is a rupture of the protective fibrous cap. It can occur in plaques that have distinct morphological features such as large and soft lipid pool with distinct necrotic core and thinning of the fibrous cap in the region of the plaque shoulders. Fibrous caps have considerable metabolic activity. The imbalance between
25 matrix synthesis and matrix degradation thought to be regulated by inflammatory mediators combined with VSMC apoptosis are the key underlying mechanisms of plaque rupture. A second type of vulnerable plaque morphology, known as "plaque erosion", can also lead to a fatal coronary thrombotic event. Plaque erosion is morphologically different from plaque rupture. Eroded plaques do not have fractures in the plaque fibrous
30 cap, only superficial erosion of the intima. The loss of endothelial cells can expose the thrombogenic subendothelial matrix that precipitates thrombus formation. This process

could be regulated by inflammatory mediators. The propagation of the acute thrombi for both plaque rupture and plaque erosion events depends on the balance between coagulation and thrombolysis. MI due to a vulnerable plaque is a complex phenomenon that includes: plaque vulnerability, blood vulnerability (hypercoagulation, hypofibrinolysis), and heart vulnerability (sensitivity of the heart to ischemia or propensity for arrhythmia).

Recurrent myocardial infarction (RMI) can generally be viewed as a severe form of MI progression caused by multiple vulnerable plaques that are able to undergo pre-rupture or a pre-erosive state, coupled with extreme blood coagulability.

The incidence of MI is still high despite currently available preventive measures and therapeutic intervention. More than 1,500,000 people in the US suffer acute MI each year (many without seeking help due to unrecognized MI), and one third of these people die. The lifetime risk of coronary artery disease events at age 40 years is 42.4% for men (one in two) and 24.9% for women (one in four) (Lloyd-Jones DM; *Lancet*, 1999 353: 89-92).

The current diagnosis of MI is based on the levels of troponin I or T that indicate the cardiac muscle progressive necrosis, impaired electrocardiogram (ECG), and detection of abnormal ventricular wall motion or angiographic data (the presence of acute thrombi). However, due to the asymptomatic nature of 25% of acute MIs (absence of atypical chest pain, low ECG sensitivity), a significant portion of MIs are not diagnosed and therefore not treated appropriately (e.g., prevention of recurrent MIs).

Despite a very high prevalence and lifetime risk of MI, there are no good prognostic markers that can identify an individual with a high risk of vulnerable plaques and justify preventive treatments. MI risk assessment and prognosis is currently done using classic risk factors or the recently introduced Framingham Risk Index. Both of these assessments put a significant weight on LDL levels to justify preventive treatment. However, it is well established that half of all MIs occur in individuals without overt hyperlipidemia. Hence, there is a need for additional risk factors for predicting predisposition to MI.

Other emerging risk factors are inflammatory biomarkers such as C-reactive protein (CRP), ICAM-1, SAA, TNF α , homocysteine, impaired fasting glucose, new lipid

markers (ox LDL, Lp-a, MAD-LDL, etc.) and pro-thrombotic factors (fibrinogen, PAI-1). Despite showing some promise, these markers have significant limitations such as low specificity and low positive predictive value, and the need for multiple reference intervals to be used for different groups of people (e.g., males-females, smokers-non smokers, hormone replacement therapy users, different age groups). These limitations diminish the utility of such markers as independent prognostic markers for MI screening.

Genetics plays an important role in MI risk. Families with a positive family history of MI account for 14% of the general population, 72% of premature MIs, and 48% of all MIs (Williams R R, *Am J Cardiology*, 2001; 87:129). In addition, replicated linkage studies have revealed evidence of multiple regions of the genome that are associated with MI and relevant to MI genetic traits, including regions on chromosomes 14, 2, 3 and 7 (Broeckel U, *Nature Genetics*, 2002; 30: 210; Harrap S, *Arterioscler Thromb Vasc Biol*, 2002; 22: 874-878, Shearman A, *Human Molecular Genetics*, 2000, 9; 9,1315-1320), implying that genetic risk factors influence the onset, manifestation, and progression of MI. Recent association studies have identified allelic variants that are associated with acute complications of coronary heart disease, including allelic variants of the ApoE, ApoA5, Lpa, APOCIII, and Klotho genes.

Genetic markers such as single nucleotide polymorphisms are preferable to other types of biomarkers. Genetic markers that are prognostic for MI can be genotyped early in life and could predict individual response to various risk factors. The combination of serum protein levels and genetic predisposition revealed by genetic analysis of susceptibility genes can provide an integrated assessment of the interaction between genotypes and environmental factors, resulting in synergistically increased prognostic value of diagnostic tests.

Thus, there is an urgent need for novel genetic markers that are predictive of predisposition to MI, particularly for individuals who are unrecognized as having a predisposition to MI. Such genetic markers may enable prognosis of MI in much larger populations compared with the populations that can currently be evaluated by using existing risk factors and biomarkers. The availability of a genetic test may allow, for example, appropriate preventive treatments for acute coronary events to be provided for susceptible individuals (such preventive treatments may include, for example, statin

treatments and statin dose escalation, as well as changes to modifiable risk factors), lowering of the thresholds for ECG and angiography testing, and allow adequate monitoring of informative biomarkers.

Moreover, the discovery of genetic markers associated with MI will provide novel targets for therapeutic intervention or preventive treatments of MI, and enable the development of new therapeutic agents for treating MI and other cardiovascular disorders.

Stroke

Stroke is a prevalent and serious disease. Stroke is the most common cause of disability, the second leading cause of dementia, and the third leading cause of mortality in the United States. It affects 4.7 million individuals in the United States, with 500,000 first attacks and 200,000 recurrent cases yearly. Approximately one in four men and one in five women aged 45 years will have a stroke if they live to their 85th year. About 25% of those who have a stroke die within a year. For that, stroke is the third leading cause of mortality in the United States and is responsible for 170,000 deaths a year. Among those who survive the stroke attack, 30 to 50% do not regain functional independence.

Stroke occurs when an artery bringing oxygen or nutrients to the brain either ruptures, causing the hemorrhagic type of strokes, or gets occluded, causing the thrombotic/embolic strokes that are collectively referred to as ischemic strokes. In each case, a cascade of cellular changes due to ischemia or increased cranial pressure leads to injuries or death of the brain cells. In the United States, the majority (about 80-90%) of strokes are ischemic, including 31% large-vessel thrombotic (also referred to as large-vessel occlusive disease), 20% small-vessel thrombotic (also referred to as small-vessel occlusive disease), and 32% embolic or cardiogenic (caused by a clot originating from elsewhere in the body, e.g., from blood pooling due to atrial fibrillation, or from carotid artery stenosis). The ischemic form of stroke shares common pathological etiology with atherosclerosis and thrombosis. 10-20% of strokes are of the hemorrhagic type, involving bleeding within or around the brain. Bleeding within the brain is known as cerebral hemorrhage, which is often linked to high blood pressure. Bleeding into the meninges surrounding the brain is known as a subarachnoid hemorrhage, which could be caused by

a ruptured cerebral aneurysm, an arteriovenous malformation, or a head injury. The hemorrhagic strokes, although less prevalent, pose a greater danger. Whereas about 8% of ischemic strokes result in death within 30 days, about 38% of hemorrhagic strokes result in death within the same time period.

5 Known risk factors for stroke can be divided into modifiable and non-modifiable risk factors. Older age, male sex, black or Hispanic ethnicity, and family history of stroke are non-modifiable risk factors. Modifiable risk factors include hypertension, smoking, increased insulin levels, asymptomatic carotid disease, cardiac vessel disease, and hyperlipidemia. Information derived from the Dutch Twin Registry estimates the
10 heritability of stroke as 0.32 for stroke death and 0.17 for stroke hospitalization.

The acute nature of stroke leaves physicians with little time to prevent or lessen the devastation of brain damage. Strategies to diminish the impact of stroke include prevention and treatment with thrombolytic and, possibly, neuroprotective agents. The success of preventive measures will depend on the identification of risk factors and
15 means to modulate their impact.

Although some risk factors for stroke are not modifiable, such as age and family history, other underlying pathology or risk factors of stroke such as atherosclerosis, hypertension, smoking, diabetes, aneurysm, and atrial fibrillation, are chronic and amenable to effective life-style, medical, and surgical treatments. Early recognition of
20 patients with these risk factors, and especially those with a family history, with a non-invasive test of genetic markers will enable physicians to target the highest risk individuals for aggressive risk reduction.

Statin Treatment

25 Coronary heart disease (CHD) accounts for approximately two-thirds of cardiovascular mortality in the United States, with CHD accounting for 1 in every 5 deaths in 1998, which makes it the largest single cause of mortality (*American Heart Association. 2001 Heart and Stroke Statistical Update. Dallas, TX: American Heart Association. 2000*). Stroke is the third leading cause of death, accounting for 1 of every
30 15 deaths. Reduction of coronary and cerebrovascular events and total mortality by treatment with HMG-CoA reductase inhibitors (statins) has been demonstrated in a

number of randomized, double blinded, placebo controlled prospective trials (Waters, D.D., *What do the statin trials tell us?* Clin Cardiol, 2001. 24(8 Suppl): p. III3-7, Singh, B.K. and J.L. Mehta, *Management of dyslipidemia in the primary prevention of coronary heart disease.* Curr Opin Cardiol, 2002. 17(5): p. 503-11). These drugs have their

5 primary effect through the inhibition of hepatic cholesterol synthesis, thereby upregulating LDL receptor in the liver. The resultant increase in LDL catabolism results in decreased circulating LDL, a major risk factor for cardiovascular disease. In addition, statins cause relatively small reductions in triglyceride levels (5 to 10%) and elevations in HDL cholesterol (5 to 10%). In a 5 year primary intervention trial (WOSCOPS),
10 pravastatin decreased clinical events 29% compared to placebo in hypercholesterolemic subjects, achieving a 26% reduction in LDL-cholesterol (LDL-C) (Shepherd, J., et al., *Prevention of coronary heart disease with pravastatin in men with hypercholesterolemia.* West of Scotland Coronary Prevention Study Group. N Engl J Med, 1995. 333(20): p. 1301-7). In a similar primary prevention trial (AFCAPS/TexCAPS) (Downs, J.R., et al.,
15 *Primary prevention of acute coronary events with lovastatin in men and women with average cholesterol levels: results of AFCAPS/TexCAPS. Air Force/Texas Coronary Atherosclerosis Prevention Study.* Jama, 1998. 279(20): p. 1615-22) in which subjects with average cholesterol levels were treated with lovastatin, LDL-C was reduced an average of 25% and events decreased by 37%.

20 Secondary prevention statin trials include the CARE (Sacks, F.M., et al., *The effect of pravastatin on coronary events after myocardial infarction in patients with average cholesterol levels. Cholesterol and Recurrent Events Trial investigators.* N Engl J Med, 1996. 335(14): p. 1001-9) and LIPID (treatment with pravastatin) (*Prevention of cardiovascular events and death with pravastatin in patients with coronary heart disease and a broad range of initial cholesterol levels. The Long-Term Intervention with Pravastatin in Ischaemic Disease (LIPID) Study Group.* N Engl J Med, 1998. 339(19): p. 1349-57), and 4S (treatment with simvastatin) (*Randomised trial of cholesterol lowering in 4444 patients with coronary heart disease: the Scandinavian Simvastatin Survival Study (4S).* Lancet, 1994. 344(8934): p. 1383-9) studies. In these trials, clinical event risk
25 was reduced from between 23% and 34% with achieved LDL-C lowering ranging
30 between 25% and 35%.

In addition to LDL-lowering, a variety of potential non-lipid lowering effects have been suggested to play a role in cardiovascular risk reduction by statins. These include anti-inflammatory effects on various vascular cell types including foam cell macrophages, improved endothelial responses, inhibition of platelet reactivity thereby decreasing hypercoaguability, and many others (Puddu, P., G.M. Puddu, and A. Muscari, *Current thinking in statin therapy*. Acta Cardiol, 2001. 56(4): p. 225-31, Albert, M.A., et al., *Effect of statin therapy on C-reactive protein levels: the pravastatin inflammation/CRP evaluation (PRINCE): a randomized trial and cohort study*. Jama, 2001. 286(1): p. 64-70, Rosenson, R.S., *Non-lipid-lowering effects of statins on atherosclerosis*. Curr Cardiol Rep, 1999. 1(3): p. 225-32, Dangas, G., et al., *Pravastatin: an antithrombotic effect independent of the cholesterol-lowering effect*. Thromb Haemost, 2000. 83(5): p. 688-92, Crisby, M., *Modulation of the inflammatory process by statins*. Drugs Today (Barc), 2003. 39(2): p. 137-43, Liao, J.K., *Role of statin pleiotropism in acute coronary syndromes and stroke*. Int J Clin Pract Suppl, 2003(134): p. 51-7). However, because hypercholesterolemia is a factor in many of these additional pathophysiologic mechanisms that are reversed by statins, many of these statin benefits may be a consequence of LDL lowering.

Statins as a class of drug are generally well tolerated. The most common side effects include a variety of muscle-related complaints or myopathies. While the incidence of muscle side effects are low, the most serious side effect, myositis with rhabdomyolysis, is life threatening. This adverse effect has been highlighted by the recent withdrawal of cerivastatin when the drug was found to be associated with a relatively high level of rhabdomyolysis-related deaths. In addition, the development of a high dose sustained release formulation of simvastatin was discontinued for rhabdomyolysis-related issues (Davidson, M.H., et al., *The efficacy and six-week tolerability of simvastatin 80 and 160 mg/day*. Am J Cardiol, 1997. 79(1): p. 38-42).

Statins can be divided into two types according to their physicochemical and pharmacokinetic properties. Statins such as lovastatin, simvastatin, atorvastatin, and cerivastatin are hydrophobic in nature and, as such, diffuse across membranes and thus are highly cell permeable. Hydrophilic statins such as pravastatin are more polar, such that they require specific cell surface transporters for cellular uptake (Ziegler, K. and W.

Stunkel, *Tissue-selective action of pravastatin due to hepatocellular uptake via a sodium-independent bile acid transporter*. Biochim Biophys Acta, 1992. 1139(3): p. 203-9,

Yamazaki, M., et al., *Na(+)-independent multispecific anion transporter mediates active transport of pravastatin into rat liver*. Am J Physiol, 1993. 264(1 Pt 1): p. G36-44,

- 5 Komai, T., et al., *Carrier-mediated uptake of pravastatin by rat hepatocytes in primary culture*. Biochem Pharmacol, 1992. 43(4): p. 667-70). The latter statin utilizes a transporter, OATP2, whose tissue distribution is confined to the liver and, therefore, they are relatively hepato-specific inhibitors (Hsiang, B., et al., *A novel human hepatic organic anion transporting polypeptide (OATP2). Identification of a liver-specific human*
10 *organic anion transporting polypeptide and identification of rat and human hydroxymethylglutaryl-CoA reductase inhibitor transporters*. J Biol Chem, 1999.

274(52): p. 37161-8). The former statins, not requiring specific transport mechanisms, are available to all cells and they can directly impact a much broader spectrum of cells and tissues. These differences in properties may influence the spectrum of activities that

- 15 each statin possesses. Pravastatin, for instance, has a low myopathic potential in animal models and myocyte cultures compared to other hydrophobic statins (Masters, B.A., et al., *In vitro myotoxicity of the 3-hydroxy-3-methylglutaryl coenzyme A reductase inhibitors, pravastatin, lovastatin, and simvastatin, using neonatal rat skeletal myocytes*. Toxicol Appl Pharmacol, 1995. 131(1): p. 163-74. Nakahara, K., et al., *Myopathy*

- 20 *induced by HMG-CoA reductase inhibitors in rabbits: a pathological, electrophysiological, and biochemical study*. Toxicol Appl Pharmacol, 1998. 152(1): p. 99-106, Reijneveld, J.C., et al., *Differential effects of 3-hydroxy-3-methylglutaryl-coenzyme A reductase inhibitors on the development of myopathy in young rats*. Pediatr Res, 1996. 39(6): p. 1028-35).

- 25 Cardiovascular mortality in developed countries has decreased sharply in recent decades (Tunstall-Pedoe, H., et al., *Estimation of contribution of changes in coronary care to improving survival, event rates, and coronary heart disease mortality across the WHO MONICA Project populations*. Lancet, 2000. 355(9205): p. 688-700). This is likely due to the development and use of efficacious hypertension, thrombolytic and lipid
30 lowering therapies (Kuulasmaa, K., et al., *Estimation of contribution of changes in classic risk factors to trends in coronary-event rates across the WHO MONICA Project*

populations. *Lancet*, 2000. 355(9205): p. 675-87). Nevertheless, cardiovascular diseases remain the major cause of death in industrialized countries, at least in part due to the presence of highly prevalent risk factors and insufficient treatment (Wong, M.D., et al., *Contribution of major diseases to disparities in mortality*. *N Engl J Med*, 2002. 347(20): p. 1585-92). Even with appropriate therapy, not all patients respond equally well to statin treatment. Despite the overwhelming evidence that statins decrease risk for cardiovascular disease, both in primary and secondary intervention settings, statin therapy clearly only achieves partial risk reduction. While a decrease in risk of 23 to 37% seen in the above trials is substantial and extremely important clinically, the majority of events still are not prevented by statin treatment. This is not surprising given the complexity of cardiovascular disease etiology, which is influenced by genetics, environment, and a variety of additional risk factors including dyslipidemia, age, gender, hypertension, diabetes, obesity, and smoking. It is reasonable to assume that all of these multi-factorial risks modify statin responses and determine the final benefit that each individual achieves from therapy. Furthermore, with the increasing incidence of Type 2 diabetes and obesity in Western countries (Flegal, K.M., et al., *Prevalence and trends in obesity among US adults, 1999-2000*. *Jama*, 2002. 288(14): p. 1723-7; Boyle, J.P., et al., *Projection of diabetes burden through 2050: impact of changing demography and disease prevalence in the U.S*. *Diabetes Care*, 2001. 24(11): p. 1936-40), which are two major risk factors for coronary artery disease, and the emergence of greater cardiovascular risk factors in the developing world (Yusuf, S., et al., *Global burden of cardiovascular diseases: Part II: variations in cardiovascular disease by specific ethnic groups and geographic regions and prevention strategies*. *Circulation*, 2001. 104(23): p. 2855-64, Yusuf, S., et al., *Global burden of cardiovascular diseases: part I: general considerations, the epidemiologic transition, risk factors, and impact of urbanization*. *Circulation*, 2001. 104(22): p. 2746-53), the need for ever more effective treatment of CHD is predicted to steadily increase.

Thus, there is a growing need for ways to better identify people who have the highest chance to benefit from statins, and those who have the lowest risk of developing side-effects. As indicated above, severe myopathies represent a significant risk for a low percentage of the patient population. This would be particularly true for patients that

may be treated more aggressively with statins in the future. There are currently at least three studies in progress that are investigating whether treatments aimed at lowering LDL-C to levels below current NCEP goals by administering higher statin doses to patients further reduces CHD risk or provides additional cardiovascular benefits

5 (reviewed in Clark, L.T., *Treating dyslipidemia with statins: the risk-benefit profile*. Am Heart J, 2003. 145(3): p. 387-96). It is possible that more aggressive statin therapy than is currently standard practice will become the norm in the future if additional benefit is observed in such trials. More aggressive statin therapy will likely increase the incidence of the above adverse events as well as elevate the cost of treatment. Thus, increased
10 emphasis will be placed on stratifying responder and non-responder patients in order for maximum benefit-risk ratios to be achieved at the lowest cost.

The Third Report of the Expert Panel on Detection, Evaluation and Treatment of High Blood Cholesterol in Adults (ATPIII) contains current recommendations for the management of high serum cholesterol (*Executive Summary of The Third Report of The*
15 *National Cholesterol Education Program (NCEP) Expert Panel on Detection, Evaluation, And Treatment of High Blood Cholesterol In Adults (Adult Treatment Panel III)*. Jama, 2001. 285(19): p. 2486-97). A meta-analysis of 38 primary and secondary prevention trials found that for every 10% decrease in serum cholesterol, CHD mortality was reduced by 15%. These guidelines took into account additional risk factors beyond
20 serum cholesterol when making recommendations for lipid lowering strategies. After considering additional risk factors and updated information on lipid lowering clinical trials, more patients are classified in the highest risk category of CHD or CHD risk equivalent than before and are recommended to decrease their LDL to less than 100 mg/dl. As a consequence, more aggressive therapy is recommended and drug therapy is
25 recommended for 36.5 million Americans. In implementing these recommendations, cost-effectiveness of treatments is a primary concern. In lower risk populations, the cost of reducing one event may exceed \$125,000 compared with around \$25,000 per event in a high-risk patient group (Singh, B.K. and J.L. Mehta, *Management of dyslipidemia in the primary prevention of coronary heart disease*. Curr Opin Cardiol, 2002. 17(5): p.
30 503-11). The cost of preventing an event in a very low risk patient may exceed \$1 million. In the context of cost-containment, further risk stratification of patients will help

to avoid unnecessary treatment of patients. In addition to the various clinical endpoints that are currently considered in determining overall risk, the determination of who and who not to treat with statins based on "statin response" genotypes could substantially increase the precision of these determinations in the future.

- 5 Evidence from gene association studies is accumulating to indicate that responses to drugs are, indeed, at least partly under genetic control. As such, pharmacogenetics - the study of variability in drug responses attributed to hereditary factors in different populations - may significantly assist in providing answers toward meeting this challenge (Roses, A.D., *Pharmacogenetics and the practice of medicine*. Nature, 2000. 405(6788): p. 857-65, Mooser, V., et al., *Cardiovascular pharmacogenetics in the SNP era*. J
- 10 Thromb Haemost, 2003. 1(7): p. 1398-1402, Humma, L.M. and S.G. Terra, *Pharmacogenetics and cardiovascular disease: impact on drug response and applications to disease management*. Am. J. Health Syst Pharm, 2002. 59(13): p. 1241-52): Numerous associations have been reported between selected genotypes, as defined
- 15 by SNPs and other sequence variations and specific responses to cardiovascular drugs. Polymorphisms in several genes have been suggested to influence responses to statins including CETP (Kuivenhoven, J.A., et al., *The role of a common variant of the cholesteryl ester transfer protein gene in the progression of coronary atherosclerosis*. The Regression Growth Evaluation Statin Study Group. N Engl J Med, 1998. 338(2):p.
- 20 86-93), beta-fibrinogen (de Maat, M.P., et al., *-455G/A polymorphism of the beta-fibrinogen gene is associated with the progression of coronary atherosclerosis in symptomatic men: proposed role for an acute-phase reaction pattern of fibrinogen*. REGRESS group. Arterioscler Thromb Vasc Biol, 1998. 18(2): p. 265-71), hepatic lipase (Zambon, A., et al., *Common hepatic lipase gene promoter variant determines clinical*
- 25 *response to intensive lipid-lowering treatment*. Circulation, 2001. 103(6): p. 792-8, lipoprotein lipase (Jukema, J.W., et al., *The Asp9 Asn mutation in the lipoprotein lipase gene is associated with increased progression of coronary atherosclerosis*. REGRESS Study Group, Interuniversity Cardiology Institute, Utrecht, The Netherlands. Regression Growth Evaluation Statin Study. Circulation, 1996. 94(8): p. 1913-8), glycoprotein IIIa
- 30 (Bray, P.F., et al., *The platelet Pl(A2) and angiotensin-converting enzyme (ACE) D allele polymorphisms and the risk of recurrent events after acute myocardial infarction*. Am J

Cardiol, 2001. 88(4): p. 347-52), stromelysin-1 (de Maat, M.P., et al., *Effect of the stromelysin-1 promoter on efficacy of pravastatin in coronary atherosclerosis and restenosis*. Am J Cardiol, 1999. 83(6): p. 852-6), and apolipoprotein E (Gerdes, L.U., et al., *The apolipoprotein epsilon4 allele determines prognosis and the effect on prognosis of simvastatin in survivors of myocardial infarction: a substudy of the Scandinavian simvastatin survival study*. Circulation, 2000. 101(12): p. 1366-71, Pedro-Botet, J., et al., *Apolipoprotein E genotype affects plasma lipid response to atorvastatin in a gender specific manner*. Atherosclerosis, 2001. 158(1): p. 183-93).

Some of these variants were shown to effect clinical events while others were associated with changes in surrogate endpoints. The CETP variant alleles B1 and B2 were shown to be correlated with HDL cholesterol levels. Patients with B1B1 and B1B2 genotypes have lower HDL cholesterol and greater progression of angiographically-determined atherosclerosis than B2B2 subjects when on placebo during the pravastatin REGRESS clinical trial. Furthermore, B1B1 and B1B2 had significantly less progression of atherosclerosis when on pravastatin whereas B2B2 patients derived no benefit. Similarly, beta-fibrinogen promoter sequence variants were also associated with disease progression and response to pravastatin in the same study as were Stromelysin-1 promoter variants. In the Cholesterol and Recurrent Events (CARE) trial, a pravastatin secondary intervention study, glycoprotein IIIa variants were also associated with clinical event response to pravastatin. In all of the above cases, genetic subgroups of placebo-treated patients with CHD were identified who had increased risk for major coronary events. Treatment with pravastatin abolished the harmful effects associated with the "riskier" genotype, while having little effect on patients with genotypes that were associated with less risk. Finally, the impact of the apolipoprotein ϵ 4 genotype on prognosis and the response to simvastatin or placebo was investigated in the Scandanavian Simvastatin Survival Study (Pedro-Botet, J., et al., *Apolipoprotein E genotype affects plasma lipid response to atorvastatin in a gender specific manner*. Atherosclerosis, 2001. 158(1): p. 183-93). Patients with at least one apolipoprotein ϵ 4 allele had a higher risk for all cause death than those lacking the allele. As was the case with pravastatin treatment, simvastatin reversed this detrimental effect of the "riskier allele". These results suggest that, in general, high-risk patients with ischemic heart disease derive the greatest benefit

from statin therapy. However, these initial observations should be repeated in other cohorts to further support the predictive value of these specific genotypes. Although it is likely that additional genes beyond the five examples above impact the final outcome of an individual's response to statins, these five examples serve to illustrate that it is possible to identify genes that associate with statin clinical responses that could be used to predict which patients will benefit from statin treatment and which will not.

SNPs

The genomes of all organisms undergo spontaneous mutation in the course of their continuing evolution, generating variant forms of progenitor genetic sequences (Gusella, *Ann. Rev. Biochem.* 55, 831-854 (1986)). A variant form may confer an evolutionary advantage or disadvantage relative to a progenitor form or may be neutral. In some instances, a variant form confers an evolutionary advantage to the species and is eventually incorporated into the DNA of many or most members of the species and effectively becomes the progenitor form. Additionally, the effects of a variant form may be both beneficial and detrimental, depending on the circumstances. For example, a heterozygous sickle cell mutation confers resistance to malaria, but a homozygous sickle cell mutation is usually lethal. In many cases, both progenitor and variant forms survive and co-exist in a species population. The coexistence of multiple forms of a genetic sequence gives rise to genetic polymorphisms, including SNPs.

Approximately 90% of all polymorphisms in the human genome are SNPs. SNPs are single base positions in DNA at which different alleles, or alternative nucleotides, exist in a population. The SNP position (interchangeably referred to herein as SNP, SNP site, SNP locus, SNP marker, or marker) is usually preceded by and followed by highly conserved sequences of the allele (e.g., sequences that vary in less than 1/100 or 1/1000 members of the populations). An individual may be homozygous or heterozygous for an allele at each SNP position. A SNP can, in some instances, be referred to as a "cSNP" to denote that the nucleotide sequence containing the SNP is an amino acid coding sequence.

A SNP may arise from a substitution of one nucleotide for another at the polymorphic site. Substitutions can be transitions or transversions. A transition is the

replacement of one purine nucleotide by another purine nucleotide, or one pyrimidine by another pyrimidine. A transversion is the replacement of a purine by a pyrimidine, or vice versa. A SNP may also be a single base insertion or deletion variant referred to as an "indel" (Weber *et al.*, "Human diallelic insertion/deletion polymorphisms", *Am J Hum Genet* 2002 Oct;71(4):854-62).

A synonymous codon change, or silent mutation/SNP (terms such as "SNP", "polymorphism", "mutation", "mutant", "variation", and "variant" are used herein interchangeably), is one that does not result in a change of amino acid due to the degeneracy of the genetic code. A substitution that changes a codon coding for one amino acid to a codon coding for a different amino acid (i.e., a non-synonymous codon change) is referred to as a missense mutation. A nonsense mutation results in a type of non-synonymous codon change in which a stop codon is formed, thereby leading to premature termination of a polypeptide chain and a truncated protein. A read-through mutation is another type of non-synonymous codon change that causes the destruction of a stop codon, thereby resulting in an extended polypeptide product. While SNPs can be bi-, tri-, or tetra- allelic, the vast majority of the SNPs are bi-allelic, and are thus often referred to as "bi-allelic markers", or "di-allelic markers".

As used herein, references to SNPs and SNP genotypes include individual SNPs and/or haplotypes, which are groups of SNPs that are generally inherited together. Haplotypes can have stronger correlations with diseases or other phenotypic effects compared with individual SNPs, and therefore may provide increased diagnostic accuracy in some cases (Stephens *et al. Science* 293, 489-493, 20 July 2001).

Causative SNPs are those SNPs that produce alterations in gene expression or in the expression, structure, and/or function of a gene product, and therefore are most predictive of a possible clinical phenotype. One such class includes SNPs falling within regions of genes encoding a polypeptide product, i.e. cSNPs. These SNPs may result in an alteration of the amino acid sequence of the polypeptide product (i.e., non-synonymous codon changes) and give rise to the expression of a defective or other variant protein. Furthermore, in the case of nonsense mutations, a SNP may lead to premature termination of a polypeptide product. Such variant products can result in a

pathological condition, e.g., genetic disease. Examples of genes in which a SNP within a coding sequence causes a genetic disease include sickle cell anemia and cystic fibrosis.

Causative SNPs do not necessarily have to occur in coding regions; causative SNPs can occur in, for example, any genetic region that can ultimately affect the expression, structure, and/or activity of the protein encoded by a nucleic acid. Such genetic regions include, for example, those involved in transcription, such as SNPs in transcription factor binding domains, SNPs in promoter regions, in areas involved in transcript processing, such as SNPs at intron-exon boundaries that may cause defective splicing, or SNPs in mRNA processing signal sequences such as polyadenylation signal

regions. Some SNPs that are not causative SNPs nevertheless are in close association with, and therefore segregate with, a disease-causing sequence. In this situation, the presence of a SNP correlates with the presence of, or predisposition to, or an increased risk in developing the disease. These SNPs, although not causative, are nonetheless also useful for diagnostics, disease predisposition screening, and other uses.

An association study of a SNP and a specific disorder involves determining the presence or frequency of the SNP allele in biological samples from individuals with the disorder of interest, such as those individuals who respond to statin treatment ("responders") or those individuals who do not respond to statin treatment ("non-responders"), and comparing the information to that of controls (i.e., individuals who do not have the disorder; controls may be also referred to as "healthy" or "normal" individuals) who are preferably of similar age and race. The appropriate selection of patients and controls is important to the success of SNP association studies. Therefore, a pool of individuals with well-characterized phenotypes is extremely desirable.

A SNP may be screened in diseased tissue samples or any biological sample obtained from a diseased individual, and compared to control samples, and selected for its increased (or decreased) occurrence in a specific phenotype, such as response or non-response to statin treatment of cardiovascular disease. Once a statistically significant association is established between one or more SNP(s) and a pathological condition (or other phenotype) of interest, then the region around the SNP can optionally be thoroughly screened to identify the causative genetic locus/sequence(s) (e.g., causative SNP/mutation, gene, regulatory region, etc.) that influences the pathological condition or

phenotype. Association studies may be conducted within the general population and are not limited to studies performed on related individuals in affected families (linkage studies).

Clinical trials have shown that patient response to treatment with pharmaceuticals is often heterogeneous. There is a continuing need to improve pharmaceutical agent design and therapy. In that regard, SNPs can be used to identify patients most suited to therapy with particular pharmaceutical agents such as statins (this is often termed "pharmacogenomics"). Similarly, SNPs can be used to exclude patients from certain treatment due to the patient's increased likelihood of developing toxic side effects or their likelihood of not responding to the treatment. Pharmacogenomics can also be used in pharmaceutical research to assist the drug development and selection process. (Linder et al. (1997), *Clinical Chemistry*, 43, 254; Marshall (1997), *Nature Biotechnology*, 15, 1249; International Patent Application WO 97/40462, Spectra Biomedical; and Schafer et al. (1998), *Nature Biotechnology*, 16, 3).

SUMMARY OF THE INVENTION

The present invention relates to the identification of novel SNPs, unique combinations of such SNPs, and haplotypes of SNPs that are associated with cardiovascular disorders and/or drug response, particularly acute coronary events (e.g., myocardial infarction and stroke) and response to statins for the treatment (including preventive treatment) of cardiovascular disorders such as acute coronary events. The polymorphisms disclosed herein are directly useful as targets for the design of diagnostic reagents and the development of therapeutic agents for use in the diagnosis and treatment of cardiovascular disorders and related pathologies, particularly acute coronary events.

Based on the identification of SNPs associated with cardiovascular disorders, particularly acute coronary events, and/or response to statin treatment, the present invention also provides methods of detecting these variants as well as the design and preparation of detection reagents needed to accomplish this task. The invention specifically provides, for example, novel SNPs in genetic sequences involved in cardiovascular disorders and/or responsiveness to statin treatment, isolated nucleic acid molecules (including, for example, DNA and RNA molecules) containing these SNPs,

variant proteins encoded by nucleic acid molecules containing such SNPs, antibodies to the encoded variant proteins, computer-based and data storage systems containing the novel SNP information, methods of detecting these SNPs in a test sample, methods of determining the risk of an individual of experiencing a first or recurring acute coronary event, methods for prognosing the severity or consequences of the acute coronary event, methods of treating an individual who has an increased risk of experiencing an acute coronary event, methods of identifying individuals who have an altered (i.e., increased or decreased) likelihood of responding to statin treatment based on the presence or absence of one or more particular nucleotides (alleles) at one or more SNP sites disclosed herein or the detection of one or more encoded variant products (e.g., variant mRNA transcripts or variant proteins), methods of identifying individuals who are more or less likely to respond to a treatment, particularly statin treatment of a cardiovascular disorder such as an acute coronary event (or more or less likely to experience undesirable side effects from a treatment, etc.), methods of screening for compounds useful in the treatment of a disorder associated with a variant gene/protein, compounds identified by these methods, methods of treating disorders mediated by a variant gene/protein, methods of using the novel SNPs of the present invention for human identification, etc.

Since cardiovascular disorders/diseases share certain similar features that may be due to common genetic factors that are involved in their underlying mechanisms, the SNPs identified herein as being particularly associated with acute coronary events and/or statin response may be used as diagnostic/prognostic markers or therapeutic targets for a broad spectrum of cardiovascular diseases such as coronary heart disease (CHD), atherosclerosis, cerebrovascular disease, congestive heart failure, congenital heart disease, and pathologies and symptoms associated with various heart diseases (e.g., angina, hypertension), as well as for predicting responses to a variety of HMG-CoA reductase inhibitors with lipid-lowering activities (statins), and even drugs other than statins that are used to treat cardiovascular diseases. In addition, the SNPs of the present invention are useful for predicting primary acute coronary events, as well as their reoccurrence.

The present invention further provides methods for selecting or formulating a treatment regimen (e.g., methods for determining whether or not to administer statin

treatment to an individual having cardiovascular disease, methods for selecting a particular statin-based treatment regimen such as dosage and frequency of administration of statin, or a particular form/type of statin such as a particular pharmaceutical formulation or compound, methods for administering an alternative, non-statin-based treatment to individuals who are predicted to be unlikely to respond positively to statin treatment, etc.), and methods for determining the likelihood of experiencing toxicity or other undesirable side effects from statin treatment, etc. The present invention also provides methods for selecting individuals to whom a statin or other therapeutic will be administered based on the individual's genotype, and methods for selecting individuals for a clinical trial of a statin or other therapeutic agent based on the genotypes of the individuals (e.g., selecting individuals to participate in the trial who are most likely to respond positively from the statin treatment). Furthermore, the SNPs of the invention are useful for predicting treatment responsiveness at any stage of CHD, including the initial decision for prescribing treatment before the occurrence of the first acute coronary event.

In Tables 1-2, the present invention provides gene information, transcript sequences (SEQ ID NOS:1-517), encoded amino acid sequences (SEQ ID NOS:518-1034), genomic sequences (SEQ ID NOS:13,194-13,514), transcript-based context sequences (SEQ ID NOS:1035-13,193) and genomic-based context sequences (SEQ ID NOS:13,515-85,090) that contain the SNPs of the present invention, and extensive SNP information that includes observed alleles, allele frequencies, populations/ethnic groups in which alleles have been observed, information about the type of SNP and corresponding functional effect, and, for cSNPs, information about the encoded polypeptide product. The transcript sequences (SEQ ID NOS:1-517), amino acid sequences (SEQ ID NOS:518-1034), genomic sequences (SEQ ID NOS:13,194-13,514), transcript-based SNP context sequences (SEQ ID NOS: 1035-13,193), and genomic-based SNP context sequences (SEQ ID NOS:13,515-85,090) are also provided in the Sequence Listing.

In a specific embodiment of the present invention, SNPs that occur naturally in the human genome are provided as isolated nucleic acid molecules. These SNPs are associated with cardiovascular disorders, particular acute coronary events, and/or response to statin treatment, such that they can have a variety of uses in the diagnosis

and/or treatment of cardiovascular disorders and related pathologies and particularly in the treatment of cardiovascular disorders with statins. One aspect of the present invention relates to an isolated nucleic acid molecule comprising a nucleotide sequence in which at least one nucleotide is a SNP disclosed in Tables 3 and/or 4. In an alternative embodiment, a nucleic acid of the invention is an amplified polynucleotide, which is produced by amplification of a SNP-containing nucleic acid template. In another embodiment, the invention provides for a variant protein which is encoded by a nucleic acid molecule containing a SNP disclosed herein.

In yet another embodiment of the invention, a reagent for detecting a SNP in the context of its naturally-occurring flanking nucleotide sequences (which can be, e.g., either DNA or mRNA) is provided. In particular, such a reagent may be in the form of, for example, a hybridization probe or an amplification primer that is useful in the specific detection of a SNP of interest. In an alternative embodiment, a protein detection reagent is used to detect a variant protein that is encoded by a nucleic acid molecule containing a SNP disclosed herein. A preferred embodiment of a protein detection reagent is an antibody or an antigen-reactive antibody fragment.

Various embodiments of the invention also provide kits comprising SNP detection reagents, and methods for detecting the SNPs disclosed herein by employing detection reagents. In a specific embodiment, the present invention provides for a method of identifying an individual having an increased or decreased risk of developing a cardiovascular disorder (e.g. experiencing an acute coronary event) by detecting the presence or absence of one or more SNP alleles disclosed herein. The present invention also provides methods for evaluating whether an individual is likely (or unlikely) to respond to statin treatment of cardiovascular disease by detecting the presence or absence of one or more SNP alleles disclosed herein.

The nucleic acid molecules of the invention can be inserted in an expression vector, such as to produce a variant protein in a host cell. Thus, the present invention also provides for a vector comprising a SNP-containing nucleic acid molecule, genetically-engineered host cells containing the vector, and methods for expressing a recombinant variant protein using such host cells. In another specific embodiment, the host cells, SNP-containing nucleic acid molecules, and/or variant proteins can be used as

targets in a method for screening and identifying therapeutic agents or pharmaceutical compounds useful in the treatment of cardiovascular diseases.

An aspect of this invention is a method for treating cardiovascular disorders, particular acute coronary events, in a human subject wherein said human subject harbors a SNP, gene, transcript, and/or encoded protein identified in Tables 1-2, which method comprises administering to said human subject a therapeutically or prophylactically effective amount of one or more agents (e.g. statins) counteracting the effects of the disorder, such as by inhibiting (or stimulating) the activity of the gene, transcript, and/or encoded protein identified in Tables 1-2.

Another aspect of this invention is a method for identifying an agent useful in therapeutically or prophylactically treating cardiovascular disorders, particular acute coronary events, in a human subject wherein said human subject harbors a SNP, gene, transcript, and/or encoded protein identified in Tables 1-2, which method comprises contacting the gene, transcript, or encoded protein with a candidate agent (e.g., statin) under conditions suitable to allow formation of a binding complex between the gene, transcript, or encoded protein and the candidate agent (such as a statin) and detecting the formation of the binding complex, wherein the presence of the complex identifies said agent.

Another aspect of this invention is a method for treating a cardiovascular disorder in a human subject, which method comprises:

(i) determining that said human subject harbors a SNP, gene, transcript, and/or encoded protein identified in Tables 1-2, and

(ii) administering to said subject a therapeutically or prophylactically effective amount of one or more agents (such as a statin) counteracting the effects of the disease.

Many other uses and advantages of the present invention will be apparent to those skilled in the art upon review of the detailed description of the preferred embodiments herein. Solely for clarity of discussion, the invention is described in the sections below by way of non-limiting examples.

DESCRIPTION OF THE FILES CONTAINED ON THE CD-R NAMED CL001559CDR

The CD-R named CL001559CDR contains the following five text (ASCII) files:

- 1) File SEQLIST_1559.txt provides the Sequence Listing. The Sequence Listing provides the transcript sequences (SEQ ID NOS:1-517) and protein sequences (SEQ ID NOS:518-1034) as shown in Table 1, and genomic sequences (SEQ ID NOS:13,194-13,514) as shown in Table 2, for each gene that contains one or more SNPs of the present invention. Also provided in the Sequence Listing are context sequences flanking each SNP, including both transcript-based context sequences as shown in Table 1 (SEQ ID NOS:1035-13,193) and genomic-based context sequences as shown in Table 2 (SEQ ID NOS:13,515-85,090). The context sequences generally provide 100bp upstream (5') and 100bp downstream (3') of each SNP, with the SNP in the middle of the context sequence, for a total of 200bp of context sequence surrounding each SNP. File SEQLIST_1559.txt is 56,606 KB in size, and was created on November 18, 2004.
- 2) File TABLE1_1559.txt provides Table 1. File TABLE1_1559.txt is 9,852 KB in size, and was created on November 17, 2004.
- 3) File TABLE2_1559.txt provides Table 2. File TABLE2_1559.txt is 52,843 KB in size, and was created on November 18, 2004.
- 4) File TABLE3_1559.txt provides Table 3. File TABLE3_1559.txt is 59 KB in size, and was created on November 17, 2004.
- 5) File TABLE4_1559.txt provides Table 4. File TABLE4_1559.txt is 105 KB in size, and was created on November 18, 2004.

The material contained on the CD-R labeled CL001559CDR is hereby incorporated by reference pursuant to 37 CFR 1.77(b)(4).

DESCRIPTION OF TABLE 1 AND TABLE 2

Table 1 and Table 2 (both provided on the CD-R) disclose the SNP and associated gene/transcript/protein information of the present invention. For each gene, Table 1 and Table 2 each provide a header containing gene/transcript/protein information, followed by a transcript and protein sequence (in Table 1) or genomic sequence (in Table 2), and then SNP information regarding each SNP found in that gene/transcript.

NOTE: SNPs may be included in both Table 1 and Table 2; Table 1 presents the SNPs relative to their transcript sequences and encoded protein sequences, whereas Table

2 presents the SNPs relative to their genomic sequences (in some instances Table 2 may also include, after the last gene sequence, genomic sequences of one or more intergenic regions, as well as SNP context sequences and other SNP information for any SNPs that lie within these intergenic regions). SNPs can readily be cross-referenced between Tables
 5 based on their hCV (or, in some instances, hDV) identification numbers.

The gene/transcript/protein information includes:

- a gene number (1 through n, where n = the total number of genes in the Table)
- a Celera hCG and UID internal identification numbers for the gene
- 10 - a Celera hCT and UID internal identification numbers for the transcript (Table 1 only)
- a public Genbank accession number (e.g., RefSeq NM number) for the transcript (Table 1 only)
- a Celera hCP and UID internal identification numbers for the protein encoded by
 15 the hCT transcript (Table 1 only)
- a public Genbank accession number (e.g., RefSeq NP number) for the protein (Table 1 only)
- an art-known gene symbol
- an art-known gene/protein name
- 20 - Celera genomic axis position (indicating start nucleotide position-stop nucleotide position)
- the chromosome number of the chromosome on which the gene is located
- an OMIM (Online Mendelian Inheritance in Man; Johns Hopkins University/NCBI) public reference number for obtaining further information regarding
 25 the medical significance of each gene
- alternative gene/protein name(s) and/or symbol(s) in the OMIM entry

NOTE: Due to the presence of alternative splice forms, multiple transcript/protein entries can be provided for a single gene entry in Table 1; i.e., for a single Gene Number, multiple entries may be provided in series that differ in their transcript/protein
 30 information and sequences.

Following the gene/transcript/protein information is a transcript sequence and protein sequence (in Table 1), or a genomic sequence (in Table 2), for each gene, as follows:

- transcript sequence (Table 1 only) (corresponding to SEQ ID NOS:1-517 of the Sequence Listing), with SNPs identified by their IUB codes (transcript sequences can include 5' UTR, protein coding, and 3' UTR regions). (NOTE: If there are differences between the nucleotide sequence of the hCT transcript and the corresponding public transcript sequence identified by the Genbank accession number, the hCT transcript sequence (and encoded protein) is provided, unless the public sequence is a RefSeq transcript sequence identified by an NM number, in which case the RefSeq NM transcript sequence (and encoded protein) is provided. However, whether the hCT transcript or RefSeq NM transcript is used as the transcript sequence, the disclosed SNPs are represented by their IUB codes within the transcript.)
- the encoded protein sequence (Table 1 only) (corresponding to SEQ ID NOS:518-1034 of the Sequence Listing)
- the genomic sequence of the gene (Table 2 only), including 6kb on each side of the gene boundaries (i.e., 6kb on the 5' side of the gene plus 6kb on the 3' side of the gene) (corresponding to SEQ ID NOS:13,194-13,514 of the Sequence Listing).

After the last gene sequence, Table 2 may include additional genomic sequences of intergenic regions (in such instances, these sequences are identified as "Intergenic region:" followed by a numerical identification number), as well as SNP context sequences and other SNP information for any SNPs that lie within each intergenic region (and such SNPs are identified as "INTERGENIC" for SNP type).

NOTE: The transcript, protein, and transcript-based SNP context sequences are provided in both Table 1 and in the Sequence Listing. The genomic and genomic-based SNP context sequences are provided in both Table 2 and in the Sequence Listing. SEQ ID NOS are indicated in Table 1 for each transcript sequence (SEQ ID NOS:1-517), protein sequence (SEQ ID NOS:518-1034), and transcript-based SNP context sequence (SEQ ID NOS:1035-13,193), and SEQ ID NOS are indicated in Table 2 for each genomic sequence (SEQ ID NOS:13,194-13,514), and genomic-based SNP context sequence (SEQ ID NOS:13,515-85,090).

The SNP information includes:

- context sequence (taken from the transcript sequence in Table 1, and taken from the genomic sequence in Table 2) with the SNP represented by its IUB code, including 100 bp upstream (5') of the SNP position plus 100 bp downstream (3') of the SNP position (the transcript-based SNP context sequences in Table 1 are provided in the Sequence Listing as SEQ ID NOS:1035-13,193; the genomic-based SNP context sequences in Table 2 are provided in the Sequence Listing as SEQ ID NOS:13,515-85,090).
- Celera hCV internal identification number for the SNP (in some instances, an "hDV" number is given instead of an "hCV" number)
- SNP position [position of the SNP within the given transcript sequence (Table 1) or within the given genomic sequence (Table 2)]
- SNP source (may include any combination of one or more of the following five codes, depending on which internal sequencing projects and/or public databases the SNP has been observed in: "Applera" = SNP observed during the re-sequencing of genes and regulatory regions of 39 individuals, "Celera" = SNP observed during shotgun sequencing and assembly of the Celera human genome sequence, "Celera Diagnostics" = SNP observed during re-sequencing of nucleic acid samples from individuals who have cardiovascular disorders (e.g., experienced an acute coronary event), and/or have undergone statin treatment, "dbSNP" = SNP observed in the dbSNP public database, "HGBASE" = SNP observed in the HGBASE public database, "HGMD" = SNP observed in the Human Gene Mutation Database (HGMD) public database, "HapMap" = SNP observed in the International HapMap Project public database, "CSNP" = SNP observed in an internal Applied Biosystems (Foster City, CA) database of coding SNPs (cSNPs)) (NOTE: multiple "Applera" source entries for a single SNP indicate that the same SNP was covered by multiple overlapping amplification products and the re-sequencing results (e.g., observed allele counts) from each of these amplification products is being provided)
- Population/allele/allele count information in the format of [population1(first_allele,count|second_allele,count)population2(first_allele,count|second_

allele,count) total (first_allele,total count|second_allele,total count)]. The information in this field includes populations/ethnic groups in which particular SNP alleles have been observed (“cau” = Caucasian, “his” = Hispanic, “chn” = Chinese, and “afr” = African-American, “jpn” = Japanese, “ind” = Indian, “mex” = Mexican, “ain” = “American Indian, “cra” = Celera donor, “no_pop” = no population information available), identified SNP alleles, and observed allele counts (within each population group and total allele counts), where available [“-“ in the allele field represents a deletion allele of an insertion/deletion (“indel”) polymorphism (in which case the corresponding insertion allele, which may be comprised of one or more nucleotides, is indicated in the allele field on the opposite side of the “|”); “-“ in the count field indicates that allele count information is not available]. For certain SNPs from the public dbSNP database, population/ethnic information is indicated as follows (this population information is publicly available in dbSNP): “HISP1” = human individual DNA (anonymized samples) from 23 individuals of self-described HISPANIC heritage; “PAC1” = human individual DNA (anonymized samples) from 24 individuals of self-described PACIFIC RIM heritage; “CAUC1” = human individual DNA (anonymized samples) from 31 individuals of self-described CAUCASIAN heritage; “AFR1” = human individual DNA (anonymized samples) from 24 individuals of self-described AFRICAN/AFRICAN AMERICAN heritage; “P1” = human individual DNA (anonymized samples) from 102 individuals of self-described heritage; “PA130299515”; “SC_12_A” = SANGER 12 DNAs of Asian origin from Coriell cell repositories, 6 of which are male and 6 female; “SC_12_C” = SANGER 12 DNAs of Caucasian origin from Coriell cell repositories from the CEPH/UTAH library. Six male and 6 female; “SC_12_AA” = SANGER 12 DNAs of African-American origin from Coriell cell repositories 6 of which are male and 6 female; “SC_95_C” = SANGER 95 DNAs of Caucasian origin from Coriell cell repositories from the CEPH/UTAH library; and “SC_12_CA” = Caucasians - 12 DNAs from Coriell cell repositories that are from the CEPH/UTAH library. Six male and 6 female.

NOTE: For SNPs of “Applera” SNP source, genes/regulatory regions of 39 individuals (20 Caucasians and 19 African Americans) were re-sequenced and, since each SNP position is represented by two chromosomes in each individual (with the exception

of SNPs on X and Y chromosomes in males, for which each SNP position is represented by a single chromosome), up to 78 chromosomes were genotyped for each SNP position. Thus, the sum of the African-American ("afr") allele counts is up to 38, the sum of the Caucasian allele counts ("cau") is up to 40, and the total sum of all allele counts is up to 78.

(NOTE: semicolons separate population/allele/count information corresponding to each indicated SNP source; i.e., if four SNP sources are indicated, such as "Celera", "dbSNP", "HGBASE", and "HGMD", then population/allele/count information is provided in four groups which are separated by semicolons and listed in the same order as the listing of SNP sources, with each population/allele/count information group corresponding to the respective SNP source based on order; thus, in this example, the first population/allele/count information group would correspond to the first listed SNP source (Celera) and the third population/allele/count information group separated by semicolons would correspond to the third listed SNP source (HGBASE); if population/allele/count information is not available for any particular SNP source, then a pair of semicolons is still inserted as a place-holder in order to maintain correspondence between the list of SNP sources and the corresponding listing of population/allele/count information)

- SNP type (e.g., location within gene/transcript and/or predicted functional effect) ["MIS-SENSE MUTATION" = SNP causes a change in the encoded amino acid (i.e., a non-synonymous coding SNP); "SILENT MUTATION" = SNP does not cause a change in the encoded amino acid (i.e., a synonymous coding SNP); "STOP CODON MUTATION" = SNP is located in a stop codon; "NONSENSE MUTATION" = SNP creates or destroys a stop codon; "UTR 5" = SNP is located in a 5' UTR of a transcript; "UTR 3" = SNP is located in a 3' UTR of a transcript; "PUTATIVE UTR 5" = SNP is located in a putative 5' UTR; "PUTATIVE UTR 3" = SNP is located in a putative 3' UTR; "DONOR SPLICE SITE" = SNP is located in a donor splice site (5' intron boundary); "ACCEPTOR SPLICE SITE" = SNP is located in an acceptor splice site (3' intron boundary); "CODING REGION" = SNP is located in a protein-coding region of the transcript; "EXON" = SNP is located in an exon; "INTRON" = SNP is located in an intron; "hmCS" = SNP is located in a human-mouse conserved segment; "TFBS" = SNP

is located in a transcription factor binding site; "UNKNOWN" = SNP type is not defined; "INTERGENIC" = SNP is intergenic, i.e., outside of any gene boundary]

- Protein coding information (Table 1 only), where relevant, in the format of [protein SEQ ID NO:#, amino acid position, (amino acid-1, codon1) (amino acid-2, codon2)]. The information in this field includes SEQ ID NO of the encoded protein sequence, position of the amino acid residue within the protein identified by the SEQ ID NO that is encoded by the codon containing the SNP, amino acids (represented by one-letter amino acid codes) that are encoded by the alternative SNP alleles (in the case of stop codons, "X" is used for the one-letter amino acid code), and alternative codons containing the alternative SNP nucleotides which encode the amino acid residues (thus, for example, for missense mutation-type SNPs, at least two different amino acids and at least two different codons are generally indicated; for silent mutation-type SNPs, one amino acid and at least two different codons are generally indicated, etc.). In instances where the SNP is located outside of a protein-coding region (e.g., in a UTR region), "None" is indicated following the protein SEQ ID NO.

DESCRIPTION OF TABLE 3 AND TABLE 4

Tables 3 and 4 (both provided on the CD-R) provide a list of a subset of SNPs from Table 1 (in the case of Table 3) or Table 2 (in the case of Table 4) for which the SNP source falls into one of the following three categories: 1) SNPs for which the SNP source is only "Applera" and none other, 2) SNPs for which the SNP source is only "Celera Diagnostics" and none other, and 3) SNPs for which the SNP source is both "Applera" and "Celera Diagnostics" but none other.

These SNPs have not been observed in any of the public databases (dbSNP, HGBASE, and HGMD), and were also not observed during shotgun sequencing and assembly of the Celera human genome sequence (i.e., "Celera" SNP source). Tables 3 and 4 provide the hCV identification number (or hDV identification number for SNPs having "Celera Diagnostics" SNP source) and the SEQ ID NO of the context sequence for each of these SNPs.

DESCRIPTION OF TABLE 5

Table 5 provides sequences (SEQ ID NOS:85,091-85,702) of primers that have been synthesized and used in the laboratory to carry out allele-specific PCR reactions in order to assay the SNPs disclosed in Tables 6-15 during the course of association studies to verify the association of these SNPs with cardiovascular disorders (particularly acute coronary events such as myocardial infarction and stroke) and statin response.

Table 5 provides the following:

- the column labeled "Marker" provides an hCV identification number for each SNP site
- the column labeled "Alleles" designates the two alternative alleles at the SNP site identified by the hCV identification number that are targeted by the allele-specific primers (the allele-specific primers are shown as "Sequence A" and "Sequence B") [NOTE: Alleles may be presented in Table 5 based on a different orientation (i.e., the reverse complement) relative to how the same alleles are presented in Tables 1-2].
- the column labeled "Sequence A (allele-specific primer)" provides an allele-specific primer that is specific for an allele designated in the "Alleles" column
- the column labeled "Sequence B (allele-specific primer)" provides an allele-specific primer that is specific for the other allele designated in the "Alleles" column
- the column labeled "Sequence C (common primer)" provides a common primer that is used in conjunction with each of the allele-specific primers (the "Sequence A" primer and the "Sequence B" primer) and which hybridizes at a site away from the SNP position.

All primer sequences are given in the 5' to 3' direction.

Each of the nucleotides designated in the "Alleles" column matches or is the reverse complement of (depending on the orientation of the primer relative to the designated allele) the 3' nucleotide of the allele-specific primer (either "Sequence A" or "Sequence B") that is specific for that allele.

DESCRIPTION OF TABLES 6-15

Tables 6-15 provide results of statistical analyses for SNPs disclosed in Tables 1-4 (SNPs can be cross-referenced between tables based on their hCV identification numbers), and the association of these SNPs with various cardiovascular disease clinical

endpoints or drug response traits. The statistical results shown in Tables 6-15 provide support for the association of these SNPs with cardiovascular disorders, particularly acute coronary events such as myocardial infarction and stroke, and/or the association of these SNPs with response to statin treatment, such as statin treatment administered as a preventive treatment for acute coronary events. For example, the statistical results provided in Tables 6-15 show that the association of these SNPs with acute coronary events and/or response to statin treatment is supported by p-values < 0.05 in an allelic association test.

Table 6 presents statistical associations of SNPs with various trial endpoints. Table 7 presents statistical associations of SNPs with clinical variables such as lab tests at base line and at the end of a trial. Table 8 presents statistical associations of SNPs with cardiovascular endpoints prevention (SNPs predictive of response to statins as a preventive treatment). Table 9 shows the association of SNPs with adverse coronary events such as RMI and stroke in CARE samples. This association of certain SNPs with adverse coronary events could also be replicated by comparing associations in samples between initial analysis and replication (see example section). Table 10 shows association of SNPs predictive of statin response with cardiovascular events prevention under statin treatment, justified by stepwise logistic regression analysis with an adjustment for conventional risk factors such as age, sex, smoking status, baseline glucose levels, body mass index (BMI), history of hypertension, etc. (this adjustment supports independence of the SNP association from conventional risk factors). The statistical results provided in Table 11 demonstrate association of a SNP in the CD6 gene that is predictive of statin response in the prevention of RMI, justified as a significant difference in risk associated with the SNP between placebo and Statin treated strata (Breslow Day p-values < 0.05). Table 11 presents the results observed in samples taken from both the CARE and WOSCOP studies. In both studies the individuals homozygous for the minor allele were statistically different from heterozygous and major allele homozygous individuals in the pravastatin treated group vs. the placebo treated group. Table 12 shows the association of a SNP in the FCAR gene that is predictive of MI risk and response to statin treatment. Individuals who participated in both the CARE and WOSCOPS studies, who did not receive pravastatin treatment and who were

heterozygous or homozygous for the major allele had a significantly higher risk of having an MI vs. individuals who were homozygous for the minor allele. However, individuals in the CARE study who were heterozygous or homozygous for the FCAR major allele were also statistically significantly protected by pravastatin treatment against an adverse coronary event relative to the individuals homozygous for the minor allele.

NOTE: SNPs can be cross-referenced between all tables herein based on the hCV identification number of each SNP. However, eleven of the SNPs that are included in the tables may possess two different hCV identification numbers, as follows:

- hCV15871020 is equivalent to hCV22273027

- hCV15962586 is equivalent to hCV22274323

- hCV16192174 is equivalent to hCV22271999

- hCV22273204 is equivalent to hCV16179443

- hCV25617571 is equivalent to hCV15943347

- hCV25637308 is equivalent to hCV27501445

- hCV25637309 is equivalent to hCV27469009

- hCV25640926 is equivalent to hCV9485713

- hCV7499900 is equivalent to hCV25620145

- hCV16172571 is equivalent to hCV25474627

- hCV16273460 is equivalent to hCV26165616

Table 6 column heading	Definition
Public	Locus Link HUGO approved gene symbol for the gene that contains the tested SNP
Marker	Internal hCV identification number for the tested SNP
Stratum	Subpopulation used for analysis
Phenotype	Disease endpoints (definitions of entries in this column are provided below)
Overall* Chi-square Test: statistic/ p-value	Result of the Overall Score Test (chi-square test) for the logistic regression model in which the qualitative phenotype is a function of SNP genotype (based on placebo patients only)

SNP effect** Chi-square Test: statistic/ p-value	Result of the chi-square test of the SNP effect (based on the logistic regression model for placebo patients only)
Placebo Patients n/total(%) 0 Rare Alleles	"n" is the number of placebo patients with no rare alleles genotype for investigated phenotype. The "total" is the total number of placebo patients with this genotype, and "%" is the percentage of placebo patients with this genotype.
Placebo Patients n/total(%) 1 Rare Allele	"n" is the number of placebo patients with one rare allele genotype for investigated phenotype. The "total" is the total number of placebo patients with this genotype, and "%" is the percentage of placebo patients with this genotype.
Placebo Patients n/total(%) 2 Rare Alleles	"n" is the number of placebo patients with two rare alleles genotype for investigated phenotype. The "total" is the total number of placebo patients with this genotype, and "%" is the percentage of placebo patients with this genotype.
Odd Ratio (95%CI) 2 Rare Alleles vs. 0 Rare Alleles	"Odds ratio" indicates the odds of having this phenotype given that genotype contains two rare alleles of a SNP versus the odds of having this phenotype given a genotype containing no rare alleles. "95%CI" is the 95% confidence interval.
Odd Ratio (95%CI) 1 Rare Alleles vs. 0 Rare Alleles	"Odds ratio" indicates the odds of having this phenotype given that genotype contains one rare allele versus the odds of having this phenotype given a genotype containing no rare alleles. "95%CI" is the 95% confidence interval
Significance Level	"Significance Level" indicates the summary of the result of the "Overall Score Test (chi-square test)" for the logistic regression model and the result of the "chi-square test of the SNP effect". If both p-values are less than 0.05, "<0.05" is indicated. If both p-values are less than 0.005, "<0.005" is indicated.
Table 7 column heading	Definition
Public	Locus Link HUGO approved gene symbol for the gene that contains the tested SNP
Marker	Internal hCV identification number for the tested SNP
Stratum	Subpopulation used for analysis
Phenotype (at Baseline)	Clinical quantitative variables - lab test results at baseline or change from baseline discharge (definitions of entries in this

	column are provided below)
Overall* F-Test: statistic/ p-value	Results of the Overall F-Test for the analysis of variance model in which the quantitative phenotype is a function of SNP genotype (based on placebo patients only)
SNP effect** F-Test: statistic/ p-value	Results of the F-test of the SNP effect (based on the analysis of variance model for placebo patients only)
Placebo Patients Mean (se)# (N) 0 Rare Alleles	"n" is the number of placebo patients with a tested SNP genotype (zero rare alleles) and presented phenotype. "Mean" is the least squares estimate of the mean phenotype result for placebo patients with this genotype. "se" is the least squares estimate of the standard error of the mean phenotype for placebo patients with 0 rare allele genotype
Placebo Patients Mean (se)# (N) 1 Rare Allele	"n" is the number of placebo patients with a tested SNP genotype (one rare allele) and presented phenotype. Mean is the least squares estimate of the mean phenotype result for placebo patients with this genotype. se is the least squares estimate of the standard error of the mean phenotype for placebo patients 1 rare allele genotype
Placebo Patients Mean (se)# (N) 2 Rare Alleles	"n" is the number of placebo patients with a tested SNP genotype (one rare allele) and presented phenotype. Mean is the least squares estimate of the mean phenotype result for placebo patients with this genotype. se is the least squares estimate of the standard error of the mean phenotype for placebo patients 2 rare alleles genotype
Significance Level	"Significance Level" indicates the summary of the result of the "Overall F-Test" for the analysis of variance model and the result of the "F-test of the SNP effect". If both p-values are less than 0.05, "<0.05" is indicated. If both p-values are less than 0.005, "<0.005" is indicated.
Table 8 column heading	Definition
Public	Locus Link HUGO approved gene symbol for the gene that contains the tested SNP
Marker	Internal hCV identification number for the tested SNP
Stratum	Subpopulation used for analysis

Phenotype	Disease endpoints (definitions of entries in this column are provided below)
Overall* Chi-square Test: statistic/ p-value	Results of the Overall Score Test (chi-square test) for the regression model in which the qualitative phenotype is a function of the SNP genotype, treatment group, and the interaction between SNP genotype and treatment group
Interaction Effect** Chi-square Test: statistic/ p-value	Results of the chi-square test of the interaction between SNP genotype and treatment group (based on the logistic regression model).
0 Rare Alleles n/total (%) Prava	Results for patients under pravastatin treatment. "n" is the number of pravastatin patients with no rare allele genotype and the investigated phenotype. The "total" is the total number of pravastatin patients with this genotype. "%" is the percentage of pravastatin patients with this genotype who had the investigated phenotype.
0 Rare Alleles n/total (%) Placebo	Results for patients under placebo. "n" is the number of placebo patients with no rare allele genotype and investigated phenotype. "Total" is the total number of placebo patients with the genotype. "%" is the percentage of placebo patients with no rare allele genotype and the investigated phenotype.
1 Rare Allele n/total (%) Prava	Results for patients under pravastatin treatment. "n" is the number of patients under pravastatin with one rare allele genotype and the investigated phenotype. The "total" is the total number of pravastatin patients with the genotype. "%" is the percentage of pravastatin patients with one rare allele genotype and the investigated phenotype.
1 Rare Allele n/total (%) Placebo	Results for patients on placebo. "n" is the number of placebo patients with one rare allele genotype and the investigated phenotype. The "total" is the total number of pravastatin patients with the genotype. "%" is the percentage of pravastatin patients with one rare allele genotype and the investigated phenotype.
2 Rare Alleles n/total (%) Prava	Results for patients under pravastatin treatment. "n" is the number of patients under pravastatin with two rare allele genotype and the investigated phenotype. The "total" is the total number of pravastatin patients with the genotype. "%" is the percentage of pravastatin patients with two rare allele genotypes and the investigated phenotype

2 Rare Alleles n/total (%) Placebo	Results for patients on placebo. "n" is the number of placebo patients with two rare allele genotype and the investigated phenotype. The "total" is the total number of pravastatin patients with the genotype. "%" is the percentage of pravastatin patients with two rare allele genotypes and the investigated phenotype
Prava vs Placebo Odds Ratio (95%CI) 0 Rare Alleles	Odds ratio and its 95% confidence interval for patients with no rare allele genotype, the odd ratios of having the event given pravastatin use versus the odds of having the event on placebo
Prava vs Placebo Odds Ratio (95%CI) 1 Rare Allele	Odds ratio and its 95% confidence interval for patients with one rare allele genotype, the odd ratios of having the event given pravastatin use versus the odds of having the event on placebo
Prava vs Placebo Odds Ratio (95%CI) 2 Rare Alleles	Odds ratio and its 95% confidence interval for patients with two rare alleles genotype, the odd ratio of having the event given pravastatin use versus the odds of having the event on placebo
Significance Level	"Significance Level" indicates the summary of the result of the "Overall Score Test (chi-square test)" for the regression model and the result of the "chi-square test of the interaction". If both p-values are less than 0.05, "<0.05" is indicated. If both p-values are less than 0.005, "<0.005" is indicated.

Table 9 column heading	Definition
Endpoint	Endpoint measured in study
Public	Locus Link HUGO approved gene symbol for the gene that contains the tested SNP
Marker	Internal hCV identification number for the SNP that is tested
Genotype/mode	Effect seen in major homozygous ("Maj. Hom"), minor homozygous ("Min Hom") or heterozygous (Het)/recessive ("Rec") or dominant ("Dom")
Strata	Indicates whether the analysis of the dataset has been stratified by genotypes, such as major homozygote ("Maj Hom"), minor homozygote ("Min Hom"), and heterozygote ("Het")

Confounders	Variables that change the marker risk estimates by $\geq 5\%$
P risk est.	Significance of risk estimated by Wald Test
RR	Relative risk
95%CI	95% confidence interval for relative risk
case	Number of patients (with the corresponding genotype or mode) developed recurrent MI or Stroke during 5 years follow up
Case AF (%)	The allele frequency of patients (with the corresponding genotype or mode) that developed recurrent MI during 6 years follow up
Control	Number of patients (with the corresponding genotype or mode) that had MI
Control AF (%)	The allele frequency of patients (with the corresponding genotype or mode) that had MI
Analysis 1	Statistics are based on initial analysis (see examples).
Analysis 2	Statistics are based on replication analysis (see examples)
Table 10	See Table footnotes and Examples section
Table 11	See Table footnotes and Examples section
Table 12	See Table footnotes and Examples section
Table 13	See Table footnotes and Examples section
Table 14	See Table footnotes and Examples section
Table 15	See Table footnotes and Examples section

Definition of entries in the “Phenotype” column of Table 6:

Phenotype
Definite Nonfatal MI
Fatal CHD/Definite Nonfatal MI
CARE MI: Q-Wave MI
MI (Fatal/Nonfatal)
Fatal Coronary Heart Disease
Total Mortality
Cardiovascular Mortality
Fatal Atherosclerotic Cardiovascular Disease
History of Diabetes
Stroke
Percutaneous Transluminal Coronary Angioplasty
Hosp. for Cardiovascular Disease
Fatal/Nonfatal Cerebrovascular Disease
Hosp. for Unstable Angina
Total Cardiovascular Disease Events
Any Report of Stroke Prior to or During CARE
Any Report of Stroke During CARE
1st Stroke Occurred During CARE
Fatal/Nonfatal MI (def & prob)
History of Congestive Heart Failure (AE)
Nonfatal MI (Probable/Definite)
Nonfatal MI (def & prob)
Fatal/Nonfatal Atherosclerotic CV Disease
Coronary Artery Bypass Graft
Coronary Artery Bypass or Revascularization
Congestive Heart Failure
Hosp. for Peripheral Arterial Disease
History of Coronary Artery Bypass Graft
CARE MI: Non Q-Wave MI
Fatal MI
History of Percutaneous Transluminal Coronary Angioplasty
Catheterization
Total Coronary Heart Disease Events
History of Angina Pectoris
More Than 1 Prior MI
Family History of CV Disease
History of Hypertension
History of Stroke

Definition of entries in the “Phenotype (at Baseline)” column of Table 7:

Phenotype (at Baseline)
Change from Baseline in Urinary Glucose (at LOCF)
Change from Baseline in Urinary Glucose (at LOCF)
Baseline HDL
Baseline Lymphocytes, Absolute (k/cumm)
Baseline HDL

Definition of entries in the "Phenotype" column of Table 8:

Phenotype
Catheterization
Nonfatal MI (Probable/Definite)
Nonfatal MI (def & prob)
Family History of CV Disease
MI (Fatal/Nonfatal)
Definite Nonfatal MI
Fatal/Nonfatal MI (def & prob)
Fatal Coronary Heart Disease
Total Mortality
Total Coronary Heart Disease Events
Cardiovascular Mortality
Fatal Atherosclerotic Cardiovascular Disease
Fatal/Nonfatal Atherosclerotic CV Disease
Hosp. for Cardiovascular Disease
Total Cardiovascular Disease Events
History of Angina Pectoris
Fatal CHD/Definite Nonfatal MI
Coronary Artery Bypass or Revascularization
Coronary Artery Bypass Graft
Hospitalization for Unstable Angina
Percutaneous Transluminal Coronary Angioplasty
Fatal/Nonfatal Cerebrovascular Disease
Stroke

DESCRIPTION OF THE FIGURE

- 5 Figure 1 provides a diagrammatic representation of a computer-based discovery system containing the SNP information of the present invention in computer readable form.

DETAILED DESCRIPTION OF THE INVENTION

- 10 The present invention provides SNPs associated with cardiovascular disorders, particularly acute coronary events such as myocardial infarction and stroke (including

recurrent acute coronary events such as recurrent myocardial infarction), and SNPs that are associated with an individual's responsiveness to therapeutic agents, particularly lipid-lowering compounds such as statins, that are used for the treatment (including preventive treatment) of cardiovascular disorders, particularly treatment of acute coronary events. The present invention further provides nucleic acid molecules containing these SNPs, methods and reagents for the detection of the SNPs disclosed herein, uses of these SNPs for the development of detection reagents, and assays or kits that utilize such reagents. The acute coronary event-associated SNPs and statin response-associated SNPs disclosed herein are useful for diagnosing, screening for, and evaluating an individual's increased or decreased risk of developing cardiovascular disease as well as their responsiveness to drug treatment. Furthermore, such SNPs and their encoded products are useful targets for the development of therapeutic agents.

A large number of SNPs have been identified from re-sequencing DNA from 39 individuals, and they are indicated as "Applera" SNP source in Tables 1-2. Their allele frequencies observed in each of the Caucasian and African-American ethnic groups are provided. Additional SNPs included herein were previously identified during shotgun sequencing and assembly of the human genome, and they are indicated as "Celera" SNP source in Tables 1-2. Furthermore, the information provided in Table 1-2, particularly the allele frequency information obtained from 39 individuals and the identification of the precise position of each SNP within each gene/transcript, allows haplotypes (i.e., groups of SNPs that are co-inherited) to be readily inferred. The present invention encompasses SNP haplotypes, as well as individual SNPs.

Thus, the present invention provides individual SNPs associated with cardiovascular disorders, particularly acute coronary events, and SNPs associated with responsiveness to statin for the treatment of cardiovascular diseases, as well as combinations of SNPs and haplotypes in genetic regions associated with cardiovascular disorders and/or statin response, polymorphic/variant transcript sequences (SEQ ID NOS:1-517) and genomic sequences (SEQ ID NOS:13,194-13,514) containing SNPs, encoded amino acid sequences (SEQ ID NOS: 518-1034), and both transcript-based SNP context sequences (SEQ ID NOS: 1035-13,193) and genomic-based SNP context sequences (SEQ ID NOS:13,515-85,090) (transcript sequences, protein sequences, and

transcript-based SNP context sequences are provided in Table 1 and the Sequence Listing; genomic sequences and genomic-based SNP context sequences are provided in Table 2 and the Sequence Listing), methods of detecting these polymorphisms in a test sample, methods of determining the risk of an individual of having or developing a cardiovascular disorder such as an acute coronary event, methods of determining response to statin treatment of cardiovascular disease, methods of screening for compounds useful for treating cardiovascular disease, compounds identified by these screening methods, methods of using the disclosed SNPs to select a treatment strategy, methods of treating a disorder associated with a variant gene/protein (i.e., therapeutic methods), and methods of using the SNPs of the present invention for human identification.

Since cardiovascular disorders/diseases share certain similar features that may be due to common genetic factors that are involved in their underlying mechanisms, the SNPs identified herein as being particularly associated with acute coronary events and/or statin response may be used as diagnostic/prognostic markers or therapeutic targets for a broad spectrum of cardiovascular diseases such as coronary heart disease (CHD), atherosclerosis, cerebrovascular disease, congestive heart failure, congenital heart disease, and pathologies and symptoms associated with various heart diseases (e.g., angina, hypertension), as well as for predicting responses to drugs other than statins that are used to treat cardiovascular diseases.

The present invention further provides methods for selecting or formulating a treatment regimen (e.g., methods for determining whether or not to administer statin treatment to an individual having cardiovascular disease, methods for selecting a particular statin-based treatment regimen such as dosage and frequency of administration of statin, or a particular form/type of statin such as a particular pharmaceutical formulation or compound, methods for administering an alternative, non-statin-based treatment to individuals who are predicted to be unlikely to respond positively to statin treatment, etc.), and methods for determining the likelihood of experiencing toxicity or other undesirable side effects from statin treatment, etc. The present invention also provides methods for selecting individuals to whom a statin or other therapeutic will be administered based on the individual's genotype, and methods for selecting individuals for

a clinical trial of a statin or other therapeutic agent based on the genotypes of the individuals (e.g., selecting individuals to participate in the trial who are most likely to respond positively from the statin treatment).

5 The present invention provides novel SNPs associated with cardiovascular disorders and/or response to statin treatment, as well as SNPs that were previously known in the art, but were not previously known to be associated with cardiovascular disorders and/or statin response. Accordingly, the present invention provides novel compositions and methods based on the novel SNPs disclosed herein, and also provides novel methods of using the known, but previously unassociated, SNPs in methods relating to evaluating
10 an individual's likelihood of having or developing a cardiovascular disorder, predicting the likelihood of an individual experiencing a reoccurrence of a cardiovascular disorder (e.g., experiencing recurrent myocardial infarctions), prognosing the severity of a cardiovascular disorder in an individual, or prognosing an individual's recovery from a cardiovascular disorder, and methods relating to evaluating an individual's likelihood of
15 responding to statin treatment for cardiovascular disease. In Tables 1-2, known SNPs are identified based on the public database in which they have been observed, which is indicated as one or more of the following SNP types: "dbSNP" = SNP observed in dbSNP, "HGBASE" = SNP observed in HGBASE, and "HGMD" = SNP observed in the Human Gene Mutation Database (HGMD). Novel SNPs for which the SNP source is
20 only "Applera" and none other, i.e., those that have not been observed in any public databases and which were also not observed during shotgun sequencing and assembly of the Celera human genome sequence (i.e., "Celera" SNP source), are indicated in Tables 3-4.

25 Particular SNP alleles of the present invention can be associated with either an increased risk of having a cardiovascular disorder (e.g., experiencing an acute coronary event) or of responding to statin treatment of cardiovascular disease, or a decreased likelihood of having a cardiovascular disorder or of responding to statin treatment of cardiovascular disease. Thus, whereas certain SNPs (or their encoded products) can be assayed to determine whether an individual possesses a SNP allele that is indicative of an
30 increased likelihood of experiencing a coronary event or of responding to statin treatment, other SNPs (or their encoded products) can be assayed to determine whether

an individual possesses a SNP allele that is indicative of a decreased likelihood of experiencing a coronary event or of responding to statin treatment. Similarly, particular SNP alleles of the present invention can be associated with either an increased or decreased likelihood of having a reoccurrence of a cardiovascular disorder, of fully
5 recovering from a cardiovascular disorder, of experiencing toxic effects from a particular treatment or therapeutic compound, etc. The term "altered" may be used herein to encompass either of these two possibilities (e.g., an increased or a decreased risk/likelihood). SNP alleles that are associated with a decreased risk of having or developing a cardiovascular disorder such as myocardial infarction may be referred to as
10 "protective" alleles, and SNP alleles that are associated with an increased risk of having or developing a cardiovascular disorder may be referred to as "susceptibility" alleles, "risk" alleles, or "risk factors".

Those skilled in the art will readily recognize that nucleic acid molecules may be double-stranded molecules and that reference to a particular site on one strand refers, as
15 well, to the corresponding site on a complementary strand. In defining a SNP position, SNP allele, or nucleotide sequence, reference to an adenine, a thymine (uridine), a cytosine, or a guanine at a particular site on one strand of a nucleic acid molecule also defines the thymine (uridine), adenine, guanine, or cytosine (respectively) at the corresponding site on a complementary strand of the nucleic acid molecule. Thus,
20 reference may be made to either strand in order to refer to a particular SNP position, SNP allele, or nucleotide sequence. Probes and primers, may be designed to hybridize to either strand and SNP genotyping methods disclosed herein may generally target either strand. Throughout the specification, in identifying a SNP position, reference is generally made to the protein-encoding strand, only for the purpose of convenience.

25 References to variant peptides, polypeptides, or proteins of the present invention include peptides, polypeptides, proteins, or fragments thereof, that contain at least one amino acid residue that differs from the corresponding amino acid sequence of the art-known peptide/polypeptide/protein (the art-known protein may be interchangeably referred to as the "wild-type", "reference", or "normal" protein). Such variant
30 peptides/polypeptides/proteins can result from a codon change caused by a nonsynonymous nucleotide substitution at a protein-coding SNP position (i.e., a missense

mutation) disclosed by the present invention. Variant peptides/polypeptides/proteins of the present invention can also result from a nonsense mutation, i.e. a SNP that creates a premature stop codon, a SNP that generates a read-through mutation by abolishing a stop codon, or due to any SNP disclosed by the present invention that otherwise alters the structure, function/activity, or expression of a protein, such as a SNP in a regulatory region (e.g. a promoter or enhancer) or a SNP that leads to alternative or defective splicing, such as a SNP in an intron or a SNP at an exon/intron boundary. As used herein, the terms “polypeptide”, “peptide”, and “protein” are used interchangeably.

10 **ISOLATED NUCLEIC ACID MOLECULES** 15 **AND SNP DETECTION REAGENTS & KITS**

Tables 1 and 2 provide a variety of information about each SNP of the present invention that is associated with cardiovascular disorders (e.g., acute coronary events such as myocardial infarction and stroke) and/or responsiveness to statin treatment, including the transcript sequences (SEQ ID NOS:1-517), genomic sequences (SEQ ID NOS:13,194-13,514), and protein sequences (SEQ ID NOS:518-1034) of the encoded gene products (with the SNPs indicated by IUB codes in the nucleic acid sequences). In addition, Tables 1 and 2 include SNP context sequences, which generally include 100 nucleotide upstream (5') plus 100 nucleotides downstream (3') of each SNP position (SEQ ID NOS:1035-13,193 correspond to transcript-based SNP context sequences disclosed in Table 1, and SEQ ID NOS:13,515-85,090 correspond to genomic-based context sequences disclosed in Table 2), the alternative nucleotides (alleles) at each SNP position, and additional information about the variant where relevant, such as SNP type (coding, missense, splice site, UTR, etc.), human populations in which the SNP was observed, observed allele frequencies, information about the encoded protein, etc.

Isolated Nucleic Acid Molecules

The present invention provides isolated nucleic acid molecules that contain one or more SNPs disclosed Table 1 and/or Table 2. Preferred isolated nucleic acid molecules contain one or more SNPs identified in Table 3 and/or Table 4. Isolated nucleic acid molecules containing one or more SNPs disclosed in at least one of Tables 1-4 may be

interchangeably referred to throughout the present text as “SNP-containing nucleic acid molecules”. Isolated nucleic acid molecules may optionally encode a full-length variant protein or fragment thereof. The isolated nucleic acid molecules of the present invention also include probes and primers (which are described in greater detail below in the section entitled “SNP Detection Reagents”), which may be used for assaying the disclosed SNPs, and isolated full-length genes, transcripts, cDNA molecules, and fragments thereof, which may be used for such purposes as expressing an encoded protein.

As used herein, an “isolated nucleic acid molecule” generally is one that contains a SNP of the present invention or one that hybridizes to such molecule such as a nucleic acid with a complementary sequence, and is separated from most other nucleic acids present in the natural source of the nucleic acid molecule. Moreover, an “isolated” nucleic acid molecule, such as a cDNA molecule containing a SNP of the present invention, can be substantially free of other cellular material, or culture medium when produced by recombinant techniques, or chemical precursors or other chemicals when chemically synthesized. A nucleic acid molecule can be fused to other coding or regulatory sequences and still be considered “isolated”. Nucleic acid molecules present in non-human transgenic animals, which do not naturally occur in the animal, are also considered “isolated”. For example, recombinant DNA molecules contained in a vector are considered “isolated”. Further examples of “isolated” DNA molecules include recombinant DNA molecules maintained in heterologous host cells, and purified (partially or substantially) DNA molecules in solution. Isolated RNA molecules include in vivo or in vitro RNA transcripts of the isolated SNP-containing DNA molecules of the present invention. Isolated nucleic acid molecules according to the present invention further include such molecules produced synthetically.

Generally, an isolated SNP-containing nucleic acid molecule comprises one or more SNP positions disclosed by the present invention with flanking nucleotide sequences on either side of the SNP positions. A flanking sequence can include nucleotide residues that are naturally associated with the SNP site and/or heterologous nucleotide sequences. Preferably the flanking sequence is up to about 500, 300, 100, 60, 50, 30, 25, 20, 15, 10, 8, or 4 nucleotides (or any other length in-between) on either side of a SNP position, or as long

as the full-length gene or entire protein-coding sequence (or any portion thereof such as an exon), especially if the SNP-containing nucleic acid molecule is to be used to produce a protein or protein fragment.

For full-length genes and entire protein-coding sequences, a SNP flanking sequence can be, for example, up to about 5KB, 4KB, 3KB, 2KB, 1KB on either side of the SNP. Furthermore, in such instances, the isolated nucleic acid molecule comprises exonic sequences (including protein-coding and/or non-coding exonic sequences), but may also include intronic sequences. Thus, any protein coding sequence may be either contiguous or separated by introns. The important point is that the nucleic acid is isolated from remote and unimportant flanking sequences and is of appropriate length such that it can be subjected to the specific manipulations or uses described herein such as recombinant protein expression, preparation of probes and primers for assaying the SNP position, and other uses specific to the SNP-containing nucleic acid sequences.

An isolated SNP-containing nucleic acid molecule can comprise, for example, a full-length gene or transcript, such as a gene isolated from genomic DNA (e.g., by cloning or PCR amplification), a cDNA molecule, or an mRNA transcript molecule. Polymorphic transcript sequences are provided in Table 1 and in the Sequence Listing (SEQ ID NOS: 1-517), and polymorphic genomic sequences are provided in Table 2 and in the Sequence Listing (SEQ ID NOS:13,194-13,514). Furthermore, fragments of such full-length genes and transcripts that contain one or more SNPs disclosed herein are also encompassed by the present invention, and such fragments may be used, for example, to express any part of a protein, such as a particular functional domain or an antigenic epitope.

Thus, the present invention also encompasses fragments of the nucleic acid sequences provided in Tables 1-2 (transcript sequences are provided in Table 1 as SEQ ID NOS:1-517, genomic sequences are provided in Table 2 as SEQ ID NOS:13,194-13,514, transcript-based SNP context sequences are provided in Table 1 as SEQ ID NO:1035-13,193, and genomic-based SNP context sequences are provided in Table 2 as SEQ ID NO:13,515-85,090) and their complements. A fragment typically comprises a contiguous nucleotide sequence at least about 8 or more nucleotides, more preferably at least about 12 or more nucleotides, and even more preferably at least about 16 or more nucleotides. Further, a fragment could comprise at least about 18, 20, 22, 25, 30, 40, 50, 60, 80, 100, 150,

200, 250 or 500 (or any other number in-between) nucleotides in length. The length of the fragment will be based on its intended use. For example, the fragment can encode epitope-bearing regions of a variant peptide or regions of a variant peptide that differ from the normal/wild-type protein, or can be useful as a polynucleotide probe or primer. Such fragments can be isolated using the nucleotide sequences provided in Table 1 and/or Table 2 for the synthesis of a polynucleotide probe. A labeled probe can then be used, for example, to screen a cDNA library, genomic DNA library, or mRNA to isolate nucleic acid corresponding to the coding region. Further, primers can be used in amplification reactions, such as for purposes of assaying one or more SNPs sites or for cloning specific regions of a gene.

An isolated nucleic acid molecule of the present invention further encompasses a SNP-containing polynucleotide that is the product of any one of a variety of nucleic acid amplification methods, which are used to increase the copy numbers of a polynucleotide of interest in a nucleic acid sample. Such amplification methods are well known in the art, and they include but are not limited to, polymerase chain reaction (PCR) (U.S. Patent Nos. 4,683,195; and 4,683,202; *PCR Technology: Principles and Applications for DNA Amplification*, ed. H.A. Erlich, Freeman Press, NY, NY, 1992), ligase chain reaction (LCR) (Wu and Wallace, *Genomics* 4:560, 1989; Landegren *et al.*, *Science* 241:1077, 1988), strand displacement amplification (SDA) (U.S. Patent Nos. 5,270,184; and 5,422,252), transcription-mediated amplification (TMA) (U.S. Patent No. 5,399,491), linked linear amplification (LLA) (U.S. Patent No. 6,027,923), and the like, and isothermal amplification methods such as nucleic acid sequence based amplification (NASBA), and self-sustained sequence replication (Guatelli *et al.*, *Proc. Natl. Acad. Sci. USA* 87: 1874, 1990). Based on such methodologies, a person skilled in the art can readily design primers in any suitable regions 5' and 3' to a SNP disclosed herein. Such primers may be used to amplify DNA of any length so long that it contains the SNP of interest in its sequence.

As used herein, an "amplified polynucleotide" of the invention is a SNP-containing nucleic acid molecule whose amount has been increased at least two fold by any nucleic acid amplification method performed *in vitro* as compared to its starting amount in a test sample. In other preferred embodiments, an amplified polynucleotide is

the result of at least ten fold, fifty fold, one hundred fold, one thousand fold, or even ten thousand fold increase as compared to its starting amount in a test sample. In a typical PCR amplification, a polynucleotide of interest is often amplified at least fifty thousand fold in amount over the unamplified genomic DNA, but the precise amount of

5 amplification needed for an assay depends on the sensitivity of the subsequent detection method used.

Generally, an amplified polynucleotide is at least about 16 nucleotides in length. More typically, an amplified polynucleotide is at least about 20 nucleotides in length. In a preferred embodiment of the invention, an amplified polynucleotide is at least about 30

10 nucleotides in length. In a more preferred embodiment of the invention, an amplified polynucleotide is at least about 32, 40, 45, 50, or 60 nucleotides in length. In yet another preferred embodiment of the invention, an amplified polynucleotide is at least about 100, 200, 300, 400, or 500 nucleotides in length. While the total length of an amplified polynucleotide of the invention can be as long as an exon, an intron or the entire gene

15 where the SNP of interest resides, an amplified product is typically up to about 1,000 nucleotides in length (although certain amplification methods may generate amplified products greater than 1000 nucleotides in length). More preferably, an amplified polynucleotide is not greater than about 600-700 nucleotides in length. It is understood that irrespective of the length of an amplified polynucleotide, a SNP of interest may be

20 located anywhere along its sequence.

In a specific embodiment of the invention, the amplified product is at least about 201 nucleotides in length, comprises one of the transcript-based context sequences or the genomic-based context sequences shown in Tables 1-2. Such a product may have

25 additional sequences on its 5' end or 3' end or both. In another embodiment, the amplified product is about 101 nucleotides in length, and it contains a SNP disclosed herein. Preferably, the SNP is located at the middle of the amplified product (e.g., at position 101 in an amplified product that is 201 nucleotides in length, or at position 51 in an amplified product that is 101 nucleotides in length), or within 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 12, 15, or 20 nucleotides from the middle of the amplified product (however, as

30 indicated above, the SNP of interest may be located anywhere along the length of the amplified product).

The present invention provides isolated nucleic acid molecules that comprise, consist of, or consist essentially of one or more polynucleotide sequences that contain one or more SNPs disclosed herein, complements thereof, and SNP-containing fragments thereof.

Accordingly, the present invention provides nucleic acid molecules that consist of
5 any of the nucleotide sequences shown in Table 1 and/or Table 2 (transcript sequences are provided in Table 1 as SEQ ID NOS:1-517, genomic sequences are provided in Table 2 as SEQ ID NOS:13,194-13,514, transcript-based SNP context sequences are provided in Table 1 as SEQ ID NO:1035-13,193, and genomic-based SNP context sequences are provided in Table 2 as SEQ ID NO:13,515-85,090), or any nucleic acid molecule that encodes any of
10 the variant proteins provided in Table 1 (SEQ ID NOS:518-1034). A nucleic acid molecule consists of a nucleotide sequence when the nucleotide sequence is the complete nucleotide sequence of the nucleic acid molecule.

The present invention further provides nucleic acid molecules that consist essentially of any of the nucleotide sequences shown in Table 1 and/or Table 2 (transcript sequences
15 are provided in Table 1 as SEQ ID NOS:1-517, genomic sequences are provided in Table 2 as SEQ ID NOS:13,194-13,514, transcript-based SNP context sequences are provided in Table 1 as SEQ ID NO:1035-13,193, and genomic-based SNP context sequences are provided in Table 2 as SEQ ID NO:13,515-85,090), or any nucleic acid molecule that encodes any of the variant proteins provided in Table 1 (SEQ ID NOS:518-1034). A
20 nucleic acid molecule consists essentially of a nucleotide sequence when such a nucleotide sequence is present with only a few additional nucleotide residues in the final nucleic acid molecule.

The present invention further provides nucleic acid molecules that comprise any of the nucleotide sequences shown in Table 1 and/or Table 2 or a SNP-containing fragment
25 thereof (transcript sequences are provided in Table 1 as SEQ ID NOS:1-517, genomic sequences are provided in Table 2 as SEQ ID NOS:13,194-13,514, transcript-based SNP context sequences are provided in Table 1 as SEQ ID NO:1035-13,193, and genomic-based SNP context sequences are provided in Table 2 as SEQ ID NO:13,515-85,090), or any nucleic acid molecule that encodes any of the variant proteins provided in Table 1 (SEQ ID
30 NOS:518-1034). A nucleic acid molecule comprises a nucleotide sequence when the nucleotide sequence is at least part of the final nucleotide sequence of the nucleic acid

molecule. In such a fashion, the nucleic acid molecule can be only the nucleotide sequence or have additional nucleotide residues, such as residues that are naturally associated with it or heterologous nucleotide sequences. Such a nucleic acid molecule can have one to a few additional nucleotides or can comprise many more additional nucleotides. A brief
5 description of how various types of these nucleic acid molecules can be readily made and isolated is provided below, and such techniques are well known to those of ordinary skill in the art (Sambrook and Russell, 2000, Molecular Cloning: A Laboratory Manual, Cold Spring Harbor Press, NY).

The isolated nucleic acid molecules can encode mature proteins plus additional
10 amino or carboxyl-terminal amino acids or both, or amino acids interior to the mature peptide (when the mature form has more than one peptide chain, for instance). Such sequences may play a role in processing of a protein from precursor to a mature form, facilitate protein trafficking, prolong or shorten protein half-life, or facilitate manipulation of a protein for assay or production. As generally is the case *in situ*, the additional amino acids
15 may be processed away from the mature protein by cellular enzymes.

Thus, the isolated nucleic acid molecules include, but are not limited to, nucleic acid molecules having a sequence encoding a peptide alone, a sequence encoding a mature peptide and additional coding sequences such as a leader or secretory sequence (e.g., a pre-pro or pro-protein sequence), a sequence encoding a mature peptide with or without
20 additional coding sequences, plus additional non-coding sequences, for example introns and non-coding 5' and 3' sequences such as transcribed but untranslated sequences that play a role in, for example, transcription, mRNA processing (including splicing and polyadenylation signals), ribosome binding, and/or stability of mRNA. In addition, the nucleic acid molecules may be fused to heterologous marker sequences encoding, for
25 example, a peptide that facilitates purification.

Isolated nucleic acid molecules can be in the form of RNA, such as mRNA, or in the form DNA, including cDNA and genomic DNA, which may be obtained, for example, by molecular cloning or produced by chemical synthetic techniques or by a combination thereof (Sambrook and Russell, 2000, Molecular Cloning: A Laboratory
30 Manual, Cold Spring Harbor Press, NY). Furthermore, isolated nucleic acid molecules, particularly SNP detection reagents such as probes and primers, can also be partially or

completely in the form of one or more types of nucleic acid analogs, such as peptide nucleic acid (PNA) (U.S. Patent Nos. 5,539,082; 5,527,675; 5,623,049; 5,714,331). The nucleic acid, especially DNA, can be double-stranded or single-stranded. Single-stranded nucleic acid can be the coding strand (sense strand) or the complementary non-coding strand (anti-sense strand). DNA, RNA, or PNA segments can be assembled, for example, from fragments of the human genome (in the case of DNA or RNA) or single nucleotides, short oligonucleotide linkers, or from a series of oligonucleotides, to provide a synthetic nucleic acid molecule. Nucleic acid molecules can be readily synthesized using the sequences provided herein as a reference; oligonucleotide and PNA oligomer synthesis techniques are well known in the art (see, e.g., Corey, "Peptide nucleic acids: expanding the scope of nucleic acid recognition", *Trends Biotechnol.* 1997 Jun;15(6):224-9, and Hyrup et al., "Peptide nucleic acids (PNA): synthesis, properties and potential applications", *Bioorg Med Chem.* 1996 Jan;4(1):5-23). Furthermore, large-scale automated oligonucleotide/PNA synthesis (including synthesis on an array or bead surface or other solid support) can readily be accomplished using commercially available nucleic acid synthesizers, such as the Applied Biosystems (Foster City, CA) 3900 High-Throughput DNA Synthesizer or Expedite 8909 Nucleic Acid Synthesis System, and the sequence information provided herein.

The present invention encompasses nucleic acid analogs that contain modified, synthetic, or non-naturally occurring nucleotides or structural elements or other alternative/modified nucleic acid chemistries known in the art. Such nucleic acid analogs are useful, for example, as detection reagents (e.g., primers/probes) for detecting one or more SNPs identified in Table 1 and/or Table 2. Furthermore, kits/systems (such as beads, arrays, etc.) that include these analogs are also encompassed by the present invention. For example, PNA oligomers that are based on the polymorphic sequences of the present invention are specifically contemplated. PNA oligomers are analogs of DNA in which the phosphate backbone is replaced with a peptide-like backbone (Lagriffoul *et al.*, *Bioorganic & Medicinal Chemistry Letters*, 4: 1081-1082 (1994), Petersen *et al.*, *Bioorganic & Medicinal Chemistry Letters*, 6: 793-796 (1996), Kumar *et al.*, *Organic Letters* 3(9): 1269-1272 (2001), WO96/04000). PNA hybridizes to complementary RNA or DNA with higher affinity and specificity than conventional oligonucleotides and

oligonucleotide analogs. The properties of PNA enable novel molecular biology and biochemistry applications unachievable with traditional oligonucleotides and peptides.

Additional examples of nucleic acid modifications that improve the binding properties and/or stability of a nucleic acid include the use of base analogs such as
5 inosine, intercalators (U.S. Patent No. 4,835,263) and the minor groove binders (U.S. Patent No. 5,801,115). Thus, references herein to nucleic acid molecules, SNP-containing nucleic acid molecules, SNP detection reagents (e.g., probes and primers), oligonucleotides/polynucleotides include PNA oligomers and other nucleic acid analogs. Other examples of nucleic acid analogs and alternative/modified nucleic acid chemistries
10 known in the art are described in *Current Protocols in Nucleic Acid Chemistry*, John Wiley & Sons, N.Y. (2002).

The present invention further provides nucleic acid molecules that encode fragments of the variant polypeptides disclosed herein as well as nucleic acid molecules that encode obvious variants of such variant polypeptides. Such nucleic acid molecules
15 may be naturally occurring, such as paralogs (different locus) and orthologs (different organism), or may be constructed by recombinant DNA methods or by chemical synthesis. Non-naturally occurring variants may be made by mutagenesis techniques, including those applied to nucleic acid molecules, cells, or organisms. Accordingly, the variants can contain nucleotide substitutions, deletions, inversions and insertions (in
20 addition to the SNPs disclosed in Tables 1-2). Variation can occur in either or both the coding and non-coding regions. The variations can produce conservative and/or non-conservative amino acid substitutions.

Further variants of the nucleic acid molecules disclosed in Tables 1-2, such as naturally occurring allelic variants (as well as orthologs and paralogs) and synthetic
25 variants produced by mutagenesis techniques, can be identified and/or produced using methods well known in the art. Such further variants can comprise a nucleotide sequence that shares at least 70-80%, 80-85%, 85-90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, or 99% sequence identity with a nucleic acid sequence disclosed in Table 1 and/or Table 2 (or a fragment thereof) and that includes a novel SNP allele disclosed in Table 1
30 and/or Table 2. Further, variants can comprise a nucleotide sequence that encodes a polypeptide that shares at least 70-80%, 80-85%, 85-90%, 91%, 92%, 93%, 94%, 95%,

96%, 97%, 98%, or 99% sequence identity with a polypeptide sequence disclosed in Table 1 (or a fragment thereof) and that includes a novel SNP allele disclosed in Table 1 and/or Table 2. Thus, an aspect of the present invention that is specifically contemplated are isolated nucleic acid molecules that have a certain degree of sequence variation
5 compared with the sequences shown in Tables 1-2, but that contain a novel SNP allele disclosed herein. In other words, as long as an isolated nucleic acid molecule contains a novel SNP allele disclosed herein, other portions of the nucleic acid molecule that flank the novel SNP allele can vary to some degree from the specific transcript, genomic, and context sequences shown in Tables 1-2, and can encode a polypeptide that varies to some
10 degree from the specific polypeptide sequences shown in Table 1.

To determine the percent identity of two amino acid sequences or two nucleotide sequences of two molecules that share sequence homology, the sequences are aligned for optimal comparison purposes (e.g., gaps can be introduced in one or both of a first and a second amino acid or nucleic acid sequence for optimal alignment and non-homologous
15 sequences can be disregarded for comparison purposes). In a preferred embodiment, at least 30%, 40%, 50%, 60%, 70%, 80%, or 90% or more of the length of a reference sequence is aligned for comparison purposes. The amino acid residues or nucleotides at corresponding amino acid positions or nucleotide positions are then compared. When a position in the first sequence is occupied by the same amino acid residue or nucleotide as
20 the corresponding position in the second sequence, then the molecules are identical at that position (as used herein, amino acid or nucleic acid "identity" is equivalent to amino acid or nucleic acid "homology"). The percent identity between the two sequences is a function of the number of identical positions shared by the sequences, taking into account the number of gaps, and the length of each gap, which need to be introduced for optimal
25 alignment of the two sequences.

The comparison of sequences and determination of percent identity between two sequences can be accomplished using a mathematical algorithm. (*Computational Molecular Biology*, Lesk, A.M., ed., Oxford University Press, New York, 1988; *Biocomputing: Informatics and Genome Projects*, Smith, D.W., ed., Academic Press, New
30 York, 1993; *Computer Analysis of Sequence Data, Part 1*, Griffin, A.M., and Griffin, H.G., eds., Humana Press, New Jersey, 1994; *Sequence Analysis in Molecular Biology*, von

Heinje, G., Academic Press, 1987; and *Sequence Analysis Primer*, Gribskov, M. and Devereux, J., eds., M Stockton Press, New York, 1991). In a preferred embodiment, the percent identity between two amino acid sequences is determined using the Needleman and Wunsch algorithm (*J. Mol. Biol.* (48):444-453 (1970)) which has been incorporated
5 into the GAP program in the GCG software package, using either a Blossom 62 matrix or a PAM250 matrix, and a gap weight of 16, 14, 12, 10, 8, 6, or 4 and a length weight of 1, 2, 3, 4, 5, or 6.

In yet another preferred embodiment, the percent identity between two nucleotide sequences is determined using the GAP program in the GCG software package

10 (Devereux, J., *et al.*, *Nucleic Acids Res.* 12(1):387 (1984)), using a NWSgapdna.CMP matrix and a gap weight of 40, 50, 60, 70, or 80 and a length weight of 1, 2, 3, 4, 5, or 6.

In another embodiment, the percent identity between two amino acid or nucleotide sequences is determined using the algorithm of E. Myers and W. Miller (CABIOS, 4:11-17 (1989)) which has been incorporated into the ALIGN program (version 2.0), using a
15 PAM120 weight residue table, a gap length penalty of 12, and a gap penalty of 4.

The nucleotide and amino acid sequences of the present invention can further be used as a "query sequence" to perform a search against sequence databases to, for example, identify other family members or related sequences. Such searches can be performed using the NBLAST and XBLAST programs (version 2.0) of Altschul, *et al.* (*J. Mol. Biol.* 215:403-10 (1990)). BLAST nucleotide searches can be performed with the NBLAST program, score = 100, wordlength = 12 to obtain nucleotide sequences homologous to the nucleic acid molecules of the invention. BLAST protein searches can be performed with the XBLAST program, score = 50, wordlength = 3 to obtain amino acid sequences homologous to the proteins of the invention. To obtain gapped
25 alignments for comparison purposes, Gapped BLAST can be utilized as described in Altschul *et al.* (*Nucleic Acids Res.* 25(17):3389-3402 (1997)). When utilizing BLAST and gapped BLAST programs, the default parameters of the respective programs (e.g., XBLAST and NBLAST) can be used. In addition to BLAST, examples of other search and sequence comparison programs used in the art include, but are not limited to, FASTA
30 (Pearson, *Methods Mol. Biol.* 25, 365-389 (1994)) and KERR (Dufresne *et al.*, *Nat*

Biotechnol 2002 Dec;20(12):1269-71). For further information regarding bioinformatics techniques, see *Current Protocols in Bioinformatics*, John Wiley & Sons, Inc., N.Y.

The present invention further provides non-coding fragments of the nucleic acid molecules disclosed in Table 1 and/or Table 2. Preferred non-coding fragments include, but are not limited to, promoter sequences, enhancer sequences, intronic sequences, 5' untranslated regions (UTRs), 3' untranslated regions, gene modulating sequences and gene termination sequences. Such fragments are useful, for example, in controlling heterologous gene expression and in developing screens to identify gene-modulating agents.

SNP Detection Reagents

In a specific aspect of the present invention, the SNPs disclosed in Table 1 and/or Table 2, and their associated transcript sequences (provided in Table 1 as SEQ ID NOS:1-517), genomic sequences (provided in Table 2 as SEQ ID NOS:13,194-13,514), and context sequences (transcript-based context sequences are provided in Table 1 as SEQ ID NOS:1035-13,193; genomic-based context sequences are provided in Table 2 as SEQ ID NOS:13,515-85,090), can be used for the design of SNP detection reagents. As used herein, a "SNP detection reagent" is a reagent that specifically detects a specific target SNP position disclosed herein, and that is preferably specific for a particular nucleotide (allele) of the target SNP position (i.e., the detection reagent preferably can differentiate between different alternative nucleotides at a target SNP position, thereby allowing the identity of the nucleotide present at the target SNP position to be determined). Typically, such detection reagent hybridizes to a target SNP-containing nucleic acid molecule by complementary base-pairing in a sequence specific manner, and discriminates the target variant sequence from other nucleic acid sequences such as an art-known form in a test sample. An example of a detection reagent is a probe that hybridizes to a target nucleic acid containing one or more of the SNPs provided in Table 1 and/or Table 2. In a preferred embodiment, such a probe can differentiate between nucleic acids having a particular nucleotide (allele) at a target SNP position from other nucleic acids that have a different nucleotide at the same target SNP position. In addition, a detection reagent may hybridize to a specific region 5' and/or 3' to a SNP position, particularly a region corresponding to the context sequences

provided in Table 1 and/or Table 2 (transcript-based context sequences are provided in Table 1 as SEQ ID NOS:1035-13,193; genomic-based context sequences are provided in Table 2 as SEQ ID NOS:13,515-85,090). Another example of a detection reagent is a primer which acts as an initiation point of nucleotide extension along a complementary strand of a target polynucleotide. The SNP sequence information provided herein is also useful for designing primers, e.g. allele-specific primers, to amplify (e.g., using PCR) any SNP of the present invention.

In one preferred embodiment of the invention, a SNP detection reagent is an isolated or synthetic DNA or RNA polynucleotide probe or primer or PNA oligomer, or a combination of DNA, RNA and/or PNA, that hybridizes to a segment of a target nucleic acid molecule containing a SNP identified in Table 1 and/or Table 2. A detection reagent in the form of a polynucleotide may optionally contain modified base analogs, intercalators or minor groove binders. Multiple detection reagents such as probes may be, for example, affixed to a solid support (e.g., arrays or beads) or supplied in solution (e.g., probe/primer sets for enzymatic reactions such as PCR, RT-PCR, TaqMan assays, or primer-extension reactions) to form a SNP detection kit.

A probe or primer typically is a substantially purified oligonucleotide or PNA oligomer. Such oligonucleotide typically comprises a region of complementary nucleotide sequence that hybridizes under stringent conditions to at least about 8, 10, 12, 16, 18, 20, 22, 25, 30, 40, 50, 55, 60, 65, 70, 80, 90, 100, 120 (or any other number in-between) or more consecutive nucleotides in a target nucleic acid molecule. Depending on the particular assay, the consecutive nucleotides can either include the target SNP position, or be a specific region in close enough proximity 5' and/or 3' to the SNP position to carry out the desired assay.

Other preferred primer and probe sequences can readily be determined using the transcript sequences (SEQ ID NOS:1-517), genomic sequences (SEQ ID NOS:13,194-13,514), and SNP context sequences (transcript-based context sequences are provided in Table 1 as SEQ ID NOS:1035-13,193; genomic-based context sequences are provided in Table 2 as SEQ ID NOS:13,515-85,090) disclosed in the Sequence Listing and in Tables 1-2. It will be apparent to one of skill in the art that such primers and probes are directly

useful as reagents for genotyping the SNPs of the present invention, and can be incorporated into any kit/system format.

In order to produce a probe or primer specific for a target SNP-containing sequence, the gene/transcript and/or context sequence surrounding the SNP of interest is typically examined using a computer algorithm which starts at the 5' or at the 3' end of the nucleotide sequence. Typical algorithms will then identify oligomers of defined length that are unique to the gene/SNP context sequence, have a GC content within a range suitable for hybridization, lack predicted secondary structure that may interfere with hybridization, and/or possess other desired characteristics or that lack other undesired characteristics.

A primer or probe of the present invention is typically at least about 8 nucleotides in length. In one embodiment of the invention, a primer or a probe is at least about 10 nucleotides in length. In a preferred embodiment, a primer or a probe is at least about 12 nucleotides in length. In a more preferred embodiment, a primer or probe is at least about 16, 17, 18, 19, 20, 21, 22, 23, 24 or 25 nucleotides in length. While the maximal length of a probe can be as long as the target sequence to be detected, depending on the type of assay in which it is employed, it is typically less than about 50, 60, 65, or 70 nucleotides in length. In the case of a primer, it is typically less than about 30 nucleotides in length. In a specific preferred embodiment of the invention, a primer or a probe is within the length of about 18 and about 28 nucleotides. However, in other embodiments, such as nucleic acid arrays and other embodiments in which probes are affixed to a substrate, the probes can be longer, such as on the order of 30-70, 75, 80, 90, 100, or more nucleotides in length (see the section below entitled "SNP Detection Kits and Systems").

For analyzing SNPs, it may be appropriate to use oligonucleotides specific for alternative SNP alleles. Such oligonucleotides which detect single nucleotide variations in target sequences may be referred to by such terms as "allele-specific oligonucleotides", "allele-specific probes", or "allele-specific primers". The design and use of allele-specific probes for analyzing polymorphisms is described in, e.g., *Mutation Detection A Practical Approach*, ed. Cotton *et al.* Oxford University Press, 1998; Saiki *et al.*, *Nature* 324, 163-166 (1986); Dattagupta, EP235,726; and Saiki, WO 89/11548.

While the design of each allele-specific primer or probe depends on variables such as the precise composition of the nucleotide sequences flanking a SNP position in a target nucleic acid molecule, and the length of the primer or probe, another factor in the use of primers and probes is the stringency of the condition under which the hybridization between the probe or primer and the target sequence is performed. Higher stringency conditions utilize buffers with lower ionic strength and/or a higher reaction temperature, and tend to require a more perfect match between probe/primer and a target sequence in order to form a stable duplex. If the stringency is too high, however, hybridization may not occur at all. In contrast, lower stringency conditions utilize buffers with higher ionic strength and/or a lower reaction temperature, and permit the formation of stable duplexes with more mismatched bases between a probe/primer and a target sequence. By way of example and not limitation, exemplary conditions for high stringency hybridization conditions using an allele-specific probe are as follows: Prehybridization with a solution containing 5X standard saline phosphate EDTA (SSPE); 0.5% NaDodSO₄ (SDS) at 55°C, and incubating probe with target nucleic acid molecules in the same solution at the same temperature, followed by washing with a solution containing 2X SSPE, and 0.1% SDS at 55°C or room temperature.

Moderate stringency hybridization conditions may be used for allele-specific primer extension reactions with a solution containing, e.g., about 50mM KCl at about 46°C. Alternatively, the reaction may be carried out at an elevated temperature such as 60°C. In another embodiment, a moderately stringent hybridization condition suitable for oligonucleotide ligation assay (OLA) reactions wherein two probes are ligated if they are completely complementary to the target sequence may utilize a solution of about 100mM KCl at a temperature of 46°C.

In a hybridization-based assay, allele-specific probes can be designed that hybridize to a segment of target DNA from one individual but do not hybridize to the corresponding segment from another individual due to the presence of different polymorphic forms (e.g., alternative SNP alleles/nucleotides) in the respective DNA segments from the two individuals. Hybridization conditions should be sufficiently stringent that there is a significant detectable difference in hybridization intensity between alleles, and preferably an essentially binary response, whereby a probe

hybridizes to only one of the alleles or significantly more strongly to one allele. While a probe may be designed to hybridize to a target sequence that contains a SNP site such that the SNP site aligns anywhere along the sequence of the probe, the probe is preferably designed to hybridize to a segment of the target sequence such that the SNP site aligns
5 with a central position of the probe (e.g., a position within the probe that is at least three nucleotides from either end of the probe). This design of probe generally achieves good discrimination in hybridization between different allelic forms.

In another embodiment, a probe or primer may be designed to hybridize to a segment of target DNA such that the SNP aligns with either the 5' most end or the 3'
10 most end of the probe or primer. In a specific preferred embodiment that is particularly suitable for use in an oligonucleotide ligation assay (U.S. Patent No. 4,988,617), the 3' most nucleotide of the probe aligns with the SNP position in the target sequence.

Oligonucleotide probes and primers may be prepared by methods well known in the art. Chemical synthetic methods include, but are limited to, the phosphotriester
15 method described by Narang *et al.*, 1979, *Methods in Enzymology* 68:90; the phosphodiester method described by Brown *et al.*, 1979, *Methods in Enzymology* 68:109, the diethylphosphoamidate method described by Beaucage *et al.*, 1981, *Tetrahedron Letters* 22:1859; and the solid support method described in U.S. Patent No. 4,458,066.

20 Allele-specific probes are often used in pairs (or, less commonly, in sets of 3 or 4, such as if a SNP position is known to have 3 or 4 alleles, respectively, or to assay both strands of a nucleic acid molecule for a target SNP allele), and such pairs may be identical except for a one nucleotide mismatch that represents the allelic variants at the SNP position. Commonly, one member of a pair perfectly matches a reference form of a target sequence
25 that has a more common SNP allele (i.e., the allele that is more frequent in the target population) and the other member of the pair perfectly matches a form of the target sequence that has a less common SNP allele (i.e., the allele that is rarer in the target population). In the case of an array, multiple pairs of probes can be immobilized on the same support for simultaneous analysis of multiple different polymorphisms.

30 In one type of PCR-based assay, an allele-specific primer hybridizes to a region on a target nucleic acid molecule that overlaps a SNP position and only primes

amplification of an allelic form to which the primer exhibits perfect complementarity (Gibbs, 1989, *Nucleic Acid Res.* 17 2427-2448). Typically, the primer's 3'-most nucleotide is aligned with and complementary to the SNP position of the target nucleic acid molecule. This primer is used in conjunction with a second primer that hybridizes at a distal site. Amplification proceeds from the two primers, producing a detectable product that indicates which allelic form is present in the test sample. A control is usually performed with a second pair of primers, one of which shows a single base mismatch at the polymorphic site and the other of which exhibits perfect complementarity to a distal site. The single-base mismatch prevents amplification or substantially reduces amplification efficiency, so that either no detectable product is formed or it is formed in lower amounts or at a slower pace. The method generally works most effectively when the mismatch is at the 3'-most position of the oligonucleotide (i.e., the 3'-most position of the oligonucleotide aligns with the target SNP position) because this position is most destabilizing to elongation from the primer (see, e.g., WO 93/22456). This PCR-based assay can be utilized as part of the TaqMan assay, described below.

In a specific embodiment of the invention, a primer of the invention contains a sequence substantially complementary to a segment of a target SNP-containing nucleic acid molecule except that the primer has a mismatched nucleotide in one of the three nucleotide positions at the 3'-most end of the primer, such that the mismatched nucleotide does not base pair with a particular allele at the SNP site. In a preferred embodiment, the mismatched nucleotide in the primer is the second from the last nucleotide at the 3'-most position of the primer. In a more preferred embodiment, the mismatched nucleotide in the primer is the last nucleotide at the 3'-most position of the primer.

In another embodiment of the invention, a SNP detection reagent of the invention is labeled with a fluorogenic reporter dye that emits a detectable signal. While the preferred reporter dye is a fluorescent dye, any reporter dye that can be attached to a detection reagent such as an oligonucleotide probe or primer is suitable for use in the invention. Such dyes include, but are not limited to, Acridine, AMCA, BODIPY, Cascade Blue, Cy2, Cy3, Cy5, Cy7, Dabcyl, Edans, Eosin, Erythrosin, Fluorescein, 6-Fam, Tet, Joe, Hex, Oregon Green, Rhodamine, Rhodol Green, Tamra, Rox, and Texas Red.

In yet another embodiment of the invention, the detection reagent may be further labeled with a quencher dye such as Tamra, especially when the reagent is used as a self-quenching probe such as a TaqMan (U.S. Patent Nos. 5,210,015 and 5,538,848) or Molecular Beacon probe (U.S. Patent Nos. 5,118,801 and 5,312,728), or other stemless or
5 linear beacon probe (Livak *et al.*, 1995, PCR Method Appl. 4:357-362; Tyagi *et al.*, 1996, Nature Biotechnology 14: 303-308; Nazarenko *et al.*, 1997, Nucl. Acids Res. 25:2516-2521; U.S. Patent Nos. 5,866,336 and 6,117,635).

The detection reagents of the invention may also contain other labels, including but not limited to, biotin for streptavidin binding, hapten for antibody binding, and
10 oligonucleotide for binding to another complementary oligonucleotide such as pairs of zipcodes.

The present invention also contemplates reagents that do not contain (or that are complementary to) a SNP nucleotide identified herein but that are used to assay one or more SNPs disclosed herein. For example, primers that flank, but do not hybridize
15 directly to a target SNP position provided herein are useful in primer extension reactions in which the primers hybridize to a region adjacent to the target SNP position (i.e., within one or more nucleotides from the target SNP site). During the primer extension reaction, a primer is typically not able to extend past a target SNP site if a particular nucleotide (allele) is present at that target SNP site, and the primer extension product can be detected
20 in order to determine which SNP allele is present at the target SNP site. For example, particular ddNTPs are typically used in the primer extension reaction to terminate primer extension once a ddNTP is incorporated into the extension product (a primer extension product which includes a ddNTP at the 3'-most end of the primer extension product, and in which the ddNTP is a nucleotide of a SNP disclosed herein, is a composition that is
25 specifically contemplated by the present invention). Thus, reagents that bind to a nucleic acid molecule in a region adjacent to a SNP site and that are used for assaying the SNP site, even though the bound sequences do not necessarily include the SNP site itself, are also contemplated by the present invention.

SNP Detection Kits and Systems

A person skilled in the art will recognize that, based on the SNP and associated sequence information disclosed herein, detection reagents can be developed and used to assay any SNP of the present invention individually or in combination, and such detection reagents can be readily incorporated into one of the established kit or system formats which are well known in the art. The terms “kits” and “systems”, as used herein in the context of SNP detection reagents, are intended to refer to such things as combinations of multiple SNP detection reagents, or one or more SNP detection reagents in combination with one or more other types of elements or components (e.g., other types of biochemical reagents, containers, packages such as packaging intended for commercial sale, substrates to which SNP detection reagents are attached, electronic hardware components, etc.). Accordingly, the present invention further provides SNP detection kits and systems, including but not limited to, packaged probe and primer sets (e.g., TaqMan probe/primer sets), arrays/microarrays of nucleic acid molecules, and beads that contain one or more probes, primers, or other detection reagents for detecting one or more SNPs of the present invention. The kits/systems can optionally include various electronic hardware components; for example, arrays (“DNA chips”) and microfluidic systems (“lab-on-a-chip” systems) provided by various manufacturers typically comprise hardware components. Other kits/systems (e.g., probe/primer sets) may not include electronic hardware components, but may be comprised of, for example, one or more SNP detection reagents (along with, optionally, other biochemical reagents) packaged in one or more containers.

In some embodiments, a SNP detection kit typically contains one or more detection reagents and other components (e.g., a buffer, enzymes such as DNA polymerases or ligases, chain extension nucleotides such as deoxynucleotide triphosphates, and in the case of Sanger-type DNA sequencing reactions, chain terminating nucleotides, positive control sequences, negative control sequences, and the like) necessary to carry out an assay or reaction, such as amplification and/or detection of a SNP-containing nucleic acid molecule. A kit may further contain means for determining the amount of a target nucleic acid, and means for comparing the amount

with a standard, and can comprise instructions for using the kit to detect the SNP-containing nucleic acid molecule of interest. In one embodiment of the present invention, kits are provided which contain the necessary reagents to carry out one or more assays to detect one or more SNPs disclosed herein. In a preferred embodiment of the present invention, SNP detection kits/systems are in the form of nucleic acid arrays, or compartmentalized kits, including microfluidic/lab-on-a-chip systems.

SNP detection kits/systems may contain, for example, one or more probes, or pairs of probes, that hybridize to a nucleic acid molecule at or near each target SNP position. Multiple pairs of allele-specific probes may be included in the kit/system to simultaneously assay large numbers of SNPs, at least one of which is a SNP of the present invention. In some kits/systems, the allele-specific probes are immobilized to a substrate such as an array or bead. For example, the same substrate can comprise allele-specific probes for detecting at least 1; 10; 100; 1000; 10,000; 100,000 (or any other number in-between) or substantially all of the SNPs shown in Table 1 and/or Table 2.

The terms "arrays", "microarrays", and "DNA chips" are used herein interchangeably to refer to an array of distinct polynucleotides affixed to a substrate, such as glass, plastic, paper, nylon or other type of membrane, filter, chip, or any other suitable solid support. The polynucleotides can be synthesized directly on the substrate, or synthesized separate from the substrate and then affixed to the substrate. In one embodiment, the microarray is prepared and used according to the methods described in U.S. Patent No. 5,837,832, Chee et al., PCT application W095/11995 (Chee et al.), Lockhart, D. J. et al. (1996; *Nat. Biotech.* 14: 1675-1680) and Schena, M. et al. (1996; *Proc. Natl. Acad. Sci.* 93: 10614-10619), all of which are incorporated herein in their entirety by reference. In other embodiments, such arrays are produced by the methods described by Brown et al., U.S. Patent No. 5,807,522.

Nucleic acid arrays are reviewed in the following references: Zammattéo et al., "New chips for molecular biology and diagnostics", *Biotechnol Annu Rev.* 2002;8:85-101; Sosnowski et al., "Active microelectronic array system for DNA hybridization, genotyping and pharmacogenomic applications", *Psychiatr Genet.* 2002 Dec;12(4):181-92; Heller, "DNA microarray technology: devices, systems, and applications", *Annu Rev Biomed Eng.* 2002;4:129-53. Epub 2002 Mar 22; Kolchinsky et al., "Analysis of SNPs

and other genomic variations using gel-based chips”, *Hum Mutat.* 2002 Apr;19(4):343-60; and McGall et al., “High-density genechip oligonucleotide probe arrays”, *Adv Biochem Eng Biotechnol.* 2002;77:21-42.

Any number of probes, such as allele-specific probes, may be implemented in an array, and each probe or pair of probes can hybridize to a different SNP position. In the case of polynucleotide probes, they can be synthesized at designated areas (or synthesized separately and then affixed to designated areas) on a substrate using a light-directed chemical process. Each DNA chip can contain, for example, thousands to millions of individual synthetic polynucleotide probes arranged in a grid-like pattern and miniaturized (e.g., to the size of a dime). Preferably, probes are attached to a solid support in an ordered, addressable array.

A microarray can be composed of a large number of unique, single-stranded polynucleotides, usually either synthetic antisense polynucleotides or fragments of cDNAs, fixed to a solid support. Typical polynucleotides are preferably about 6-60 nucleotides in length, more preferably about 15-30 nucleotides in length, and most preferably about 18-25 nucleotides in length. For certain types of microarrays or other detection kits/systems, it may be preferable to use oligonucleotides that are only about 7-20 nucleotides in length. In other types of arrays, such as arrays used in conjunction with chemiluminescent detection technology, preferred probe lengths can be, for example, about 15-80 nucleotides in length, preferably about 50-70 nucleotides in length, more preferably about 55-65 nucleotides in length, and most preferably about 60 nucleotides in length. The microarray or detection kit can contain polynucleotides that cover the known 5' or 3' sequence of a gene/transcript or target SNP site, sequential polynucleotides that cover the full-length sequence of a gene/transcript; or unique polynucleotides selected from particular areas along the length of a target gene/transcript sequence, particularly areas corresponding to one or more SNPs disclosed in Table 1 and/or Table 2. Polynucleotides used in the microarray or detection kit can be specific to a SNP or SNPs of interest (e.g., specific to a particular SNP allele at a target SNP site, or specific to particular SNP alleles at multiple different SNP sites), or specific to a polymorphic gene/transcript or genes/transcripts of interest.

Hybridization assays based on polynucleotide arrays rely on the differences in hybridization stability of the probes to perfectly matched and mismatched target sequence variants. For SNP genotyping, it is generally preferable that stringency conditions used in hybridization assays are high enough such that nucleic acid molecules that differ from one another at as little as a single SNP position can be differentiated (e.g., typical SNP hybridization assays are designed so that hybridization will occur only if one particular nucleotide is present at a SNP position, but will not occur if an alternative nucleotide is present at that SNP position). Such high stringency conditions may be preferable when using, for example, nucleic acid arrays of allele-specific probes for SNP detection. Such high stringency conditions are described in the preceding section, and are well known to those skilled in the art and can be found in, for example, *Current Protocols in Molecular Biology*, John Wiley & Sons, N.Y. (1989), 6.3:1-6.3.6.

In other embodiments, the arrays are used in conjunction with chemiluminescent detection technology. The following patents and patent applications, which are all hereby incorporated by reference, provide additional information pertaining to chemiluminescent detection: U.S. patent applications 10/620332 and 10/620333 describe chemiluminescent approaches for microarray detection; U.S. Patent Nos. 6124478, 6107024, 5994073, 5981768, 5871938, 5843681, 5800999, and 5773628 describe methods and compositions of dioxetane for performing chemiluminescent detection; and U.S. published application US2002/0110828 discloses methods and compositions for microarray controls.

In one embodiment of the invention, a nucleic acid array can comprise an array of probes of about 15-25 nucleotides in length. In further embodiments, a nucleic acid array can comprise any number of probes, in which at least one probe is capable of detecting one or more SNPs disclosed in Table 1 and/or Table 2, and/or at least one probe comprises a fragment of one of the sequences selected from the group consisting of those disclosed in Table 1, Table 2, the Sequence Listing, and sequences complementary thereto, said fragment comprising at least about 8 consecutive nucleotides, preferably 10, 12, 15, 16, 18, 20, more preferably 22, 25, 30, 40, 47, 50, 55, 60, 65, 70, 80, 90, 100, or more consecutive nucleotides (or any other number in-between) and containing (or being complementary to) a novel SNP allele disclosed in Table 1 and/or Table 2. In some

embodiments, the nucleotide complementary to the SNP site is within 5, 4, 3, 2, or 1 nucleotide from the center of the probe, more preferably at the center of said probe.

A polynucleotide probe can be synthesized on the surface of the substrate by using a chemical coupling procedure and an ink jet application apparatus, as described in PCT application W095/251116 (Baldeschweiler et al.) which is incorporated herein in its entirety by reference. In another aspect, a "gridded" array analogous to a dot (or slot) blot may be used to arrange and link cDNA fragments or oligonucleotides to the surface of a substrate using a vacuum system, thermal, UV, mechanical or chemical bonding procedures. An array, such as those described above, may be produced by hand or by using available devices (slot blot or dot blot apparatus), materials (any suitable solid support), and machines (including robotic instruments), and may contain 8, 24, 96, 384, 1536, 6144 or more polynucleotides, or any other number which lends itself to the efficient use of commercially available instrumentation.

Using such arrays or other kits/systems, the present invention provides methods of identifying the SNPs disclosed herein in a test sample. Such methods typically involve incubating a test sample of nucleic acids with an array comprising one or more probes corresponding to at least one SNP position of the present invention, and assaying for binding of a nucleic acid from the test sample with one or more of the probes. Conditions for incubating a SNP detection reagent (or a kit/system that employs one or more such SNP detection reagents) with a test sample vary. Incubation conditions depend on such factors as the format employed in the assay, the detection methods employed, and the type and nature of the detection reagents used in the assay. One skilled in the art will recognize that any one of the commonly available hybridization, amplification and array assay formats can readily be adapted to detect the SNPs disclosed herein.

A SNP detection kit/system of the present invention may include components that are used to prepare nucleic acids from a test sample for the subsequent amplification and/or detection of a SNP-containing nucleic acid molecule. Such sample preparation components can be used to produce nucleic acid extracts (including DNA and/or RNA), proteins or membrane extracts from any bodily fluids (such as blood, serum, plasma, urine, saliva, phlegm, gastric juices, semen, tears, sweat, etc.), skin, hair, cells (especially nucleated cells), biopsies, buccal swabs or tissue specimens. The test samples used in the

above-described methods will vary based on such factors as the assay format, nature of the detection method, and the specific tissues, cells or extracts used as the test sample to be assayed. Methods of preparing nucleic acids, proteins, and cell extracts are well known in the art and can be readily adapted to obtain a sample that is compatible with the system utilized. Automated sample preparation systems for extracting nucleic acids from a test sample are commercially available, and examples are Qiagen's BioRobot 9600, Applied Biosystems' PRISM 6700, and Roche Molecular Systems' COBAS AmpliPrep System.

Another form of kit contemplated by the present invention is a compartmentalized kit. A compartmentalized kit includes any kit in which reagents are contained in separate containers. Such containers include, for example, small glass containers, plastic containers, strips of plastic, glass or paper, or arraying material such as silica. Such containers allow one to efficiently transfer reagents from one compartment to another compartment such that the test samples and reagents are not cross-contaminated, or from one container to another vessel not included in the kit, and the agents or solutions of each container can be added in a quantitative fashion from one compartment to another or to another vessel. Such containers may include, for example, one or more containers which will accept the test sample, one or more containers which contain at least one probe or other SNP detection reagent for detecting one or more SNPs of the present invention, one or more containers which contain wash reagents (such as phosphate buffered saline, Tris-buffers, etc.), and one or more containers which contain the reagents used to reveal the presence of the bound probe or other SNP detection reagents. The kit can optionally further comprise compartments and/or reagents for, for example, nucleic acid amplification or other enzymatic reactions such as primer extension reactions, hybridization, ligation, electrophoresis (preferably capillary electrophoresis), mass spectrometry, and/or laser-induced fluorescent detection. The kit may also include instructions for using the kit. Exemplary compartmentalized kits include microfluidic devices known in the art (see, e.g., Weigl et al., "Lab-on-a-chip for drug development", *Adv Drug Deliv Rev.* 2003 Feb 24;55(3):349-77). In such microfluidic devices, the containers may be referred to as, for example, microfluidic "compartments", "chambers", or "channels".

Microfluidic devices, which may also be referred to as “lab-on-a-chip” systems, biomedical micro-electro-mechanical systems (bioMEMs), or multicomponent integrated systems, are exemplary kits/systems of the present invention for analyzing SNPs. Such systems miniaturize and compartmentalize processes such as probe/target hybridization, nucleic acid amplification, and capillary electrophoresis reactions in a single functional device. Such microfluidic devices typically utilize detection reagents in at least one aspect of the system, and such detection reagents may be used to detect one or more SNPs of the present invention. One example of a microfluidic system is disclosed in U.S. Patent No. 5,589,136, which describes the integration of PCR amplification and capillary electrophoresis in chips. Exemplary microfluidic systems comprise a pattern of microchannels designed onto a glass, silicon, quartz, or plastic wafer included on a microchip. The movements of the samples may be controlled by electric, electroosmotic or hydrostatic forces applied across different areas of the microchip to create functional microscopic valves and pumps with no moving parts. Varying the voltage can be used as a means to control the liquid flow at intersections between the micro-machined channels and to change the liquid flow rate for pumping across different sections of the microchip. See, for example, U.S. Patent Nos. 6,153,073, Dubrow *et al.*, and 6,156,181, Parce *et al.*

For genotyping SNPs, an exemplary microfluidic system may integrate, for example, nucleic acid amplification, primer extension, capillary electrophoresis, and a detection method such as laser induced fluorescence detection. In a first step of an exemplary process for using such an exemplary system, nucleic acid samples are amplified, preferably by PCR. Then, the amplification products are subjected to automated primer extension reactions using ddNTPs (specific fluorescence for each ddNTP) and the appropriate oligonucleotide primers to carry out primer extension reactions which hybridize just upstream of the targeted SNP. Once the extension at the 3' end is completed, the primers are separated from the unincorporated fluorescent ddNTPs by capillary electrophoresis. The separation medium used in capillary electrophoresis can be, for example, polyacrylamide, polyethyleneglycol or dextran. The incorporated ddNTPs in the single nucleotide primer extension products are identified by laser-induced fluorescence detection. Such an exemplary microchip can be used to process, for example, at least 96 to 384 samples, or more, in parallel.

USES OF NUCLEIC ACID MOLECULES

The nucleic acid molecules of the present invention have a variety of uses, especially in predicting an individual's risk for developing a cardiovascular disorder (particularly the risk for experiencing a first or recurrent acute coronary event such as a myocardial infarction or stroke), for prognosing the progression of a cardiovascular disorder in an individual (e.g., the severity or consequences of an acute coronary event), in evaluating the likelihood of an individual who has a cardiovascular disorder of responding to treatment of the cardiovascular disorder with statin, and/or predicting the likelihood that the individual will experience toxicity or other undesirable side effects from the statin treatment, etc. For example, the nucleic acid molecules are useful as hybridization probes, such as for genotyping SNPs in messenger RNA, transcript, cDNA, genomic DNA, amplified DNA or other nucleic acid molecules, and for isolating full-length cDNA and genomic clones encoding the variant peptides disclosed in Table 1 as well as their orthologs.

A probe can hybridize to any nucleotide sequence along the entire length of a nucleic acid molecule provided in Table 1 and/or Table 2. Preferably, a probe of the present invention hybridizes to a region of a target sequence that encompasses a SNP position indicated in Table 1 and/or Table 2. More preferably, a probe hybridizes to a SNP-containing target sequence in a sequence-specific manner such that it distinguishes the target sequence from other nucleotide sequences which vary from the target sequence only by which nucleotide is present at the SNP site. Such a probe is particularly useful for detecting the presence of a SNP-containing nucleic acid in a test sample, or for determining which nucleotide (allele) is present at a particular SNP site (i.e., genotyping the SNP site).

A nucleic acid hybridization probe may be used for determining the presence, level, form, and/or distribution of nucleic acid expression. The nucleic acid whose level is determined can be DNA or RNA. Accordingly, probes specific for the SNPs described herein can be used to assess the presence, expression and/or gene copy number in a given cell, tissue, or organism. These uses are relevant for diagnosis of disorders involving an increase or decrease in gene expression relative to normal levels. *In vitro* techniques for detection of mRNA include, for example, Northern blot hybridizations and *in situ* hybridizations. *In vitro* techniques for detecting DNA include Southern blot

hybridizations and *in situ* hybridizations (Sambrook and Russell, 2000, Molecular Cloning: A Laboratory Manual, Cold Spring Harbor Press, Cold Spring Harbor, NY).

Probes can be used as part of a diagnostic test kit for identifying cells or tissues in which a variant protein is expressed, such as by measuring the level of a variant protein-
5 encoding nucleic acid (e.g., mRNA) in a sample of cells from a subject or determining if a polynucleotide contains a SNP of interest.

Thus, the nucleic acid molecules of the invention can be used as hybridization probes to detect the SNPs disclosed herein, thereby determining whether an individual with the polymorphisms is likely or unlikely to develop a cardiovascular disorder such as
10 an acute coronary event, or the likelihood that an individual will respond positively to statin treatment of a cardiovascular disorder. Detection of a SNP associated with a disease phenotype provides a diagnostic tool for an active disease and/or genetic predisposition to the disease.

Furthermore, the nucleic acid molecules of the invention are therefore useful for
15 detecting a gene (gene information is disclosed in Table 2, for example) which contains a SNP disclosed herein and/or products of such genes, such as expressed mRNA transcript molecules (transcript information is disclosed in Table 1, for example), and are thus useful for detecting gene expression. The nucleic acid molecules can optionally be implemented in, for example, an array or kit format for use in detecting gene expression.

20 The nucleic acid molecules of the invention are also useful as primers to amplify any given region of a nucleic acid molecule, particularly a region containing a SNP identified in Table 1 and/or Table 2.

The nucleic acid molecules of the invention are also useful for constructing recombinant vectors (described in greater detail below). Such vectors include expression
25 vectors that express a portion of, or all of, any of the variant peptide sequences provided in Table 1. Vectors also include insertion vectors, used to integrate into another nucleic acid molecule sequence, such as into the cellular genome, to alter *in situ* expression of a gene and/or gene product. For example, an endogenous coding sequence can be replaced via homologous recombination with all or part of the coding region containing one or more
30 specifically introduced SNPs.

The nucleic acid molecules of the invention are also useful for expressing antigenic portions of the variant proteins, particularly antigenic portions that contain a variant amino acid sequence (e.g., an amino acid substitution) caused by a SNP disclosed in Table 1 and/or Table 2.

5 The nucleic acid molecules of the invention are also useful for constructing vectors containing a gene regulatory region of the nucleic acid molecules of the present invention.

The nucleic acid molecules of the invention are also useful for designing ribozymes corresponding to all, or a part, of an mRNA molecule expressed from a SNP-containing nucleic acid molecule described herein.

10 The nucleic acid molecules of the invention are also useful for constructing host cells expressing a part, or all, of the nucleic acid molecules and variant peptides.

The nucleic acid molecules of the invention are also useful for constructing transgenic animals expressing all, or a part, of the nucleic acid molecules and variant peptides. The production of recombinant cells and transgenic animals having nucleic acid
15 molecules which contain the SNPs disclosed in Table 1 and/or Table 2 allow, for example, effective clinical design of treatment compounds and dosage regimens.

The nucleic acid molecules of the invention are also useful in assays for drug screening to identify compounds that, for example, modulate nucleic acid expression.

The nucleic acid molecules of the invention are also useful in gene therapy in
20 patients whose cells have aberrant gene expression. Thus, recombinant cells, which include a patient's cells that have been engineered *ex vivo* and returned to the patient, can be introduced into an individual where the recombinant cells produce the desired protein to treat the individual.

25 SNP Genotyping Methods

The process of determining which specific nucleotide (i.e., allele) is present at each of one or more SNP positions, such as a SNP position in a nucleic acid molecule disclosed in Table 1 and/or Table 2, is referred to as SNP genotyping. The present invention provides methods of SNP genotyping, such as for use in evaluating an individual's risk for
30 developing a cardiovascular disease – particularly an acute coronary event (such as myocardial infarction or stroke) and for evaluating an individual's prognosis for disease

severity and recovery, for predicting the likelihood that an individual who has previously experienced an acute coronary event will experience one or more recurrent acute coronary events, for implementing a preventive or treatment regimen for an individual based on that individual having an increased susceptibility for developing a cardiovascular disorder (e.g., increased risk for experiencing one or more myocardial infarctions or strokes), in evaluating an individual's likelihood of responding to statin treatment for cardiovascular disease, in selecting a treatment regimen (e.g., in deciding whether or not to administer statin treatment to an individual having a cardiovascular disease, or in formulating or selecting a particular statin-based treatment regimen such as dosage and/or frequency of administration of statin treatment or choosing which form/type of statin to be administered such as a particular pharmaceutical composition or compound, etc.), determining the likelihood of experiencing toxicity or other undesirable side effects from the statin treatment, or selecting individuals for a clinical trial of a statin (e.g., selecting individuals to participate in the trial who are most likely to respond positively from the statin treatment), etc.

Nucleic acid samples can be genotyped to determine which allele(s) is/are present at any given genetic region (e.g., SNP position) of interest by methods well known in the art. The neighboring sequence can be used to design SNP detection reagents such as oligonucleotide probes, which may optionally be implemented in a kit format. Exemplary SNP genotyping methods are described in Chen et al., "Single nucleotide polymorphism genotyping: biochemistry, protocol, cost and throughput", *Pharmacogenomics J.* 2003;3(2):77-96; Kwok et al., "Detection of single nucleotide polymorphisms", *Curr Issues Mol Biol.* 2003 Apr;5(2):43-60; Shi, "Technologies for individual genotyping: detection of genetic polymorphisms in drug targets and disease genes", *Am J Pharmacogenomics.* 2002;2(3):197-205; and Kwok, "Methods for genotyping single nucleotide polymorphisms", *Annu Rev Genomics Hum Genet* 2001;2:235-58. Exemplary techniques for high-throughput SNP genotyping are described in Marnellos, "High-throughput SNP analysis for genetic association studies", *Curr Opin Drug Discov Devel.* 2003 May;6(3):317-21. Common SNP genotyping methods include, but are not limited to, TaqMan assays, molecular beacon assays, nucleic acid arrays, allele-specific primer extension, allele-specific PCR, arrayed primer extension, homogeneous primer extension assays, primer extension with detection by mass spectrometry, pyrosequencing, multiplex primer extension sorted on genetic arrays,

ligation with rolling circle amplification, homogeneous ligation, OLA (U.S. Patent No. 4,988,167), multiplex ligation reaction sorted on genetic arrays, restriction-fragment length polymorphism, single base extension-tag assays, and the Invader assay. Such methods may be used in combination with detection mechanisms such as, for example, luminescence or chemiluminescence detection, fluorescence detection, time-resolved fluorescence detection, fluorescence resonance energy transfer, fluorescence polarization, mass spectrometry, and electrical detection.

Various methods for detecting polymorphisms include, but are not limited to, methods in which protection from cleavage agents is used to detect mismatched bases in RNA/RNA or RNA/DNA duplexes (Myers *et al.*, *Science* 230:1242 (1985); Cotton *et al.*, *PNAS* 85:4397 (1988); and Saleeba *et al.*, *Meth. Enzymol.* 217:286-295 (1992)), comparison of the electrophoretic mobility of variant and wild type nucleic acid molecules (Orita *et al.*, *PNAS* 86:2766 (1989); Cotton *et al.*, *Mutat. Res.* 285:125-144 (1993); and Hayashi *et al.*, *Genet. Anal. Tech. Appl.* 9:73-79 (1992)), and assaying the movement of polymorphic or wild-type fragments in polyacrylamide gels containing a gradient of denaturant using denaturing gradient gel electrophoresis (DGGE) (Myers *et al.*, *Nature* 313:495 (1985)). Sequence variations at specific locations can also be assessed by nuclease protection assays such as RNase and S1 protection or chemical cleavage methods.

In a preferred embodiment, SNP genotyping is performed using the TaqMan assay, which is also known as the 5' nuclease assay (U.S. Patent Nos. 5,210,015 and 5,538,848). The TaqMan assay detects the accumulation of a specific amplified product during PCR. The TaqMan assay utilizes an oligonucleotide probe labeled with a fluorescent reporter dye and a quencher dye. The reporter dye is excited by irradiation at an appropriate wavelength, it transfers energy to the quencher dye in the same probe via a process called fluorescence resonance energy transfer (FRET). When attached to the probe, the excited reporter dye does not emit a signal. The proximity of the quencher dye to the reporter dye in the intact probe maintains a reduced fluorescence for the reporter. The reporter dye and quencher dye may be at the 5' most and the 3' most ends, respectively, or vice versa. Alternatively, the reporter dye may be at the 5' or 3' most end while the quencher dye is attached to an internal nucleotide, or vice versa. In yet another embodiment, both the reporter and the quencher may be attached to internal

nucleotides at a distance from each other such that fluorescence of the reporter is reduced.

During PCR, the 5' nuclease activity of DNA polymerase cleaves the probe, thereby separating the reporter dye and the quencher dye and resulting in increased fluorescence of the reporter. Accumulation of PCR product is detected directly by monitoring the increase in fluorescence of the reporter dye. The DNA polymerase cleaves the probe between the reporter dye and the quencher dye only if the probe hybridizes to the target SNP-containing template which is amplified during PCR, and the probe is designed to hybridize to the target SNP site only if a particular SNP allele is present.

Preferred TaqMan primer and probe sequences can readily be determined using the SNP and associated nucleic acid sequence information provided herein. A number of computer programs, such as PrimerExpress (Applied Biosystems, Foster City, CA); can be used to rapidly obtain optimal primer/probe sets. It will be apparent to one of skill in the art that such primers and probes for detecting the SNPs of the present invention are useful in screening for individuals who are susceptible to developing a cardiovascular disorder (e.g., an acute coronary event) or in screening individuals who have a cardiovascular disorder for their likelihood of responding to statin treatment. These probes and primers can be readily incorporated into a kit format. The present invention also includes modifications of the Taqman assay well known in the art such as the use of Molecular Beacon probes (U.S. Patent Nos. 5,118,801 and 5,312,728) and other variant formats (U.S. Patent Nos. 5,866,336 and 6,117,635).

Another preferred method for genotyping the SNPs of the present invention is the use of two oligonucleotide probes in an OLA (see, e.g., U.S. Patent No. 4,988,617). In this method, one probe hybridizes to a segment of a target nucleic acid with its 3' most end aligned with the SNP site. A second probe hybridizes to an adjacent segment of the target nucleic acid molecule directly 3' to the first probe. The two juxtaposed probes hybridize to the target nucleic acid molecule, and are ligated in the presence of a linking agent such as a ligase if there is perfect complementarity between the 3' most nucleotide of the first probe with the SNP site. If there is a mismatch, ligation would not occur.

After the reaction, the ligated probes are separated from the target nucleic acid molecule, and detected as indicators of the presence of a SNP.

The following patents, patent applications, and published international patent applications, which are all hereby incorporated by reference, provide additional information pertaining to techniques for carrying out various types of OLA: U.S. Patent Nos. 6027889, 6268148, 5494810, 5830711, and 6054564 describe OLA strategies for performing SNP detection; WO 97/31256 and WO 00/56927 describe OLA strategies for performing SNP detection using universal arrays, wherein a zipcode sequence can be introduced into one of the hybridization probes, and the resulting product, or amplified product, hybridized to a universal zip code array; U.S. application US01/17329 (and 09/584,905) describes OLA (or LDR) followed by PCR, wherein zipcodes are incorporated into OLA probes, and amplified PCR products are determined by electrophoretic or universal zipcode array readout; U.S. applications 60/427818, 60/445636, and 60/445494 describe SNplex methods and software for multiplexed SNP detection using OLA followed by PCR, wherein zipcodes are incorporated into OLA probes, and amplified PCR products are hybridized with a zipchute reagent, and the identity of the SNP determined from electrophoretic readout of the zipchute. In some embodiments, OLA is carried out prior to PCR (or another method of nucleic acid amplification). In other embodiments, PCR (or another method of nucleic acid amplification) is carried out prior to OLA.

Another method for SNP genotyping is based on mass spectrometry. Mass spectrometry takes advantage of the unique mass of each of the four nucleotides of DNA. SNPs can be unambiguously genotyped by mass spectrometry by measuring the differences in the mass of nucleic acids having alternative SNP alleles. MALDI-TOF (Matrix Assisted Laser Desorption Ionization – Time of Flight) mass spectrometry technology is preferred for extremely precise determinations of molecular mass, such as SNPs. Numerous approaches to SNP analysis have been developed based on mass spectrometry. Preferred mass spectrometry-based methods of SNP genotyping include primer extension assays, which can also be utilized in combination with other approaches, such as traditional gel-based formats and microarrays.

Typically, the primer extension assay involves designing and annealing a primer to a template PCR amplicon upstream (5') from a target SNP position. A mix of dideoxynucleotide triphosphates (ddNTPs) and/or deoxynucleotide triphosphates (dNTPs) are added to a reaction mixture containing template (e.g., a SNP-containing nucleic acid molecule which has typically been amplified, such as by PCR), primer, and DNA polymerase. Extension of the primer terminates at the first position in the template where a nucleotide complementary to one of the ddNTPs in the mix occurs. The primer can be either immediately adjacent (i.e., the nucleotide at the 3' end of the primer hybridizes to the nucleotide next to the target SNP site) or two or more nucleotides removed from the SNP position. If the primer is several nucleotides removed from the target SNP position, the only limitation is that the template sequence between the 3' end of the primer and the SNP position cannot contain a nucleotide of the same type as the one to be detected, or this will cause premature termination of the extension primer. Alternatively, if all four ddNTPs alone, with no dNTPs, are added to the reaction mixture, the primer will always be extended by only one nucleotide, corresponding to the target SNP position. In this instance, primers are designed to bind one nucleotide upstream from the SNP position (i.e., the nucleotide at the 3' end of the primer hybridizes to the nucleotide that is immediately adjacent to the target SNP site on the 5' side of the target SNP site). Extension by only one nucleotide is preferable, as it minimizes the overall mass of the extended primer, thereby increasing the resolution of mass differences between alternative SNP nucleotides. Furthermore, mass-tagged ddNTPs can be employed in the primer extension reactions in place of unmodified ddNTPs. This increases the mass difference between primers extended with these ddNTPs, thereby providing increased sensitivity and accuracy, and is particularly useful for typing heterozygous base positions. Mass-tagging also alleviates the need for intensive sample-preparation procedures and decreases the necessary resolving power of the mass spectrometer.

The extended primers can then be purified and analyzed by MALDI-TOF mass spectrometry to determine the identity of the nucleotide present at the target SNP position. In one method of analysis, the products from the primer extension reaction are combined with light absorbing crystals that form a matrix. The matrix is then hit with an

energy source such as a laser to ionize and desorb the nucleic acid molecules into the gas-phase. The ionized molecules are then ejected into a flight tube and accelerated down the tube towards a detector. The time between the ionization event, such as a laser pulse, and collision of the molecule with the detector is the time of flight of that molecule. The time of flight is precisely correlated with the mass-to-charge ratio (m/z) of the ionized molecule. Ions with smaller m/z travel down the tube faster than ions with larger m/z and therefore the lighter ions reach the detector before the heavier ions. The time-of-flight is then converted into a corresponding, and highly precise, m/z . In this manner, SNPs can be identified based on the slight differences in mass, and the corresponding time of flight differences, inherent in nucleic acid molecules having different nucleotides at a single base position. For further information regarding the use of primer extension assays in conjunction with MALDI-TOF mass spectrometry for SNP genotyping, see, e.g., Wise *et al.*, "A standard protocol for single nucleotide primer extension in the human genome using matrix-assisted laser desorption/ionization time-of-flight mass spectrometry", *Rapid Commun Mass Spectrom.* 2003;17(11):1195-202.

The following references provide further information describing mass spectrometry-based methods for SNP genotyping: Bocker, "SNP and mutation discovery using base-specific cleavage and MALDI-TOF mass spectrometry", *Bioinformatics.* 2003 Jul;19 Suppl 1:I44-I53; Storm *et al.*, "MALDI-TOF mass spectrometry-based SNP genotyping", *Methods Mol Biol.* 2003;212:241-62; Jurinke *et al.*, "The use of MassARRAY technology for high throughput genotyping", *Adv Biochem Eng Biotechnol.* 2002;77:57-74; and Jurinke *et al.*, "Automated genotyping using the DNA MassArray technology", *Methods Mol Biol.* 2002;187:179-92.

SNPs can also be scored by direct DNA sequencing. A variety of automated sequencing procedures can be utilized ((1995) *Biotechniques* 19:448), including sequencing by mass spectrometry (see, e.g., PCT International Publication No. WO94/16101; Cohen *et al.*, *Adv. Chromatogr.* 36:127-162 (1996); and Griffin *et al.*, *Appl. Biochem. Biotechnol.* 38:147-159 (1993)). The nucleic acid sequences of the present invention enable one of ordinary skill in the art to readily design sequencing primers for such automated sequencing procedures. Commercial instrumentation, such as the Applied Biosystems

377, 3100, 3700, 3730, and 3730xl DNA Analyzers (Foster City, CA), is commonly used in the art for automated sequencing.

Other methods that can be used to genotype the SNPs of the present invention include single-strand conformational polymorphism (SSCP), and denaturing gradient gel electrophoresis (DGGE) (Myers *et al.*, *Nature* 313:495 (1985)). SSCP identifies base differences by alteration in electrophoretic migration of single stranded PCR products, as described in Orita *et al.*, *Proc. Nat. Acad.* Single-stranded PCR products can be generated by heating or otherwise denaturing double stranded PCR products. Single-stranded nucleic acids may refold or form secondary structures that are partially dependent on the base sequence. The different electrophoretic mobilities of single-stranded amplification products are related to base-sequence differences at SNP positions. DGGE differentiates SNP alleles based on the different sequence-dependent stabilities and melting properties inherent in polymorphic DNA and the corresponding differences in electrophoretic migration patterns in a denaturing gradient gel (Erlich, ed., PCR Technology, *Principles and Applications for DNA Amplification*, W.H. Freeman and Co, New York, 1992, Chapter 7).

Sequence-specific ribozymes (U.S. Patent No. 5,498,531) can also be used to score SNPs based on the development or loss of a ribozyme cleavage site. Perfectly matched sequences can be distinguished from mismatched sequences by nuclease cleavage digestion assays or by differences in melting temperature. If the SNP affects a restriction enzyme cleavage site, the SNP can be identified by alterations in restriction enzyme digestion patterns, and the corresponding changes in nucleic acid fragment lengths determined by gel electrophoresis

SNP genotyping can include the steps of, for example, collecting a biological sample from a human subject (e.g., sample of tissues, cells, fluids, secretions, etc.), isolating nucleic acids (e.g., genomic DNA, mRNA or both) from the cells of the sample, contacting the nucleic acids with one or more primers which specifically hybridize to a region of the isolated nucleic acid containing a target SNP under conditions such that hybridization and amplification of the target nucleic acid region occurs, and determining the nucleotide present at the SNP position of interest, or, in some assays, detecting the presence or absence of an amplification product (assays can be designed so that

hybridization and/or amplification will only occur if a particular SNP allele is present or absent). In some assays, the size of the amplification product is detected and compared to the length of a control sample; for example, deletions and insertions can be detected by a change in size of the amplified product compared to a normal genotype.

- 5 SNP genotyping is useful for numerous practical applications, as described below. Examples of such applications include, but are not limited to, SNP-disease association analysis, disease predisposition screening, disease diagnosis, disease prognosis, disease progression monitoring, determining therapeutic strategies based on an individual's genotype ("pharmacogenomics"), developing therapeutic agents based on SNP genotypes
- 10 associated with a disease or likelihood of responding to a drug, stratifying a patient population for clinical trial for a treatment regimen, predicting the likelihood that an individual will experience toxic side effects from a therapeutic agent, and human identification applications such as forensics.

15 **Analysis of Genetic Association Between SNPs and Phenotypic Traits**

- SNP genotyping for disease diagnosis, disease predisposition screening, disease prognosis, determining drug responsiveness (pharmacogenomics), drug toxicity screening, and other uses described herein, typically relies on initially establishing a genetic association between one or more specific SNPs and the particular phenotypic
- 20 traits of interest.

- Different study designs may be used for genetic association studies (*Modern Epidemiology*, Lippincott Williams & Wilkins (1998), 609-622). Observational studies are most frequently carried out in which the response of the patients is not interfered with. The first type of observational study identifies a sample of persons in whom the
- 25 suspected cause of the disease is present and another sample of persons in whom the suspected cause is absent, and then the frequency of development of disease in the two samples is compared. These sampled populations are called cohorts, and the study is a prospective study. The other type of observational study is case-control or a retrospective study. In typical case-control studies, samples are collected from individuals with the
- 30 phenotype of interest (cases) such as certain manifestations of a disease, and from individuals without the phenotype (controls) in a population (target population) that

conclusions are to be drawn from. Then the possible causes of the disease are investigated retrospectively. As the time and costs of collecting samples in case-control studies are considerably less than those for prospective studies, case-control studies are the more commonly used study design in genetic association studies, at least during the exploration and discovery stage.

In both types of observational studies, there may be potential confounding factors that should be taken into consideration. Confounding factors are those that are associated with both the real cause(s) of the disease and the disease itself, and they include demographic information such as age, gender, ethnicity as well as environmental factors. When confounding factors are not matched in cases and controls in a study, and are not controlled properly, spurious association results can arise. If potential confounding factors are identified, they should be controlled for by analysis methods explained below.

In a genetic association study, the cause of interest to be tested is a certain allele or a SNP or a combination of alleles or a haplotype from several SNPs. Thus, tissue specimens (e.g., whole blood) from the sampled individuals may be collected and genomic DNA genotyped for the SNP(s) of interest. In addition to the phenotypic trait of interest, other information such as demographic (e.g., age, gender, ethnicity, etc.), clinical, and environmental information that may influence the outcome of the trait can be collected to further characterize and define the sample set. In many cases, these factors are known to be associated with diseases and/or SNP allele frequencies. There are likely gene-environment and/or gene-gene interactions as well. Analysis methods to address gene-environment and gene-gene interactions (for example, the effects of the presence of both susceptibility alleles at two different genes can be greater than the effects of the individual alleles at two genes combined) are discussed below.

After all the relevant phenotypic and genotypic information has been obtained, statistical analyses are carried out to determine if there is any significant correlation between the presence of an allele or a genotype with the phenotypic characteristics of an individual. Preferably, data inspection and cleaning are first performed before carrying out statistical tests for genetic association. Epidemiological and clinical data of the samples can be summarized by descriptive statistics with tables and graphs. Data validation is preferably performed to check for data completion, inconsistent entries, and

outliers. Chi-squared tests and t-tests (Wilcoxon rank-sum tests if distributions are not normal) may then be used to check for significant differences between cases and controls for discrete and continuous variables, respectively. To ensure genotyping quality, Hardy-Weinberg disequilibrium tests can be performed on cases and controls separately.

- 5 Significant deviation from Hardy-Weinberg equilibrium (HWE) in both cases and controls for individual markers can be indicative of genotyping errors. If HWE is violated in a majority of markers, it is indicative of population substructure that should be further investigated. Moreover, Hardy-Weinberg disequilibrium in cases only can indicate genetic association of the markers with the disease (*Genetic Data Analysis*, Weir
10 B., Sinauer (1990)).

- To test whether an allele of a single SNP is associated with the case or control status of a phenotypic trait, one skilled in the art can compare allele frequencies in cases and controls. Standard chi-squared tests and Fisher exact tests can be carried out on a 2x2 table (2 SNP alleles x 2 outcomes in the categorical trait of interest). To test whether
15 genotypes of a SNP are associated, chi-squared tests can be carried out on a 3x2 table (3 genotypes x 2 outcomes). Score tests are also carried out for genotypic association to contrast the three genotypic frequencies (major homozygotes, heterozygotes and minor homozygotes) in cases and controls, and to look for trends using 3 different modes of inheritance, namely dominant (with contrast coefficients 2, -1, -1), additive (with
20 contrast coefficients 1, 0, -1) and recessive (with contrast coefficients 1, 1, -2). Odds ratios for minor versus major alleles, and odds ratios for heterozygote and homozygote variants versus the wild type genotypes are calculated with the desired confidence limits, usually 95%.

- In order to control for confounders and to test for interaction and effect modifiers,
25 stratified analyses may be performed using stratified factors that are likely to be confounding, including demographic information such as age, ethnicity, and gender, or an interacting element or effect modifier, such as a known major gene (e.g., APOE for Alzheimer's disease or HLA genes for autoimmune diseases), or environmental factors such as smoking in lung cancer. Stratified association tests may be carried out using
30 Cochran-Mantel-Haenszel tests that take into account the ordinal nature of genotypes with 0, 1, and 2 variant alleles. Exact tests by StatXact may also be performed when

computationally possible. Another way to adjust for confounding effects and test for interactions is to perform stepwise multiple logistic regression analysis using statistical packages such as SAS or R. Logistic regression is a model-building technique in which the best fitting and most parsimonious model is built to describe the relation between the dichotomous outcome (for instance, getting a certain disease or not) and a set of independent variables (for instance, genotypes of different associated genes, and the associated demographic and environmental factors). The most common model is one in which the logit transformation of the odds ratios is expressed as a linear combination of the variables (main effects) and their cross-product terms (interactions) (Applied Logistic Regression, Hosmer and Lemeshow, Wiley (2000)). To test whether a certain variable or interaction is significantly associated with the outcome, coefficients in the model are first estimated and then tested for statistical significance of their departure from zero.

In addition to performing association tests one marker at a time, haplotype association analysis may also be performed to study a number of markers that are closely linked together. Haplotype association tests can have better power than genotypic or allelic association tests when the tested markers are not the disease-causing mutations themselves but are in linkage disequilibrium with such mutations. The test will even be more powerful if the disease is indeed caused by a combination of alleles on a haplotype (e.g., APOE is a haplotype formed by 2 SNPs that are very close to each other). In order to perform haplotype association effectively, marker-marker linkage disequilibrium measures, both D' and R^2 , are typically calculated for the markers within a gene to elucidate the haplotype structure. Recent studies (Daly et al, *Nature Genetics*, 29, 232-235, 2001) in linkage disequilibrium indicate that SNPs within a gene are organized in block pattern, and a high degree of linkage disequilibrium exists within blocks and very little linkage disequilibrium exists between blocks. Haplotype association with the disease status can be performed using such blocks once they have been elucidated.

Haplotype association tests can be carried out in a similar fashion as the allelic and genotypic association tests. Each haplotype in a gene is analogous to an allele in a multi-allelic marker. One skilled in the art can either compare the haplotype frequencies in cases and controls or test genetic association with different pairs of haplotypes. It has been proposed (Schaid et al, *Am. J. Hum. Genet.*, 70, 425-434, 2002) that score tests can

be done on haplotypes using the program "haplo.score". In that method, haplotypes are first inferred by EM algorithm and score tests are carried out with a generalized linear model (GLM) framework that allows the adjustment of other factors.

An important decision in the performance of genetic association tests is the determination of the significance level at which significant association can be declared when the p-value of the tests reaches that level. In an exploratory analysis where positive hits will be followed up in subsequent confirmatory testing, an unadjusted p-value < 0.1 (a significance level on the lenient side) may be used for generating hypotheses for significant association of a SNP with certain phenotypic characteristics of a disease. It is preferred that a p-value < 0.05 (a significance level traditionally used in the art) is achieved in order for a SNP to be considered to have an association with a disease. It is more preferred that a p-value < 0.01 (a significance level on the stringent side) is achieved for an association to be declared. When hits are followed up in confirmatory analyses in more samples of the same source or in different samples from different sources, adjustment for multiple testing will be performed as to avoid excess number of hits while maintaining the experiment-wise error rates at 0.05. While there are different methods to adjust for multiple testing to control for different kinds of error rates, a commonly used but rather conservative method is Bonferroni correction to control the experiment-wise or family-wise error rate (*Multiple comparisons and multiple tests*, Westfall et al, SAS Institute (1999)). Permutation tests to control for the false discovery rates, FDR, can be more powerful (Benjamini and Hochberg, Journal of the Royal Statistical Society, Series B 57, 1289-1300, 1995, *Resampling-based Multiple Testing*, Westfall and Young, Wiley (1993)). Such methods to control for multiplicity would be preferred when the tests are dependent and controlling for false discovery rates is sufficient as opposed to controlling for the experiment-wise error rates.

In replication studies using samples from different populations after statistically significant markers have been identified in the exploratory stage, meta-analyses can then be performed by combining evidence of different studies (*Modern Epidemiology*, Lippincott Williams & Wilkins, 1998, 643-673). If available, association results known in the art for the same SNPs can be included in the meta-analyses.

Since both genotyping and disease status classification can involve errors, sensitivity analyses may be performed to see how odds ratios and p-values would change upon various estimates on genotyping and disease classification error rates.

It has been well known that subpopulation-based sampling bias between cases and controls can lead to spurious results in case-control association studies (Ewens and Spielman, *Am. J. Hum. Genet.* 62, 450-458, 1995) when prevalence of the disease is associated with different subpopulation groups. Such bias can also lead to a loss of statistical power in genetic association studies. To detect population stratification, Pritchard and Rosenberg (Pritchard et al. *Am. J. Hum. Gen.* 1999, 65:220-228) suggested typing markers that are unlinked to the disease and using results of association tests on those markers to determine whether there is any population stratification. When stratification is detected, the genomic control (GC) method as proposed by Devlin and Roeder (Devlin et al. *Biometrics* 1999, 55:997-1004) can be used to adjust for the inflation of test statistics due to population stratification. GC method is robust to changes in population structure levels as well as being applicable to DNA pooling designs (Devlin et al. *Genet. Epidemiol.* 2000, 21:273-284).

While Pritchard's method recommended using 15-20 unlinked microsatellite markers, it suggested using more than 30 biallelic markers to get enough power to detect population stratification. For the GC method, it has been shown (Bacanu et al. *Am. J. Hum. Genet.* 2000, 66:1933-1944) that about 60-70 biallelic markers are sufficient to estimate the inflation factor for the test statistics due to population stratification. Hence, 70 intergenic SNPs can be chosen in unlinked regions as indicated in a genome scan (Kehoe et al. *Hum. Mol. Genet.* 1999, 8:237-245).

Once individual risk factors, genetic or non-genetic, have been found for the predisposition to disease, the next step is to set up a classification/prediction scheme to predict the category (for instance, disease or no-disease) that an individual will be in depending on his genotypes of associated SNPs and other non-genetic risk factors. Logistic regression for discrete trait and linear regression for continuous trait are standard techniques for such tasks (*Applied Regression Analysis*, Draper and Smith, Wiley (1998)). Moreover, other techniques can also be used for setting up classification. Such techniques include, but are not limited to, MART, CART, neural network, and

discriminant analyses that are suitable for use in comparing the performance of different methods (*The Elements of Statistical Learning*, Hastie, Tibshirani & Friedman, Springer (2002)).

5 **Disease Diagnosis and Predisposition Screening**

Information on association/correlation between genotypes and disease-related phenotypes can be exploited in several ways. For example, in the case of a highly statistically significant association between one or more SNPs with predisposition to a disease for which treatment is available, detection of such a genotype pattern in an individual may justify immediate administration of treatment, or at least the institution of regular monitoring of the individual. Detection of the susceptibility alleles associated with serious disease in a couple contemplating having children may also be valuable to the couple in their reproductive decisions. In the case of a weaker but still statistically significant association between a SNP and a human disease, immediate therapeutic intervention or monitoring may not be justified after detecting the susceptibility allele or SNP. Nevertheless, the subject can be motivated to begin simple life-style changes (e.g., diet, exercise) that can be accomplished at little or no cost to the individual but would confer potential benefits in reducing the risk of developing conditions for which that individual may have an increased risk by virtue of having the susceptibility allele(s).

20 The SNPs of the invention may contribute to cardiovascular disorders such as acute coronary events, or to responsiveness of an individual to statin treatment, in different ways. Some polymorphisms occur within a protein coding sequence and contribute to disease phenotype by affecting protein structure. Other polymorphisms occur in noncoding regions but may exert phenotypic effects indirectly via influence on, for example, replication, transcription, and/or translation. A single SNP may affect more than one phenotypic trait. Likewise, a single phenotypic trait may be affected by multiple SNPs in different genes.

As used herein, the terms “diagnose”, “diagnosis”, and “diagnostics” include, but are not limited to any of the following: detection of a cardiovascular disorders that an individual may presently have, predisposition/susceptibility screening (e.g., determining whether an individual has an increased risk of experiencing an acute coronary event in

the future, or determining whether an individual has a decreased risk of experiencing an acute coronary event in the future), determining a particular type or subclass of cardiovascular disorder in an individual known to currently have or to have previously experienced a cardiovascular disorder, confirming or reinforcing a previously made
5 diagnosis of a cardiovascular disorder, evaluating an individual's likelihood of responding to statin treatment for cardiovascular disorders, predisposition screening (e.g., evaluating an individual's likelihood of responding to statin treatment if the individual were to develop a cardiovascular disorder in the future), determining a particular type or subclass of responder/non-responder in an individual known to respond or not respond to
10 statin treatment, confirming or reinforcing a previously made classification of an individual as a responder/non-responder to statin treatment, pharmacogenomic evaluation of an individual to determine which therapeutic strategy that individual is most likely to positively respond to or to predict whether a patient is likely to respond to a particular treatment such as statin treatment, predicting whether a patient is likely to experience
15 toxic effects from a particular treatment or therapeutic compound, and evaluating the future prognosis of an individual having a cardiovascular disorder. Such diagnostic uses are based on the SNPs individually or in a unique combination or SNP haplotypes of the present invention.

Haplotypes are particularly useful in that, for example, fewer SNPs can be
20 genotyped to determine if a particular genomic region harbors a locus that influences a particular phenotype, such as in linkage disequilibrium-based SNP association analysis.

Linkage disequilibrium (LD) refers to the co-inheritance of alleles (e.g., alternative nucleotides) at two or more different SNP sites at frequencies greater than would be expected from the separate frequencies of occurrence of each allele in a given
25 population. The expected frequency of co-occurrence of two alleles that are inherited independently is the frequency of the first allele multiplied by the frequency of the second allele. Alleles that co-occur at expected frequencies are said to be in "linkage equilibrium". In contrast, LD refers to any non-random genetic association between allele(s) at two or more different SNP sites, which is generally due to the physical
30 proximity of the two loci along a chromosome. LD can occur when two or more SNPs sites are in close physical proximity to each other on a given chromosome and therefore

alleles at these SNP sites will tend to remain unseparated for multiple generations with the consequence that a particular nucleotide (allele) at one SNP site will show a non-random association with a particular nucleotide (allele) at a different SNP site located nearby. Hence, genotyping one of the SNP sites will give almost the same information as
5 genotyping the other SNP site that is in LD.

Various degrees of LD can be encountered between two or more SNPs with the result being that some SNPs are more closely associated (i.e., in stronger LD) than others. Furthermore, the physical distance over which LD extends along a chromosome differs between different regions of the genome, and therefore the degree of physical separation
10 between two or more SNP sites necessary for LD to occur can differ between different regions of the genome.

For diagnostic purposes and similar uses, if a particular SNP site is found to be useful for, for example, predicting an individual's susceptibility to an acute coronary event or an individual's response to statin treatment, then the skilled artisan would
15 recognize that other SNP sites which are in LD with this SNP site would also be useful for predicting an individual's response to statin treatment. Various degrees of LD can be encountered between two or more SNPs with the result being that some SNPs are more closely associated (i.e., in stronger LD) than others. Furthermore, the physical distance over which LD extends along a chromosome differs between different regions of the
20 genome, and therefore the degree of physical separation between two or more SNP sites necessary for LD to occur can differ between different regions of the genome. Thus, polymorphisms (e.g., SNPs and/or haplotypes) that are not the actual disease-causing (causative) polymorphisms, but are in LD with such causative polymorphisms, are also useful. In such instances, the genotype of the polymorphism(s) that is/are in LD with the
25 causative polymorphism is predictive of the genotype of the causative polymorphism and, consequently, predictive of the phenotype (e.g., responder/non-responder to statin treatment) that is influenced by the causative SNP(s). Therefore, polymorphic markers that are in LD with causative polymorphisms are useful as diagnostic markers, and are particularly useful when the actual causative polymorphism(s) is/are unknown.

30 Examples of polymorphisms that can be in LD with one or more causative polymorphisms (and/or in LD with one or more polymorphisms that have a significant

statistical association with a condition) and therefore useful for diagnosing the same condition that the causative/associated SNP(s) is used to diagnose, include, for example, other SNPs in the same gene, protein-coding, or mRNA transcript-coding region as the causative/associated SNP, other SNPs in the same exon or same intron as the causative/associated SNP, other SNPs in the same haplotype block as the causative/associated SNP, other SNPs in the same intergenic region as the causative/associated SNP, SNPs that are outside but near a gene (e.g., within 6kb on either side, 5' or 3', of a gene boundary) that harbors a causative/associated SNP, etc. Such useful LD SNPs can be selected from among the SNPs disclosed in Tables 1-2, for example.

Linkage disequilibrium in the human genome is reviewed in: Wall et al., "Haplotype blocks and linkage disequilibrium in the human genome", *Nat Rev Genet.* 2003 Aug;4(8):587-97; Garner et al., "On selecting markers for association studies: patterns of linkage disequilibrium between two and three diallelic loci", *Genet Epidemiol.* 2003 Jan;24(1):57-67; Ardlie et al., "Patterns of linkage disequilibrium in the human genome", *Nat Rev Genet.* 2002 Apr;3(4):299-309 (erratum in *Nat Rev Genet* 2002 Jul;3(7):566); and Remm et al., "High-density genotyping and linkage disequilibrium in the human genome using chromosome 22 as a model", *Curr Opin Chem Biol.* 2002 Feb;6(1):24-30.

The contribution or association of particular SNPs and/or SNP haplotypes with disease phenotypes, such as susceptibility to acute coronary events or responsiveness to statin treatment, enables the SNPs of the present invention to be used to develop superior diagnostic tests capable of identifying individuals who express a detectable trait, such as predisposition to acute coronary events or responder/non-responder to statin treatment, as the result of a specific genotype, or individuals whose genotype places them at an increased or decreased risk of developing a detectable trait at a subsequent time as compared to individuals who do not have that genotype. As described herein, diagnostics may be based on a single SNP or a group of SNPs. Combined detection of a plurality of SNPs (for example, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 24, 25, 30, 32, 48, 50, 64, 96, 100, or any other number in-between, or more, of the SNPs provided in Table 1 and/or Table 2) typically increases the probability of an accurate

diagnosis. For example, the presence of a single SNP known to correlate with response to statin treatment might indicate a probability of 20% that an individual will respond to statin treatment, whereas detection of five SNPs, each of which correlates with response to statin treatment, might indicate a probability of 80% that an individual will respond to statin treatment. To further increase the accuracy of diagnosis or predisposition screening, analysis of the SNPs of the present invention can be combined with that of other polymorphisms or other risk factors that correlate with disease risk and response to statin treatment, such as family history.

It will, of course, be understood by practitioners skilled in the treatment or diagnosis of cardiovascular disorders that the present invention generally does not intend to provide an absolute identification of individuals who will or will not experience an acute coronary event or develop another cardiovascular disorder, or those individuals who will or will not respond to statin treatment of cardiovascular disorders, but rather to indicate a certain increased (or decreased) degree or likelihood of developing an acute coronary event or responding to statin treatment based on statistically significant association results. However, this information is extremely valuable as it can, for example, indicate that an individual having a cardiovascular disorder should follow a particular statin-based treatment regimen, or should follow an alternative treatment regimen that does not involve statin. This information can also be used to initiate preventive treatments or to allow an individual carrying one or more significant SNPs or SNP haplotypes to foresee warning signs such as minor clinical symptoms of cardiovascular disease, or to have regularly scheduled physical exams to monitor for cardiovascular disorders in order to identify and begin treatment of the disorder at an early stage. Particularly with diseases that are extremely debilitating or fatal if not treated on time, the knowledge of a potential predisposition to the disease or likelihood of responding to available treatments, even if this predisposition or likelihood is not absolute, would likely contribute in a very significant manner to treatment efficacy.

The diagnostic techniques of the present invention may employ a variety of methodologies to determine whether a test subject has a SNP or a SNP pattern associated with an increased or decreased risk of developing a detectable trait or whether the individual suffers from a detectable trait as a result of a particular

polymorphism/mutation, including, for example, methods which enable the analysis of individual chromosomes for haplotyping, family studies, single sperm DNA analysis, or somatic hybrids. The trait analyzed using the diagnostics of the invention may be any detectable trait that is commonly observed in cardiovascular disorders or during the course of statin treatment.

Another aspect of the present invention relates to a method of determining whether an individual is at risk (or less at risk) of developing one or more traits or whether an individual expresses one or more traits as a consequence of possessing a particular trait-causing or trait-influencing allele. These methods generally involve obtaining a nucleic acid sample from an individual and assaying the nucleic acid sample to determine which nucleotide(s) is/are present at one or more SNP positions, wherein the assayed nucleotide(s) is/are indicative of an increased or decreased risk of developing the trait or indicative that the individual expresses the trait as a result of possessing a particular trait-causing or trait-influencing allele.

In another embodiment, the SNP detection reagents of the present invention are used to determine whether an individual has one or more SNP allele(s) affecting the level (e.g., the concentration of mRNA or protein in a sample, etc.) or pattern (e.g., the kinetics of expression, rate of decomposition, stability profile, K_m , V_{max} , etc.) of gene expression (collectively, the "gene response" of a cell or bodily fluid). Such a determination can be accomplished by screening for mRNA or protein expression (e.g., by using nucleic acid arrays, RT-PCR, TaqMan assays, or mass spectrometry), identifying genes having altered expression in an individual, genotyping SNPs disclosed in Table 1 and/or Table 2 that could affect the expression of the genes having altered expression (e.g., SNPs that are in and/or around the gene(s) having altered expression, SNPs in regulatory/control regions, SNPs in and/or around other genes that are involved in pathways that could affect the expression of the gene(s) having altered expression, or all SNPs could be genotyped), and correlating SNP genotypes with altered gene expression. In this manner, specific SNP alleles at particular SNP sites can be identified that affect gene expression.

Pharmacogenomics and Therapeutics/Drug Development

The present invention provides methods for assessing the pharmacogenomics of a subject harboring particular SNP alleles or haplotypes to a particular therapeutic agent or pharmaceutical compound, or to a class of such compounds. Pharmacogenomics deals with the roles which clinically significant hereditary variations (e.g., SNPs) play in the response to drugs due to altered drug disposition and/or abnormal action in affected persons. See, e.g., Roses, *Nature* 405, 857-865 (2000); Gould Rothberg, *Nature Biotechnology* 19, 209-211 (2001); Eichelbaum, *Clin. Exp. Pharmacol. Physiol.* 23(10-11):983-985 (1996); and Linder, *Clin. Chem.* 43(2):254-266 (1997). The clinical outcomes of these variations can result in severe toxicity of therapeutic drugs in certain individuals or therapeutic failure of drugs in certain individuals as a result of individual variation in metabolism. Thus, the SNP genotype of an individual can determine the way a therapeutic compound acts on the body or the way the body metabolizes the compound. For example, SNPs in drug metabolizing enzymes can affect the activity of these enzymes, which in turn can affect both the intensity and duration of drug action, as well as drug metabolism and clearance.

The discovery of SNPs in drug metabolizing enzymes, drug transporters, proteins for pharmaceutical agents, and other drug targets has explained why some patients do not obtain the expected drug effects, show an exaggerated drug effect, or experience serious toxicity from standard drug dosages. SNPs can be expressed in the phenotype of the extensive metabolizer and in the phenotype of the poor metabolizer. Accordingly, SNPs may lead to allelic variants of a protein in which one or more of the protein functions in one population are different from those in another population. SNPs and the encoded variant peptides thus provide targets to ascertain a genetic predisposition that can affect treatment modality. For example, in a ligand-based treatment, SNPs may give rise to amino terminal extracellular domains and/or other ligand-binding regions of a receptor that are more or less active in ligand binding, thereby affecting subsequent protein activation. Accordingly, ligand dosage would necessarily be modified to maximize the therapeutic effect within a given population containing particular SNP alleles or haplotypes.

As an alternative to genotyping, specific variant proteins containing variant amino acid sequences encoded by alternative SNP alleles could be identified. Thus, pharmacogenomic characterization of an individual permits the selection of effective

compounds and effective dosages of such compounds for prophylactic or therapeutic uses based on the individual's SNP genotype, thereby enhancing and optimizing the effectiveness of the therapy. Furthermore, the production of recombinant cells and transgenic animals containing particular SNPs/haplotypes allow effective clinical design and testing of treatment compounds and dosage regimens. For example, transgenic animals can be produced that differ only in specific SNP alleles in a gene that is orthologous to a human disease susceptibility gene.

Pharmacogenomic uses of the SNPs of the present invention provide several significant advantages for patient care, particularly in predicting an individual's predisposition to acute coronary events and other cardiovascular disorders and in predicting an individual's responsiveness to the use of statin for treating cardiovascular disease. Pharmacogenomic characterization of an individual, based on an individual's SNP genotype, can identify those individuals unlikely to respond to treatment with a particular medication and thereby allows physicians to avoid prescribing the ineffective medication to those individuals. On the other hand, SNP genotyping of an individual may enable physicians to select the appropriate medication and dosage regimen that will be most effective based on an individual's SNP genotype. This information increases a physician's confidence in prescribing medications and motivates patients to comply with their drug regimens. Furthermore, pharmacogenomics may identify patients predisposed to toxicity and adverse reactions to particular drugs or drug dosages. Adverse drug reactions lead to more than 100,000 avoidable deaths per year in the United States alone and therefore represent a significant cause of hospitalization and death, as well as a significant economic burden on the healthcare system (Pfoest *et. al.*, *Trends in Biotechnology*, Aug. 2000.). Thus, pharmacogenomics based on the SNPs disclosed herein has the potential to both save lives and reduce healthcare costs substantially.

Pharmacogenomics in general is discussed further in Rose *et al.*, "Pharmacogenetic analysis of clinically relevant genetic polymorphisms", *Methods Mol Med.* 2003;85:225-37. Pharmacogenomics as it relates to Alzheimer's disease and other neurodegenerative disorders is discussed in Cacabelos, "Pharmacogenomics for the treatment of dementia", *Ann Med.* 2002;34(5):357-79, Maimone *et al.*, "Pharmacogenomics of neurodegenerative diseases", *Eur J Pharmacol.* 2001 Feb

9;413(1):11-29, and Poirier, "Apolipoprotein E: a pharmacogenetic target for the treatment of Alzheimer's disease", *Mol Diagn.* 1999 Dec;4(4):335-41.

Pharmacogenomics as it relates to cardiovascular disorders is discussed in Siest et al., "Pharmacogenomics of drugs affecting the cardiovascular system", *Clin Chem Lab Med.*

5 2003 Apr;41(4):590-9, Mukherjee et al., "Pharmacogenomics in cardiovascular diseases", *Prog Cardiovasc Dis.* 2002 May-Jun;44(6):479-98, and Mooser et al., "Cardiovascular pharmacogenetics in the SNP era", *J Thromb Haemost.* 2003 Jul;1(7):1398-402.

Pharmacogenomics as it relates to cancer is discussed in McLeod et al., "Cancer pharmacogenomics: SNPs, chips, and the individual patient", *Cancer Invest.*

10 2003;21(4):630-40 and Watters et al., "Cancer pharmacogenomics: current and future applications", *Biochim Biophys Acta.* 2003 Mar 17;1603(2):99-111.

The SNPs of the present invention also can be used to identify novel therapeutic targets for cardiovascular disorders. For example, genes containing the disease-associated variants ("variant genes") or their products, as well as genes or their products
15 that are directly or indirectly regulated by or interacting with these variant genes or their products, can be targeted for the development of therapeutics that, for example, treat the disease or prevent or delay disease onset. The therapeutics may be composed of, for example, small molecules, proteins, protein fragments or peptides, antibodies, nucleic acids, or their derivatives or mimetics which modulate the functions or levels of the target
20 genes or gene products.

The SNP-containing nucleic acid molecules disclosed herein, and their complementary nucleic acid molecules, may be used as antisense constructs to control gene expression in cells, tissues, and organisms. Antisense technology is well established in the art and extensively reviewed in *Antisense Drug Technology: Principles, Strategies, and Applications*, Crooke (ed.), Marcel Dekker, Inc.: New York (2001). An antisense
25 nucleic acid molecule is generally designed to be complementary to a region of mRNA expressed by a gene so that the antisense molecule hybridizes to the mRNA and thereby blocks translation of mRNA into protein. Various classes of antisense oligonucleotides are used in the art, two of which are cleavers and blockers. Cleavers, by binding to target
30 RNAs, activate intracellular nucleases (e.g., RNaseH or RNase L) that cleave the target RNA. Blockers, which also bind to target RNAs, inhibit protein translation through steric

hindrance of ribosomes. Exemplary blockers include peptide nucleic acids, morpholinos, locked nucleic acids, and methylphosphonates (see, e.g., Thompson, *Drug Discovery Today*, 7 (17): 912-917 (2002)). Antisense oligonucleotides are directly useful as therapeutic agents, and are also useful for determining and validating gene function (e.g., in gene knock-out or knock-down experiments).

Antisense technology is further reviewed in: Lavery et al., "Antisense and RNAi: powerful tools in drug target discovery and validation", *Curr Opin Drug Discov Devel.* 2003 Jul;6(4):561-9; Stephens et al., "Antisense oligonucleotide therapy in cancer", *Curr Opin Mol Ther.* 2003 Apr;5(2):118-22; Kurreck, "Antisense technologies. Improvement through novel chemical modifications", *Eur J Biochem.* 2003 Apr;270(8):1628-44; Dias et al., "Antisense oligonucleotides: basic concepts and mechanisms", *Mol Cancer Ther.* 2002;Mar;1(5):347-55; Chen, "Clinical development of antisense oligonucleotides as anti-cancer therapeutics", *Methods Mol Med.* 2003;75:621-36; Wang et al., "Antisense anticancer oligonucleotide therapeutics", *Curr Cancer Drug Targets.* 2001 Nov;1(3):177-96; and Bennett, "Efficiency of antisense oligonucleotide drug discovery", *Antisense Nucleic Acid Drug Dev.* 2002 Jun;12(3):215-24.

The SNPs of the present invention are particularly useful for designing antisense reagents that are specific for particular nucleic acid variants. Based on the SNP information disclosed herein, antisense oligonucleotides can be produced that specifically target mRNA molecules that contain one or more particular SNP nucleotides. In this manner, expression of mRNA molecules that contain one or more undesired polymorphisms (e.g., SNP nucleotides that lead to a defective protein such as an amino acid substitution in a catalytic domain) can be inhibited or completely blocked. Thus, antisense oligonucleotides can be used to specifically bind a particular polymorphic form (e.g., a SNP allele that encodes a defective protein), thereby inhibiting translation of this form, but which do not bind an alternative polymorphic form (e.g., an alternative SNP nucleotide that encodes a protein having normal function).

Antisense molecules can be used to inactivate mRNA in order to inhibit gene expression and production of defective proteins. Accordingly, these molecules can be used to treat a disorder, such as a cardiovascular disorder, characterized by abnormal or undesired gene expression or expression of certain defective proteins. This technique can

involve cleavage by means of ribozymes containing nucleotide sequences complementary to one or more regions in the mRNA that attenuate the ability of the mRNA to be translated. Possible mRNA regions include, for example, protein-coding regions and particularly protein-coding regions corresponding to catalytic activities, substrate/ligand binding, or other functional activities of a protein.

The SNPs of the present invention are also useful for designing RNA interference reagents that specifically target nucleic acid molecules having particular SNP variants. RNA interference (RNAi), also referred to as gene silencing, is based on using double-stranded RNA (dsRNA) molecules to turn genes off. When introduced into a cell, dsRNAs are processed by the cell into short fragments (generally about 21, 22, or 23 nucleotides in length) known as small interfering RNAs (siRNAs) which the cell uses in a sequence-specific manner to recognize and destroy complementary RNAs (Thompson, *Drug Discovery Today*, 7 (17): 912-917 (2002)). Accordingly, an aspect of the present invention specifically contemplates isolated nucleic acid molecules that are about 18-26 nucleotides in length, preferably 19-25 nucleotides in length, and more preferably 20, 21, 22, or 23 nucleotides in length, and the use of these nucleic acid molecules for RNAi. Because RNAi molecules, including siRNAs, act in a sequence-specific manner, the SNPs of the present invention can be used to design RNAi reagents that recognize and destroy nucleic acid molecules having specific SNP alleles/nucleotides (such as deleterious alleles that lead to the production of defective proteins), while not affecting nucleic acid molecules having alternative SNP alleles (such as alleles that encode proteins having normal function). As with antisense reagents, RNAi reagents may be directly useful as therapeutic agents (e.g., for turning off defective, disease-causing genes), and are also useful for characterizing and validating gene function (e.g., in gene knock-out or knock-down experiments).

The following references provide a further review of RNAi: Reynolds et al., "Rational siRNA design for RNA interference", *Nat Biotechnol.* 2004 Mar;22(3):326-30. Epub 2004 Feb 01; Chi et al., "Genomewide view of gene silencing by small interfering RNAs", *PNAS* 100(11):6343-6346, 2003; Vickers et al., "Efficient Reduction of Target RNAs by Small Interfering RNA and RNase H-dependent Antisense Agents", *J. Biol. Chem.* 278: 7108-7118, 2003; Agami, "RNAi and related mechanisms and their potential

use for therapy", *Curr Opin Chem Biol.* 2002 Dec;6(6):829-34; Lavery et al., "Antisense and RNAi: powerful tools in drug target discovery and validation", *Curr Opin Drug Discov Devel.* 2003 Jul;6(4):561-9; Shi, "Mammalian RNAi for the masses", *Trends Genet* 2003 Jan;19(1):9-12), Shuey et al., "RNAi: gene-silencing in therapeutic intervention", *Drug Discovery Today* 2002 Oct;7(20):1040-1046; McManus et al., *Nat Rev Genet* 2002 Oct;3(10):737-47; Xia et al., *Nat Biotechnol* 2002 Oct;20(10):1006-10; Plasterk et al., *Curr Opin Genet Dev* 2000 Oct;10(5):562-7; Bosher et al., *Nat Cell Biol* 2000 Feb;2(2):E31-6; and Hunter, *Curr Biol* 1999 Jun 17;9(12):R440-2).

A subject suffering from a pathological condition, such as a cardiovascular disorder, ascribed to a SNP may be treated so as to correct the genetic defect (see Kren et al., *Proc. Natl. Acad. Sci. USA* 96:10349-10354 (1999)). Such a subject can be identified by any method that can detect the polymorphism in a biological sample drawn from the subject. Such a genetic defect may be permanently corrected by administering to such a subject a nucleic acid fragment incorporating a repair sequence that supplies the normal/wild-type nucleotide at the position of the SNP. This site-specific repair sequence can encompass an RNA/DNA oligonucleotide that operates to promote endogenous repair of a subject's genomic DNA. The site-specific repair sequence is administered in an appropriate vehicle, such as a complex with polyethylenimine, encapsulated in anionic liposomes, a viral vector such as an adenovirus, or other pharmaceutical composition that promotes intracellular uptake of the administered nucleic acid. A genetic defect leading to an inborn pathology may then be overcome, as the chimeric oligonucleotides induce incorporation of the normal sequence into the subject's genome. Upon incorporation, the normal gene product is expressed, and the replacement is propagated, thereby engendering a permanent repair and therapeutic enhancement of the clinical condition of the subject.

In cases in which a cSNP results in a variant protein that is ascribed to be the cause of, or a contributing factor to, a pathological condition, a method of treating such a condition can include administering to a subject experiencing the pathology the wild-type/normal cognate of the variant protein. Once administered in an effective dosing regimen, the wild-type cognate provides complementation or remediation of the pathological condition.

The invention further provides a method for identifying a compound or agent that can be used to treat cardiovascular disorders. The SNPs disclosed herein are useful as targets for the identification and/or development of therapeutic agents. A method for identifying a therapeutic agent or compound typically includes assaying the ability of the agent or compound to modulate the activity and/or expression of a SNP-containing nucleic acid or the encoded product and thus identifying an agent or a compound that can be used to treat a disorder characterized by undesired activity or expression of the SNP-containing nucleic acid or the encoded product. The assays can be performed in cell-based and cell-free systems. Cell-based assays can include cells naturally expressing the nucleic acid molecules of interest or recombinant cells genetically engineered to express certain nucleic acid molecules.

Variant gene expression in a patient having a cardiovascular disorder or undergoing statin treatment can include, for example, either expression of a SNP-containing nucleic acid sequence (for instance, a gene that contains a SNP can be transcribed into an mRNA transcript molecule containing the SNP, which can in turn be translated into a variant protein) or altered expression of a normal/wild-type nucleic acid sequence due to one or more SNPs (for instance, a regulatory/control region can contain a SNP that affects the level or pattern of expression of a normal transcript).

Assays for variant gene expression can involve direct assays of nucleic acid levels (e.g., mRNA levels), expressed protein levels, or of collateral compounds involved in a signal pathway. Further, the expression of genes that are up- or down-regulated in response to the signal pathway can also be assayed. In this embodiment, the regulatory regions of these genes can be operably linked to a reporter gene such as luciferase.

Modulators of variant gene expression can be identified in a method wherein, for example, a cell is contacted with a candidate compound/agent and the expression of mRNA determined. The level of expression of mRNA in the presence of the candidate compound is compared to the level of expression of mRNA in the absence of the candidate compound. The candidate compound can then be identified as a modulator of variant gene expression based on this comparison and be used to treat a disorder such as a cardiovascular disorder that is characterized by variant gene expression (e.g., either expression of a SNP-containing nucleic acid or altered expression of a normal/wild-type nucleic acid molecule due to one or

more SNPs that affect expression of the nucleic acid molecule) due to one or more SNPs of the present invention. When expression of mRNA is statistically significantly greater in the presence of the candidate compound than in its absence, the candidate compound is identified as a stimulator of nucleic acid expression. When nucleic acid expression is statistically significantly less in the presence of the candidate compound than in its absence, the candidate compound is identified as an inhibitor of nucleic acid expression.

The invention further provides methods of treatment, with the SNP or associated nucleic acid domain (e.g., catalytic domain, ligand/substrate-binding domain, regulatory/control region, etc.) or gene, or the encoded mRNA transcript, as a target, using a compound identified through drug screening as a gene modulator to modulate variant nucleic acid expression. Modulation can include either up-regulation (i.e., activation or agonization) or down-regulation (i.e., suppression or antagonization) of nucleic acid expression.

Expression of mRNA transcripts and encoded proteins, either wild type or variant, may be altered in individuals with a particular SNP allele in a regulatory/control element, such as a promoter or transcription factor binding domain, that regulates expression. In this situation, methods of treatment and compounds can be identified, as discussed herein, that regulate or overcome the variant regulatory/control element, thereby generating normal, or healthy, expression levels of either the wild type or variant protein.

The SNP-containing nucleic acid molecules of the present invention are also useful for monitoring the effectiveness of modulating compounds on the expression or activity of a variant gene, or encoded product, in clinical trials or in a treatment regimen. Thus, the gene expression pattern can serve as an indicator for the continuing effectiveness of treatment with the compound, particularly with compounds to which a patient can develop resistance, as well as an indicator for toxicities. The gene expression pattern can also serve as a marker indicative of a physiological response of the affected cells to the compound. Accordingly, such monitoring would allow either increased administration of the compound or the administration of alternative compounds to which the patient has not become resistant. Similarly, if the level of nucleic acid expression falls below a desirable level, administration of the compound could be commensurately decreased.

In another aspect of the present invention, there is provided a pharmaceutical pack comprising a therapeutic agent (e.g., a small molecule drug, antibody, peptide, antisense or RNAi nucleic acid molecule, etc.) and a set of instructions for administration of the therapeutic agent to humans diagnostically tested for one or more SNPs or SNP
5 haplotypes provided by the present invention.

The SNPs/haplotypes of the present invention are also useful for improving many different aspects of the drug development process. For instance, an aspect of the present invention includes selecting individuals for clinical trials based on their SNP genotype.

For example, individuals with SNP genotypes that indicate that they are likely to
10 positively respond to a drug can be included in the trials, whereas those individuals whose SNP genotypes indicate that they are less likely to or would not respond to the drug, or who are at risk for suffering toxic effects or other adverse reactions, can be excluded from the clinical trials. This not only can improve the safety of clinical trials, but also can enhance the chances that the trial will demonstrate statistically significant
15 efficacy. Furthermore, the SNPs of the present invention may explain why certain previously developed drugs performed poorly in clinical trials and may help identify a subset of the population that would benefit from a drug that had previously performed poorly in clinical trials, thereby "rescuing" previously developed drugs, and enabling the drug to be made available to a particular patient population that can benefit from it.

20 SNPs have many important uses in drug discovery, screening, and development. A high probability exists that, for any gene/protein selected as a potential drug target, variants of that gene/protein will exist in a patient population. Thus, determining the impact of gene/protein variants on the selection and delivery of a therapeutic agent should be an integral aspect of the drug discovery and development process. (Jazwinska,
25 *A Trends Guide to Genetic Variation and Genomic Medicine*, 2002 Mar; S30-S36).

Knowledge of variants (e.g., SNPs and any corresponding amino acid polymorphisms) of a particular therapeutic target (e.g., a gene, mRNA transcript, or protein) enables parallel screening of the variants in order to identify therapeutic
30 candidates (e.g., small molecule compounds, antibodies, antisense or RNAi nucleic acid compounds, etc.) that demonstrate efficacy across variants (Rothberg, *Nat Biotechnol* 2001 Mar;19(3):209-11). Such therapeutic candidates would be expected to show equal

efficacy across a larger segment of the patient population, thereby leading to a larger potential market for the therapeutic candidate.

Furthermore, identifying variants of a potential therapeutic target enables the most common form of the target to be used for selection of therapeutic candidates, thereby helping to ensure that the experimental activity that is observed for the selected candidates reflects the real activity expected in the largest proportion of a patient population (Jazwinska, *A Trends Guide to Genetic Variation and Genomic Medicine*, 2002 Mar; S30-S36).

Additionally, screening therapeutic candidates against all known variants of a target can enable the early identification of potential toxicities and adverse reactions relating to particular variants. For example, variability in drug absorption, distribution, metabolism and excretion (ADME) caused by, for example, SNPs in therapeutic targets or drug metabolizing genes, can be identified, and this information can be utilized during the drug development process to minimize variability in drug disposition and develop therapeutic agents that are safer across a wider range of a patient population. The SNPs of the present invention, including the variant proteins and encoding polymorphic nucleic acid molecules provided in Tables 1-2, are useful in conjunction with a variety of toxicology methods established in the art, such as those set forth in *Current Protocols in Toxicology*, John Wiley & Sons, Inc., N.Y.

Furthermore, therapeutic agents that target any art-known proteins (or nucleic acid molecules, either RNA or DNA) may cross-react with the variant proteins (or polymorphic nucleic acid molecules) disclosed in Table 1, thereby significantly affecting the pharmacokinetic properties of the drug. Consequently, the protein variants and the SNP-containing nucleic acid molecules disclosed in Tables 1-2 are useful in developing, screening, and evaluating therapeutic agents that target corresponding art-known protein forms (or nucleic acid molecules). Additionally, as discussed above, knowledge of all polymorphic forms of a particular drug target enables the design of therapeutic agents that are effective against most or all such polymorphic forms of the drug target.

Pharmaceutical Compositions and Administration Thereof

Any of the cardiovascular disease and/or statin response-associated proteins, and encoding nucleic acid molecules, disclosed herein can be used as therapeutic targets (or directly used themselves as therapeutic compounds) for treating cardiovascular disorders and related pathologies, and the present disclosure enables therapeutic compounds (e.g.,
5 small molecules, antibodies, therapeutic proteins, RNAi and antisense molecules, etc.) to be developed that target (or are comprised of) any of these therapeutic targets.

In general, a therapeutic compound will be administered in a therapeutically effective amount by any of the accepted modes of administration for agents that serve similar utilities. The actual amount of the therapeutic compound of this invention, i.e.,
10 the active ingredient, will depend upon numerous factors such as the severity of the disease to be treated, the age and relative health of the subject, the potency of the compound used, the route and form of administration, and other factors.

Therapeutically effective amounts of therapeutic compounds may range from, for example, approximately 0.01-50 mg per kilogram body weight of the recipient per day; preferably about 0.1-20 mg/kg/day. Thus, as an example, for administration to a 70 kg
15 person, the dosage range would most preferably be about 7 mg to 1.4 g per day.

In general, therapeutic compounds will be administered as pharmaceutical compositions by any one of the following routes: oral, systemic (e.g., transdermal, intranasal, or by suppository), or parenteral (e.g., intramuscular, intravenous, or
20 subcutaneous) administration. The preferred manner of administration is oral or parenteral using a convenient daily dosage regimen, which can be adjusted according to the degree of affliction. Oral compositions can take the form of tablets, pills, capsules, semisolids, powders, sustained release formulations, solutions, suspensions, elixirs, aerosols, or any other appropriate compositions.

The choice of formulation depends on various factors such as the mode of drug administration (e.g., for oral administration, formulations in the form of tablets, pills, or capsules are preferred) and the bioavailability of the drug substance. Recently, pharmaceutical formulations have been developed especially for drugs that show poor bioavailability based upon the principle that bioavailability can be increased by
25 increasing the surface area, i.e., decreasing particle size. For example, U.S. Patent No. 4,107,288 describes a pharmaceutical formulation having particles in the size range from
30

10 to 1,000 nm in which the active material is supported on a cross-linked matrix of macromolecules. U.S. Patent No. 5,145,684 describes the production of a pharmaceutical formulation in which the drug substance is pulverized to nanoparticles (average particle size of 400 nm) in the presence of a surface modifier and then dispersed in a liquid medium to give a pharmaceutical formulation that exhibits remarkably high bioavailability.

Pharmaceutical compositions are comprised of, in general, a therapeutic compound in combination with at least one pharmaceutically acceptable excipient. Acceptable excipients are non-toxic, aid administration, and do not adversely affect the therapeutic benefit of the therapeutic compound. Such excipients may be any solid, liquid, semi-solid or, in the case of an aerosol composition, gaseous excipient that is generally available to one skilled in the art.

Solid pharmaceutical excipients include starch, cellulose, talc, glucose, lactose, sucrose, gelatin, malt, rice, flour, chalk, silica gel, magnesium stearate, sodium stearate, glycerol monostearate, sodium chloride, dried skim milk and the like. Liquid and semisolid excipients may be selected from glycerol, propylene glycol, water, ethanol and various oils, including those of petroleum, animal, vegetable or synthetic origin, e.g., peanut oil, soybean oil, mineral oil, sesame oil, etc. Preferred liquid carriers, particularly for injectable solutions, include water, saline, aqueous dextrose, and glycols.

Compressed gases may be used to disperse a compound of this invention in aerosol form. Inert gases suitable for this purpose are nitrogen, carbon dioxide, etc.

Other suitable pharmaceutical excipients and their formulations are described in Remington's Pharmaceutical Sciences, edited by E. W. Martin (Mack Publishing Company, 18th ed., 1990).

The amount of the therapeutic compound in a formulation can vary within the full range employed by those skilled in the art. Typically, the formulation will contain, on a weight percent (wt %) basis, from about 0.01-99.99 wt % of the therapeutic compound based on the total formulation, with the balance being one or more suitable pharmaceutical excipients. Preferably, the compound is present at a level of about 1-80 wt %.

Therapeutic compounds can be administered alone or in combination with other therapeutic compounds or in combination with one or more other active ingredient(s). For example, an inhibitor or stimulator of a cardiovascular disorder-associated protein can be administered in combination with another agent that inhibits or stimulates the activity of the same or a different cardiovascular disorder-associated protein to thereby counteract the affects of a cardiovascular disorder.

For further information regarding pharmacology, see *Current Protocols in Pharmacology*, John Wiley & Sons, Inc., N.Y.

Human Identification Applications

In addition to their diagnostic and therapeutic uses in cardiovascular disorders and statin treatment of cardiovascular disorders, the SNPs provided by the present invention are also useful as human identification markers for such applications as forensics, paternity testing, and biometrics (see, e.g., Gill, "An assessment of the utility of single nucleotide polymorphisms (SNPs) for forensic purposes", *Int J Legal Med.* 2001;114(4):204-10). Genetic variations in the nucleic acid sequences between individuals can be used as genetic markers to identify individuals and to associate a biological sample with an individual. Determination of which nucleotides occupy a set of SNP positions in an individual identifies a set of SNP markers that distinguishes the individual. The more SNP positions that are analyzed, the lower the probability that the set of SNPs in one individual is the same as that in an unrelated individual. Preferably, if multiple sites are analyzed, the sites are unlinked (i.e., inherited independently). Thus, preferred sets of SNPs can be selected from among the SNPs disclosed herein, which may include SNPs on different chromosomes, SNPs on different chromosome arms, and/or SNPs that are dispersed over substantial distances along the same chromosome arm.

Furthermore, among the SNPs disclosed herein, preferred SNPs for use in certain forensic/human identification applications include SNPs located at degenerate codon positions (i.e., the third position in certain codons which can be one of two or more alternative nucleotides and still encode the same amino acid), since these SNPs do not affect the encoded protein. SNPs that do not affect the encoded protein are expected to be under less selective pressure and are therefore expected to be more polymorphic in a

population, which is typically an advantage for forensic/human identification applications. However, for certain forensics/human identification applications, such as predicting phenotypic characteristics (e.g., inferring ancestry or inferring one or more physical characteristics of an individual) from a DNA sample, it may be desirable to
5 utilize SNPs that affect the encoded protein.

For many of the SNPs disclosed in Tables 1-2 (which are identified as “Applera” SNP source), Tables 1-2 provide SNP allele frequencies obtained by re-sequencing the DNA of chromosomes from 39 individuals (Tables 1-2 also provide allele frequency information for “Celera” source SNPs and, where available, public SNPs from dbEST,
10 HGBASE, and/or HGMD). The allele frequencies provided in Tables 1-2 enable these SNPs to be readily used for human identification applications. Although any SNP disclosed in Table 1 and/or Table 2 could be used for human identification, the closer that the frequency of the minor allele at a particular SNP site is to 50%, the greater the ability of that SNP to discriminate between different individuals in a population since it becomes
15 increasingly likely that two randomly selected individuals would have different alleles at that SNP site. Using the SNP allele frequencies provided in Tables 1-2, one of ordinary skill in the art could readily select a subset of SNPs for which the frequency of the minor allele is, for example, at least 1%, 2%, 5%, 10%, 20%, 25%, 30%, 40%, 45%, or 50%, or any other frequency in-between. Thus, since Tables 1-2 provide allele frequencies based
20 on the re-sequencing of the chromosomes from 39 individuals, a subset of SNPs could readily be selected for human identification in which the total allele count of the minor allele at a particular SNP site is, for example, at least 1, 2, 4, 8, 10, 16, 20, 24, 30, 32, 36, 38, 39, 40, or any other number in-between.

Furthermore, Tables 1-2 also provide population group (interchangeably referred
25 to herein as ethnic or racial groups) information coupled with the extensive allele frequency information. For example, the group of 39 individuals whose DNA was re-sequenced was made-up of 20 Caucasians and 19 African-Americans. This population group information enables further refinement of SNP selection for human identification. For example, preferred SNPs for human identification can be selected from Tables 1-2
30 that have similar allele frequencies in both the Caucasian and African-American populations; thus, for example, SNPs can be selected that have equally high

discriminatory power in both populations. Alternatively, SNPs can be selected for which there is a statistically significant difference in allele frequencies between the Caucasian and African-American populations (as an extreme example, a particular allele may be observed only in either the Caucasian or the African-American population group but not observed in the other population group); such SNPs are useful, for example, for predicting the race/ethnicity of an unknown perpetrator from a biological sample such as a hair or blood stain recovered at a crime scene. For a discussion of using SNPs to predict ancestry from a DNA sample, including statistical methods, see Frudakis *et al.*, “A Classifier for the SNP-Based Inference of Ancestry”, *Journal of Forensic Sciences* 2003; 48(4):771-782.

SNPs have numerous advantages over other types of polymorphic markers, such as short tandem repeats (STRs). For example, SNPs can be easily scored and are amenable to automation, making SNPs the markers of choice for large-scale forensic databases. SNPs are found in much greater abundance throughout the genome than repeat polymorphisms. Population frequencies of two polymorphic forms can usually be determined with greater accuracy than those of multiple polymorphic forms at multi-allelic loci. SNPs are mutationally more stable than repeat polymorphisms. SNPs are not susceptible to artefacts such as stutter bands that can hinder analysis. Stutter bands are frequently encountered when analyzing repeat polymorphisms, and are particularly troublesome when analyzing samples such as crime scene samples that may contain mixtures of DNA from multiple sources. Another significant advantage of SNP markers over STR markers is the much shorter length of nucleic acid needed to score a SNP. For example, STR markers are generally several hundred base pairs in length. A SNP, on the other hand, comprises a single nucleotide, and generally a short conserved region on either side of the SNP position for primer and/or probe binding. This makes SNPs more amenable to typing in highly degraded or aged biological samples that are frequently encountered in forensic casework in which DNA may be fragmented into short pieces.

SNPs also are not subject to microvariant and “off-ladder” alleles frequently encountered when analyzing STR loci. Microvariants are deletions or insertions within a repeat unit that change the size of the amplified DNA product so that the amplified product does not migrate at the same rate as reference alleles with normal sized repeat

units. When separated by size, such as by electrophoresis on a polyacrylamide gel, microvariants do not align with a reference allelic ladder of standard sized repeat units, but rather migrate between the reference alleles. The reference allelic ladder is used for precise sizing of alleles for allele classification; therefore alleles that do not align with the reference allelic ladder lead to substantial analysis problems. Furthermore, when analyzing multi-allelic repeat polymorphisms, occasionally an allele is found that consists of more or less repeat units than has been previously seen in the population, or more or less repeat alleles than are included in a reference allelic ladder. These alleles will migrate outside the size range of known alleles in a reference allelic ladder, and therefore are referred to as "off-ladder" alleles. In extreme cases, the allele may contain so few or so many repeats that it migrates well out of the range of the reference allelic ladder. In this situation, the allele may not even be observed, or, with multiplex analysis, it may migrate within or close to the size range for another locus, further confounding analysis.

SNP analysis avoids the problems of microvariants and off-ladder alleles encountered in STR analysis. Importantly, microvariants and off-ladder alleles may provide significant problems, and may be completely missed, when using analysis methods such as oligonucleotide hybridization arrays, which utilize oligonucleotide probes specific for certain known alleles. Furthermore, off-ladder alleles and microvariants encountered with STR analysis, even when correctly typed, may lead to improper statistical analysis, since their frequencies in the population are generally unknown or poorly characterized, and therefore the statistical significance of a matching genotype may be questionable. All these advantages of SNP analysis are considerable in light of the consequences of most DNA identification cases, which may lead to life imprisonment for an individual, or re-association of remains to the family of a deceased individual.

DNA can be isolated from biological samples such as blood, bone, hair, saliva, or semen, and compared with the DNA from a reference source at particular SNP positions. Multiple SNP markers can be assayed simultaneously in order to increase the power of discrimination and the statistical significance of a matching genotype. For example, oligonucleotide arrays can be used to genotype a large number of SNPs simultaneously. The SNPs provided by the present invention can be assayed in combination with other

polymorphic genetic markers, such as other SNPs known in the art or STRs, in order to identify an individual or to associate an individual with a particular biological sample.

Furthermore, the SNPs provided by the present invention can be genotyped for inclusion in a database of DNA genotypes, for example, a criminal DNA databank such as the FBI's Combined DNA Index System (CODIS) database. A genotype obtained from a biological sample of unknown source can then be queried against the database to find a matching genotype, with the SNPs of the present invention providing nucleotide positions at which to compare the known and unknown DNA sequences for identity. Accordingly, the present invention provides a database comprising novel SNPs or SNP alleles of the present invention (e.g., the database can comprise information indicating which alleles are possessed by individual members of a population at one or more novel SNP sites of the present invention), such as for use in forensics, biometrics, or other human identification applications. Such a database typically comprises a computer-based system in which the SNPs or SNP alleles of the present invention are recorded on a computer readable medium (see the section of the present specification entitled "Computer-Related Embodiments").

The SNPs of the present invention can also be assayed for use in paternity testing. The object of paternity testing is usually to determine whether a male is the father of a child. In most cases, the mother of the child is known and thus, the mother's contribution to the child's genotype can be traced. Paternity testing investigates whether the part of the child's genotype not attributable to the mother is consistent with that of the putative father. Paternity testing can be performed by analyzing sets of polymorphisms in the putative father and the child, with the SNPs of the present invention providing nucleotide positions at which to compare the putative father's and child's DNA sequences for identity. If the set of polymorphisms in the child attributable to the father does not match the set of polymorphisms of the putative father, it can be concluded, barring experimental error, that the putative father is not the father of the child. If the set of polymorphisms in the child attributable to the father match the set of polymorphisms of the putative father, a statistical calculation can be performed to determine the probability of coincidental match, and a conclusion drawn as to the likelihood that the putative father is the true biological father of the child.

In addition to paternity testing, SNPs are also useful for other types of kinship testing, such as for verifying familial relationships for immigration purposes, or for cases in which an individual alleges to be related to a deceased individual in order to claim an inheritance from the deceased individual, etc. For further information regarding the utility of SNPs for paternity testing and other types of kinship testing, including methods for statistical analysis, see Krawczak, "Informativity assessment for biallelic single nucleotide polymorphisms", *Electrophoresis* 1999 Jun;20(8):1676-81.

The use of the SNPs of the present invention for human identification further extends to various authentication systems, commonly referred to as biometric systems, which typically convert physical characteristics of humans (or other organisms) into digital data. Biometric systems include various technological devices that measure such unique anatomical or physiological characteristics as finger, thumb, or palm prints; hand geometry; vein patterning on the back of the hand; blood vessel patterning of the retina and color and texture of the iris; facial characteristics; voice patterns; signature and typing dynamics; and DNA. Such physiological measurements can be used to verify identity and, for example, restrict or allow access based on the identification. Examples of applications for biometrics include physical area security, computer and network security, aircraft passenger check-in and boarding, financial transactions, medical records access, government benefit distribution, voting, law enforcement, passports, visas and immigration, prisons, various military applications, and for restricting access to expensive or dangerous items, such as automobiles or guns (see, for example, O'Connor, *Stanford Technology Law Review* and U.S. Patent No. 6,119,096).

Groups of SNPs, particularly the SNPs provided by the present invention, can be typed to uniquely identify an individual for biometric applications such as those described above. Such SNP typing can readily be accomplished using, for example, DNA chips/arrays. Preferably, a minimally invasive means for obtaining a DNA sample is utilized. For example, PCR amplification enables sufficient quantities of DNA for analysis to be obtained from buccal swabs or fingerprints, which contain DNA-containing skin cells and oils that are naturally transferred during contact.

Further information regarding techniques for using SNPs in forensic/human identification applications can be found in, for example, *Current Protocols in Human Genetics*, John Wiley & Sons, N.Y. (2002), 14.1-14.7.

5

**VARIANT PROTEINS, ANTIBODIES,
VECTORS & HOST CELLS, & USES THEREOF**

Variant Proteins Encoded by SNP-Containing Nucleic Acid Molecules

10 The present invention provides SNP-containing nucleic acid molecules, many of which encode proteins having variant amino acid sequences as compared to the art-known (i.e., wild-type) proteins. Amino acid sequences encoded by the polymorphic nucleic acid molecules of the present invention are provided as SEQ ID NOS:518-1034 in Table 1 and the Sequence Listing. These variants will generally be referred to herein as variant
15 proteins/peptides/polypeptides, or polymorphic proteins/peptides/polypeptides of the present invention. The terms "protein", "peptide", and "polypeptide" are used herein interchangeably.

A variant protein of the present invention may be encoded by, for example, a nonsynonymous nucleotide substitution at any one of the cSNP positions disclosed
20 herein. In addition, variant proteins may also include proteins whose expression, structure, and/or function is altered by a SNP disclosed herein, such as a SNP that creates or destroys a stop codon, a SNP that affects splicing, and a SNP in control/regulatory elements, e.g. promoters, enhancers, or transcription factor binding domains.

As used herein, a protein or peptide is said to be "isolated" or "purified" when it is
25 substantially free of cellular material or chemical precursors or other chemicals. The variant proteins of the present invention can be purified to homogeneity or other lower degrees of purity. The level of purification will be based on the intended use. The key feature is that the preparation allows for the desired function of the variant protein, even if in the presence of considerable amounts of other components.

30 As used herein, "substantially free of cellular material" includes preparations of the variant protein having less than about 30% (by dry weight) other proteins (i.e.,

contaminating protein), less than about 20% other proteins, less than about 10% other proteins, or less than about 5% other proteins. When the variant protein is recombinantly produced, it can also be substantially free of culture medium, i.e., culture medium represents less than about 20% of the volume of the protein preparation.

5 The language "substantially free of chemical precursors or other chemicals" includes preparations of the variant protein in which it is separated from chemical precursors or other chemicals that are involved in its synthesis. In one embodiment, the language "substantially free of chemical precursors or other chemicals" includes preparations of the variant protein having less than about 30% (by dry weight) chemical precursors or other chemicals, less
10 than about 20% chemical precursors or other chemicals, less than about 10% chemical precursors or other chemicals, or less than about 5% chemical precursors or other chemicals.

An isolated variant protein may be purified from cells that naturally express it, purified from cells that have been altered to express it (recombinant host cells), or synthesized using known protein synthesis methods. For example, a nucleic acid molecule
15 containing SNP(s) encoding the variant protein can be cloned into an expression vector, the expression vector introduced into a host cell, and the variant protein expressed in the host cell. The variant protein can then be isolated from the cells by any appropriate purification scheme using standard protein purification techniques. Examples of these techniques are described in detail below (Sambrook and Russell, 2000, Molecular Cloning: A Laboratory
20 Manual, Cold Spring Harbor Laboratory Press, Cold Spring Harbor, NY).

The present invention provides isolated variant proteins that comprise, consist of or consist essentially of amino acid sequences that contain one or more variant amino acids encoded by one or more codons which contain a SNP of the present invention.

25 Accordingly, the present invention provides variant proteins that consist of amino acid sequences that contain one or more amino acid polymorphisms (or truncations or extensions due to creation or destruction of a stop codon, respectively) encoded by the SNPs provided in Table 1 and/or Table 2. A protein consists of an amino acid sequence when the amino acid sequence is the entire amino acid sequence of the protein.

30 The present invention further provides variant proteins that consist essentially of amino acid sequences that contain one or more amino acid polymorphisms (or truncations or extensions due to creation or destruction of a stop codon, respectively) encoded by the SNPs

provided in Table 1 and/or Table 2. A protein consists essentially of an amino acid sequence when such an amino acid sequence is present with only a few additional amino acid residues in the final protein.

5 The present invention further provides variant proteins that comprise amino acid sequences that contain one or more amino acid polymorphisms (or truncations or extensions due to creation or destruction of a stop codon, respectively) encoded by the SNPs provided in Table 1 and/or Table 2. A protein comprises an amino acid sequence when the amino acid sequence is at least part of the final amino acid sequence of the protein. In such a fashion, the protein may contain only the variant amino acid sequence or have additional
10 amino acid residues, such as a contiguous encoded sequence that is naturally associated with it or heterologous amino acid residues. Such a protein can have a few additional amino acid residues or can comprise many more additional amino acids. A brief description of how various types of these proteins can be made and isolated is provided below.

The variant proteins of the present invention can be attached to heterologous
15 sequences to form chimeric or fusion proteins. Such chimeric and fusion proteins comprise a variant protein operatively linked to a heterologous protein having an amino acid sequence not substantially homologous to the variant protein. "Operatively linked" indicates that the coding sequences for the variant protein and the heterologous protein are ligated in-frame. The heterologous protein can be fused to the N-terminus or C-
20 terminus of the variant protein. In another embodiment, the fusion protein is encoded by a fusion polynucleotide that is synthesized by conventional techniques including automated DNA synthesizers. Alternatively, PCR amplification of gene fragments can be carried out using anchor primers which give rise to complementary overhangs between two consecutive gene fragments which can subsequently be annealed and re-amplified to
25 generate a chimeric gene sequence (see Ausubel *et al.*, *Current Protocols in Molecular Biology*, 1992). Moreover, many expression vectors are commercially available that already encode a fusion moiety (e.g., a GST protein). A variant protein-encoding nucleic acid can be cloned into such an expression vector such that the fusion moiety is linked in-frame to the variant protein.

30 In many uses, the fusion protein does not affect the activity of the variant protein. The fusion protein can include, but is not limited to, enzymatic fusion proteins, for example,

beta-galactosidase fusions, yeast two-hybrid GAL fusions, poly-His fusions, MYC-tagged, HI-tagged and Ig fusions. Such fusion proteins, particularly poly-His fusions, can facilitate their purification following recombinant expression. In certain host cells (e.g., mammalian host cells), expression and/or secretion of a protein can be increased by using a heterologous
5 signal sequence. Fusion proteins are further described in, for example, Terpe, "Overview of tag protein fusions: from molecular and biochemical fundamentals to commercial systems", *Appl Microbiol Biotechnol.* 2003 Jan;60(5):523-33. Epub 2002 Nov 07; Graddis et al., "Designing proteins that work using recombinant technologies", *Curr Pharm Biotechnol.* 2002 Dec;3(4):285-97; and Nilsson et al., "Affinity fusion strategies for detection,
10 purification, and immobilization of recombinant proteins", *Protein Expr Purif.* 1997 Oct;11(1):1-16.

The present invention also relates to further obvious variants of the variant polypeptides of the present invention, such as naturally-occurring mature forms (e.g., alleleic variants), non-naturally occurring recombinantly-derived variants, and orthologs and
15 paralogs of such proteins that share sequence homology. Such variants can readily be generated using art-known techniques in the fields of recombinant nucleic acid technology and protein biochemistry. It is understood, however, that variants exclude those known in the prior art before the present invention.

Further variants of the variant polypeptides disclosed in Table 1 can comprise an
20 amino acid sequence that shares at least 70-80%, 80-85%, 85-90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, or 99% sequence identity with an amino acid sequence disclosed in Table 1 (or a fragment thereof) and that includes a novel amino acid residue (allele) disclosed in Table 1 (which is encoded by a novel SNP allele). Thus, an aspect of the present invention that is specifically contemplated are polypeptides that have a certain
25 degree of sequence variation compared with the polypeptide sequences shown in Table 1, but that contain a novel amino acid residue (allele) encoded by a novel SNP allele disclosed herein. In other words, as long as a polypeptide contains a novel amino acid residue disclosed herein, other portions of the polypeptide that flank the novel amino acid residue can vary to some degree from the polypeptide sequences shown in Table 1.

30 Full-length pre-processed forms, as well as mature processed forms, of proteins that comprise one of the amino acid sequences disclosed herein can readily be identified

as having complete sequence identity to one of the variant proteins of the present invention as well as being encoded by the same genetic locus as the variant proteins provided herein.

Orthologs of a variant peptide can readily be identified as having some degree of
5 significant sequence homology/identity to at least a portion of a variant peptide as well as being encoded by a gene from another organism. Preferred orthologs will be isolated from non-human mammals, preferably primates, for the development of human therapeutic targets and agents. Such orthologs can be encoded by a nucleic acid sequence that hybridizes to a variant peptide-encoding nucleic acid molecule under moderate to
10 stringent conditions depending on the degree of relatedness of the two organisms yielding the homologous proteins.

Variant proteins include, but are not limited to, proteins containing deletions, additions and substitutions in the amino acid sequence caused by the SNPs of the present invention. One class of substitutions is conserved amino acid substitutions in which a given
15 amino acid in a polypeptide is substituted for another amino acid of like characteristics. Typical conservative substitutions are replacements, one for another, among the aliphatic amino acids Ala, Val, Leu, and Ile; interchange of the hydroxyl residues Ser and Thr; exchange of the acidic residues Asp and Glu; substitution between the amide residues Asn and Gln; exchange of the basic residues Lys and Arg; and replacements among the aromatic
20 residues Phe and Tyr. Guidance concerning which amino acid changes are likely to be phenotypically silent are found in, for example, Bowie *et al.*, *Science* 247:1306-1310 (1990).

Variant proteins can be fully functional or can lack function in one or more activities, e.g. ability to bind another molecule, ability to catalyze a substrate, ability to
25 mediate signaling, etc. Fully functional variants typically contain only conservative variations or variations in non-critical residues or in non-critical regions. Functional variants can also contain substitution of similar amino acids that result in no change or an insignificant change in function. Alternatively, such substitutions may positively or negatively affect function to some degree. Non-functional variants typically contain one
30 or more non-conservative amino acid substitutions, deletions, insertions, inversions,

truncations or extensions, or a substitution, insertion, inversion, or deletion of a critical residue or in a critical region.

Amino acids that are essential for function of a protein can be identified by methods known in the art, such as site-directed mutagenesis or alanine-scanning mutagenesis (Cunningham *et al.*, *Science* 244:1081-1085 (1989)), particularly using the amino acid sequence and polymorphism information provided in Table 1. The latter procedure introduces single alanine mutations at every residue in the molecule. The resulting mutant molecules are then tested for biological activity such as enzyme activity or in assays such as an *in vitro* proliferative activity. Sites that are critical for binding partner/substrate binding can also be determined by structural analysis such as crystallization, nuclear magnetic resonance or photoaffinity labeling (Smith *et al.*, *J. Mol. Biol.* 224:899-904 (1992); de Vos *et al.* *Science* 255:306-312 (1992)).

Polypeptides can contain amino acids other than the 20 amino acids commonly referred to as the 20 naturally occurring amino acids. Further, many amino acids, including the terminal amino acids, may be modified by natural processes, such as processing and other post-translational modifications, or by chemical modification techniques well known in the art. Accordingly, the variant proteins of the present invention also encompass derivatives or analogs in which a substituted amino acid residue is not one encoded by the genetic code, in which a substituent group is included, in which the mature polypeptide is fused with another compound, such as a compound to increase the half-life of the polypeptide (e.g., polyethylene glycol), or in which additional amino acids are fused to the mature polypeptide, such as a leader or secretory sequence or a sequence for purification of the mature polypeptide or a pro-protein sequence.

Known protein modifications include, but are not limited to, acetylation, acylation, ADP-ribosylation, amidation, covalent attachment of flavin, covalent attachment of a heme moiety, covalent attachment of a nucleotide or nucleotide derivative, covalent attachment of a lipid or lipid derivative, covalent attachment of phosphatidylinositol, cross-linking, cyclization, disulfide bond formation, demethylation, formation of covalent crosslinks, formation of cystine, formation of pyroglutamate, formylation, gamma carboxylation, glycosylation, GPI anchor formation, hydroxylation, iodination, methylation, myristoylation, oxidation, proteolytic processing, phosphorylation, prenylation,

racemization, selenoylation, sulfation, transfer-RNA mediated addition of amino acids to proteins such as arginylation, and ubiquitination.

Such protein modifications are well known to those of skill in the art and have been described in great detail in the scientific literature. Several particularly common
5 modifications, glycosylation, lipid attachment, sulfation, gamma-carboxylation of glutamic acid residues, hydroxylation and ADP-ribosylation, for instance, are described in most basic texts, such as *Proteins - Structure and Molecular Properties*, 2nd Ed., T.E. Creighton, W. H. Freeman and Company, New York (1993); Wold, F., *Posttranslational Covalent
Modification of Proteins*, B.C. Johnson, Ed., Academic Press, New York 1-12 (1983);
10 Seifter *et al.*, *Meth. Enzymol.* 182: 626-646 (1990); and Rattan *et al.*, *Ann. N.Y. Acad. Sci.* 663:48-62 (1992).

The present invention further provides fragments of the variant proteins in which the fragments contain one or more amino acid sequence variations (e.g., substitutions, or truncations or extensions due to creation or destruction of a stop codon) encoded by one or
15 more SNPs disclosed herein. The fragments to which the invention pertains, however, are not to be construed as encompassing fragments that have been disclosed in the prior art before the present invention.

As used herein, a fragment may comprise at least about 4, 8, 10, 12, 14, 16, 18, 20, 25, 30, 50, 100 (or any other number in-between) or more contiguous amino acid residues
20 from a variant protein, wherein at least one amino acid residue is affected by a SNP of the present invention, e.g., a variant amino acid residue encoded by a nonsynonymous nucleotide substitution at a cSNP position provided by the present invention. The variant amino acid encoded by a cSNP may occupy any residue position along the sequence of the fragment. Such fragments can be chosen based on the ability to retain one or more of the
25 biological activities of the variant protein or the ability to perform a function, e.g., act as an immunogen. Particularly important fragments are biologically active fragments. Such fragments will typically comprise a domain or motif of a variant protein of the present invention, e.g., active site, transmembrane domain, or ligand/substrate binding domain. Other fragments include, but are not limited to, domain or motif-containing fragments,
30 soluble peptide fragments, and fragments containing immunogenic structures. Predicted domains and functional sites are readily identifiable by computer programs well known to

those of skill in the art (e.g., PROSITE analysis) (*Current Protocols in Protein Science*, John Wiley & Sons, N.Y. (2002)).

Uses of Variant Proteins

5 The variant proteins of the present invention can be used in a variety of ways, including but not limited to, in assays to determine the biological activity of a variant protein, such as in a panel of multiple proteins for high-throughput screening; to raise antibodies or to elicit another type of immune response; as a reagent (including the labeled reagent) in assays designed to quantitatively determine levels of the variant
10 protein (or its binding partner) in biological fluids; as a marker for cells or tissues in which it is preferentially expressed (either constitutively or at a particular stage of tissue differentiation or development or in a disease state); as a target for screening for a therapeutic agent; and as a direct therapeutic agent to be administered into a human subject. Any of the variant proteins disclosed herein may be developed into reagent
15 grade or kit format for commercialization as research products. Methods for performing the uses listed above are well known to those skilled in the art (see, e.g., *Molecular Cloning: A Laboratory Manual*, Cold Spring Harbor Laboratory Press, Sambrook and Russell, 2000, and *Methods in Enzymology: Guide to Molecular Cloning Techniques*, Academic Press, Berger, S. L. and A. R. Kimmel eds., 1987).

20 In a specific embodiment of the invention, the methods of the present invention include detection of one or more variant proteins disclosed herein. Variant proteins are disclosed in Table 1 and in the Sequence Listing as SEQ ID NOS: 518-1034. Detection of such proteins can be accomplished using, for example, antibodies, small molecule compounds, aptamers, ligands/substrates, other proteins or protein fragments, or other
25 protein-binding agents. Preferably, protein detection agents are specific for a variant protein of the present invention and can therefore discriminate between a variant protein of the present invention and the wild-type protein or another variant form. This can generally be accomplished by, for example, selecting or designing detection agents that bind to the region of a protein that differs between the variant and wild-type protein, such
30 as a region of a protein that contains one or more amino acid substitutions that is/are encoded by a non-synonymous cSNP of the present invention, or a region of a protein

that follows a nonsense mutation-type SNP that creates a stop codon thereby leading to a shorter polypeptide, or a region of a protein that follows a read-through mutation-type SNP that destroys a stop codon thereby leading to a longer polypeptide in which a portion of the polypeptide is present in one version of the polypeptide but not the other.

5 In another specific aspect of the invention, the variant proteins of the present invention are used as targets for evaluating an individual's predisposition to developing a cardiovascular disorder, particularly an acute coronary event such as myocardial infarction, or stroke, for treating and/or preventing cardiovascular disorders, or for predicting an individuals response to statin treatment of cardiovascular disorders, etc. Accordingly, the
10 invention provides methods for detecting the presence of, or levels of, one or more variant proteins of the present invention in a cell, tissue, or organism. Such methods typically involve contacting a test sample with an agent (e.g., an antibody, small molecule compound, or peptide) capable of interacting with the variant protein such that specific binding of the agent to the variant protein can be detected. Such an assay can be provided in a single:
15 detection format or a multi-detection format such as an array, for example, an antibody or aptamer array (arrays for protein detection may also be referred to as "protein chips"). The variant protein of interest can be isolated from a test sample and assayed for the presence of a variant amino acid sequence encoded by one or more SNPs disclosed by the present invention. The SNPs may cause changes to the protein and the corresponding protein
20 function/activity, such as through non-synonymous substitutions in protein coding regions that can lead to amino acid substitutions, deletions, insertions, and/or rearrangements; formation or destruction of stop codons; or alteration of control elements such as promoters. SNPs may also cause inappropriate post-translational modifications.

One preferred agent for detecting a variant protein in a sample is an antibody
25 capable of selectively binding to a variant form of the protein (antibodies are described in greater detail in the next section). Such samples include, for example, tissues, cells, and biological fluids isolated from a subject, as well as tissues, cells and fluids present within a subject.

In vitro methods for detection of the variant proteins associated with cardiovascular
30 disorders and/or statin response that are disclosed herein and fragments thereof include, but are not limited to, enzyme linked immunosorbent assays (ELISAs), radioimmunoassays

(RIA), Western blots, immunoprecipitations, immunofluorescence, and protein arrays/chips (e.g., arrays of antibodies or aptamers). For further information regarding immunoassays and related protein detection methods, see *Current Protocols in Immunology*, John Wiley & Sons, N.Y., and Hage, "Immunoassays", *Anal Chem.* 1999 Jun 15;71(12):294R-304R.

5 Additional analytic methods of detecting amino acid variants include, but are not limited to, altered electrophoretic mobility, altered tryptic peptide digest, altered protein activity in cell-based or cell-free assay, alteration in ligand or antibody-binding pattern, altered isoelectric point, and direct amino acid sequencing.

10 Alternatively, variant proteins can be detected *in vivo* in a subject by introducing into the subject a labeled antibody (or other type of detection reagent) specific for a variant protein. For example, the antibody can be labeled with a radioactive marker whose presence and location in a subject can be detected by standard imaging techniques.

Other uses of the variant peptides of the present invention are based on the class or action of the protein. For example, proteins isolated from humans and their
15 mammalian orthologs serve as targets for identifying agents (e.g., small molecule drugs or antibodies) for use in therapeutic applications, particularly for modulating a biological or pathological response in a cell or tissue that expresses the protein. Pharmaceutical agents can be developed that modulate protein activity.

As an alternative to modulating gene expression, therapeutic compounds can be
20 developed that modulate protein function. For example, many SNPs disclosed herein affect the amino acid sequence of the encoded protein (e.g., non-synonymous cSNPs and nonsense mutation-type SNPs). Such alterations in the encoded amino acid sequence may affect protein function, particularly if such amino acid sequence variations occur in functional protein domains, such as catalytic domains, ATP-binding domains, or ligand/substrate
25 binding domains. It is well established in the art that variant proteins having amino acid sequence variations in functional domains can cause or influence pathological conditions. In such instances, compounds (e.g., small molecule drugs or antibodies) can be developed that target the variant protein and modulate (e.g., up- or down-regulate) protein function/activity.

30 The therapeutic methods of the present invention further include methods that target one or more variant proteins of the present invention. Variant proteins can be

targeted using, for example, small molecule compounds, antibodies, aptamers, ligands/substrates, other proteins, or other protein-binding agents. Additionally, the skilled artisan will recognize that the novel protein variants (and polymorphic nucleic acid molecules) disclosed in Table 1 may themselves be directly used as therapeutic agents by acting as competitive inhibitors of corresponding art-known proteins (or nucleic acid molecules such as mRNA molecules).

The variant proteins of the present invention are particularly useful in drug screening assays, in cell-based or cell-free systems. Cell-based systems can utilize cells that naturally express the protein, a biopsy specimen, or cell cultures. In one embodiment, cell-based assays involve recombinant host cells expressing the variant protein. Cell-free assays can be used to detect the ability of a compound to directly bind to a variant protein or to the corresponding SNP-containing nucleic acid fragment that encodes the variant protein.

A variant protein of the present invention, as well as appropriate fragments thereof, can be used in high-throughput screening assays to test candidate compounds for the ability to bind and/or modulate the activity of the variant protein. These candidate compounds can be further screened against a protein having normal function (e.g., a wild-type/non-variant protein) to further determine the effect of the compound on the protein activity. Furthermore, these compounds can be tested in animal or invertebrate systems to determine *in vivo* activity/effectiveness. Compounds can be identified that activate (agonists) or inactivate (antagonists) the variant protein, and different compounds can be identified that cause various degrees of activation or inactivation of the variant protein.

Further, the variant proteins can be used to screen a compound for the ability to stimulate or inhibit interaction between the variant protein and a target molecule that normally interacts with the protein. The target can be a ligand, a substrate or a binding partner that the protein normally interacts with (for example, epinephrine or norepinephrine). Such assays typically include the steps of combining the variant protein with a candidate compound under conditions that allow the variant protein, or fragment thereof, to interact with the target molecule, and to detect the formation of a complex between the protein and the target or to detect the biochemical consequence of the interaction with the variant protein and the target, such as any of the associated effects of signal transduction.

Candidate compounds include, for example, 1) peptides such as soluble peptides, including Ig-tailed fusion peptides and members of random peptide libraries (see, e.g., Lam *et al.*, *Nature* 354:82-84 (1991); Houghten *et al.*, *Nature* 354:84-86 (1991)) and combinatorial chemistry-derived molecular libraries made of D- and/or L- configuration amino acids; 2) phosphopeptides (e.g., members of random and partially degenerate, directed phosphopeptide libraries, see, e.g., Songyang *et al.*, *Cell* 72:767-778 (1993)); 3) antibodies (e.g., polyclonal, monoclonal, humanized, anti-idiotypic, chimeric, and single chain antibodies as well as Fab, F(ab')₂, Fab expression library fragments, and epitope-binding fragments of antibodies); and 4) small organic and inorganic molecules (e.g., molecules obtained from combinatorial and natural product libraries).

One candidate compound is a soluble fragment of the variant protein that competes for ligand binding. Other candidate compounds include mutant proteins or appropriate fragments containing mutations that affect variant protein function and thus compete for ligand. Accordingly, a fragment that competes for ligand, for example with a higher affinity, or a fragment that binds ligand but does not allow release, is encompassed by the invention.

The invention further includes other end point assays to identify compounds that modulate (stimulate or inhibit) variant protein activity. The assays typically involve an assay of events in the signal transduction pathway that indicate protein activity. Thus, the expression of genes that are up or down-regulated in response to the variant protein dependent signal cascade can be assayed. In one embodiment, the regulatory region of such genes can be operably linked to a marker that is easily detectable, such as luciferase. Alternatively, phosphorylation of the variant protein, or a variant protein target, could also be measured. Any of the biological or biochemical functions mediated by the variant protein can be used as an endpoint assay. These include all of the biochemical or biological events described herein, in the references cited herein, incorporated by reference for these endpoint assay targets, and other functions known to those of ordinary skill in the art.

Binding and/or activating compounds can also be screened by using chimeric variant proteins in which an amino terminal extracellular domain or parts thereof, an entire transmembrane domain or subregions, and/or the carboxyl terminal intracellular domain or parts thereof, can be replaced by heterologous domains or subregions. For example, a

substrate-binding region can be used that interacts with a different substrate than that which is normally recognized by a variant protein. Accordingly, a different set of signal transduction components is available as an end-point assay for activation. This allows for assays to be performed in other than the specific host cell from which the variant protein is derived.

The variant proteins are also useful in competition binding assays in methods designed to discover compounds that interact with the variant protein. Thus, a compound can be exposed to a variant protein under conditions that allow the compound to bind or to otherwise interact with the variant protein. A binding partner, such as ligand, that normally interacts with the variant protein is also added to the mixture. If the test compound interacts with the variant protein or its binding partner, it decreases the amount of complex formed or activity from the variant protein. This type of assay is particularly useful in screening for compounds that interact with specific regions of the variant protein (Hodgson, *Bio/technology*, 1992, Sept 10(9), 973-80).

To perform cell-free drug screening assays, it is sometimes desirable to immobilize either the variant protein or a fragment thereof, or its target molecule, to facilitate separation of complexes from uncomplexed forms of one or both of the proteins, as well as to accommodate automation of the assay. Any method for immobilizing proteins on matrices can be used in drug screening assays. In one embodiment, a fusion protein containing an added domain allows the protein to be bound to a matrix. For example, glutathione-S-transferase/¹²⁵I fusion proteins can be adsorbed onto glutathione sepharose beads (Sigma Chemical, St. Louis, MO) or glutathione derivatized microtitre plates, which are then combined with the cell lysates (e.g., ³⁵S-labeled) and a candidate compound, such as a drug candidate, and the mixture incubated under conditions conducive to complex formation (e.g., at physiological conditions for salt and pH). Following incubation, the beads can be washed to remove any unbound label, and the matrix immobilized and radiolabel determined directly, or in the supernatant after the complexes are dissociated. Alternatively, the complexes can be dissociated from the matrix, separated by SDS-PAGE, and the level of bound material found in the bead fraction quantitated from the gel using standard electrophoretic techniques.

Either the variant protein or its target molecule can be immobilized utilizing conjugation of biotin and streptavidin. Alternatively, antibodies reactive with the variant protein but which do not interfere with binding of the variant protein to its target molecule can be derivatized to the wells of the plate, and the variant protein trapped in the wells by antibody conjugation. Preparations of the target molecule and a candidate compound are incubated in the variant protein-presenting wells and the amount of complex trapped in the well can be quantitated. Methods for detecting such complexes, in addition to those described above for the GST-immobilized complexes, include immunodetection of complexes using antibodies reactive with the protein target molecule, or which are reactive with variant protein and compete with the target molecule, and enzyme-linked assays that rely on detecting an enzymatic activity associated with the target molecule.

Modulators of variant protein activity identified according to these drug screening assays can be used to treat a subject with a disorder mediated by the protein pathway, such as cardiovascular disease. These methods of treatment typically include the steps of administering the modulators of protein activity in a pharmaceutical composition to a subject in need of such treatment.

The variant proteins, or fragments thereof, disclosed herein can themselves be directly used to treat a disorder characterized by an absence of, inappropriate, or unwanted expression or activity of the variant protein. Accordingly, methods for treatment include the use of a variant protein disclosed herein or fragments thereof.

In yet another aspect of the invention, variant proteins can be used as "bait proteins" in a two-hybrid assay or three-hybrid assay (see, e.g., U.S. Patent No. 5,283,317; Zervos *et al.* (1993) *Cell* 72:223-232; Madura *et al.* (1993) *J. Biol. Chem.* 268:12046-12054; Bartel *et al.* (1993) *Biotechniques* 14:920-924; Iwabuchi *et al.* (1993) *Oncogene* 8:1693-1696; and Brent WO94/10300) to identify other proteins that bind to or interact with the variant protein and are involved in variant protein activity. Such variant protein-binding proteins are also likely to be involved in the propagation of signals by the variant proteins or variant protein targets as, for example, elements of a protein-mediated signaling pathway. Alternatively, such variant protein-binding proteins are inhibitors of the variant protein.

The two-hybrid system is based on the modular nature of most transcription factors, which typically consist of separable DNA-binding and activation domains. Briefly, the assay typically utilizes two different DNA constructs. In one construct, the gene that codes for a variant protein is fused to a gene encoding the DNA binding domain of a known transcription factor (e.g., GAL-4). In the other construct, a DNA sequence, from a library of DNA sequences, that encodes an unidentified protein ("prey" or "sample") is fused to a gene that codes for the activation domain of the known transcription factor. If the "bait" and the "prey" proteins are able to interact, *in vivo*, forming a variant protein-dependent complex, the DNA-binding and activation domains of the transcription factor are brought into close proximity. This proximity allows transcription of a reporter gene (e.g., LacZ) that is operably linked to a transcriptional regulatory site responsive to the transcription factor. Expression of the reporter gene can be detected, and cell colonies containing the functional transcription factor can be isolated and used to obtain the cloned gene that encodes the protein that interacts with the variant protein.

Antibodies Directed to Variant Proteins

The present invention also provides antibodies that selectively bind to the variant proteins disclosed herein and fragments thereof. Such antibodies may be used to quantitatively or qualitatively detect the variant proteins of the present invention. As used herein, an antibody selectively binds a target variant protein when it binds the variant protein and does not significantly bind to non-variant proteins, i.e., the antibody does not significantly bind to normal, wild-type, or art-known proteins that do not contain a variant amino acid sequence due to one or more SNPs of the present invention (variant amino acid sequences may be due to, for example, nonsynonymous cSNPs, nonsense SNPs that create a stop codon, thereby causing a truncation of a polypeptide or SNPs that cause read-through mutations resulting in an extension of a polypeptide).

As used herein, an antibody is defined in terms consistent with that recognized in the art: they are multi-subunit proteins produced by an organism in response to an antigen challenge. The antibodies of the present invention include both monoclonal antibodies and polyclonal antibodies, as well as antigen-reactive proteolytic fragments of such antibodies,

such as Fab, F(ab)₂, and Fv fragments. In addition, an antibody of the present invention further includes any of a variety of engineered antigen-binding molecules such as a chimeric antibody (U.S. Patent Nos. 4,816,567 and 4,816,397; Morrison *et al.*, *Proc. Natl. Acad. Sci. USA*, 81:6851, 1984; Neuberger *et al.*, *Nature* 312:604, 1984), a humanized antibody (U.S. Patent Nos. 5,693,762; 5,585,089; and 5,565,332), a single-chain Fv (U.S. Patent No. 4,946,778; Ward *et al.*, *Nature* 334:544, 1989), a bispecific antibody with two binding specificities (Segal *et al.*, *J. Immunol. Methods* 248:1, 2001; Carter, *J. Immunol. Methods* 248:7, 2001), a diabody, a triabody, and a tetrabody (Todorovska *et al.*, *J. Immunol. Methods*, 248:47, 2001), as well as a Fab conjugate (dimer or trimer), and a minibody.

Many methods are known in the art for generating and/or identifying antibodies to a given target antigen (Harlow, *Antibodies*, Cold Spring Harbor Press, (1989)). In general, an isolated peptide (e.g., a variant protein of the present invention) is used as an immunogen and is administered to a mammalian organism, such as a rat, rabbit, hamster or mouse. Either a full-length protein, an antigenic peptide fragment (e.g., a peptide fragment containing a region that varies between a variant protein and a corresponding wild-type protein), or a fusion protein can be used. A protein used as an immunogen may be naturally-occurring, synthetic or recombinantly produced, and may be administered in combination with an adjuvant, including but not limited to, Freund's (complete and incomplete), mineral gels such as aluminum hydroxide, surface active substance such as lysolecithin, pluronic polyols, polyanions, peptides, oil emulsions, keyhole limpet hemocyanin, dinitrophenol, and the like.

Monoclonal antibodies can be produced by hybridoma technology (Kohler and Milstein, *Nature*, 256:495, 1975), which immortalizes cells secreting a specific monoclonal antibody. The immortalized cell lines can be created *in vitro* by fusing two different cell types, typically lymphocytes, and tumor cells. The hybridoma cells may be cultivated *in vitro* or *in vivo*. Additionally, fully human antibodies can be generated by transgenic animals (He *et al.*, *J. Immunol.*, 169:595, 2002). Fd phage and Fd phagemid technologies may be used to generate and select recombinant antibodies *in vitro* (Hoogenboom and Chames, *Immunol. Today* 21:371, 2000; Liu *et al.*, *J. Mol. Biol.* 315:1063, 2002). The complementarity-determining regions of an antibody can be

identified, and synthetic peptides corresponding to such regions may be used to mediate antigen binding (U.S. Patent No. 5,637,677).

Antibodies are preferably prepared against regions or discrete fragments of a variant protein containing a variant amino acid sequence as compared to the
5 corresponding wild-type protein (e.g., a region of a variant protein that includes an amino acid encoded by a nonsynonymous cSNP, a region affected by truncation caused by a nonsense SNP that creates a stop codon, or a region resulting from the destruction of a stop codon due to read-through mutation caused by a SNP). Furthermore, preferred regions will include those involved in function/activity and/or protein/binding partner
10 interaction. Such fragments can be selected on a physical property, such as fragments corresponding to regions that are located on the surface of the protein, e.g., hydrophilic regions, or can be selected based on sequence uniqueness, or based on the position of the variant amino acid residue(s) encoded by the SNPs provided by the present invention. An antigenic fragment will typically comprise at least about 8-10 contiguous amino acid
15 residues in which at least one of the amino acid residues is an amino acid affected by a SNP disclosed herein. The antigenic peptide can comprise, however, at least 12, 14, 16, 20, 25, 50, 100 (or any other number in-between) or more amino acid residues, provided that at least one amino acid is affected by a SNP disclosed herein.

Detection of an antibody of the present invention can be facilitated by coupling (i.e.,
20 physically linking) the antibody or an antigen-reactive fragment thereof to a detectable substance. Detectable substances include, but are not limited to, various enzymes, prosthetic groups, fluorescent materials, luminescent materials, bioluminescent materials, and radioactive materials. Examples of suitable enzymes include horseradish peroxidase, alkaline phosphatase, β -galactosidase, or acetylcholinesterase; examples of suitable
25 prosthetic group complexes include streptavidin/biotin and avidin/biotin; examples of suitable fluorescent materials include umbelliferone, fluorescein, fluorescein isothiocyanate, rhodamine, dichlorotriazinylamine fluorescein, dansyl chloride or phycoerythrin; an example of a luminescent material includes luminol; examples of bioluminescent materials include luciferase, luciferin, and aequorin, and examples of suitable radioactive material
30 include ^{125}I , ^{131}I , ^{35}S or ^3H .

Antibodies, particularly the use of antibodies as therapeutic agents, are reviewed in: Morgan, "Antibody therapy for Alzheimer's disease", *Expert Rev Vaccines*. 2003 Feb;2(1):53-9; Ross et al., "Anticancer antibodies", *Am J Clin Pathol*. 2003 Apr;119(4):472-85; Goldenberg, "Advancing role of radiolabeled antibodies in the therapy of cancer", *Cancer Immunol Immunother*. 2003 May;52(5):281-96. Epub 2003 Mar 11; Ross et al., "Antibody-based therapeutics in oncology", *Expert Rev Anticancer Ther*. 2003 Feb;3(1):107-21; Cao et al., "Bispecific antibody conjugates in therapeutics", *Adv Drug Deliv Rev*. 2003 Feb 10;55(2):171-97; von Mehren et al., "Monoclonal antibody therapy for cancer", *Annu Rev Med*. 2003;54:343-69. Epub 2001 Dec 03; Hudson et al., "Engineered antibodies", *Nat Med*. 2003 Jan;9(1):129-34; Brekke et al., "Therapeutic antibodies for human diseases at the dawn of the twenty-first century", *Nat Rev Drug Discov*. 2003 Jan;2(1):52-62 (Erratum in: *Nat Rev Drug Discov*. 2003 Mar;2(3):240); Houdebine, "Antibody manufacture in transgenic animals and comparisons with other systems", *Curr Opin Biotechnol*. 2002 Dec;13(6):625-9; Andreakos et al., "Monoclonal antibodies in immune and inflammatory diseases", *Curr Opin Biotechnol*. 2002 Dec;13(6):615-20; Kellermann et al., "Antibody discovery: the use of transgenic mice to generate human monoclonal antibodies for therapeutics", *Curr Opin Biotechnol*. 2002 Dec;13(6):593-7; Pini et al., "Phage display and colony filter screening for high-throughput selection of antibody libraries", *Comb Chem High Throughput Screen*. 2002 Nov;5(7):503-10; Batra et al., "Pharmacokinetics and biodistribution of genetically engineered antibodies", *Curr Opin Biotechnol*. 2002 Dec;13(6):603-8; and Tangri et al., "Rationally engineered proteins or antibodies with absent or reduced immunogenicity", *Curr Med Chem*. 2002 Dec;9(24):2191-9.

Uses of Antibodies

Antibodies can be used to isolate the variant proteins of the present invention from a natural cell source or from recombinant host cells by standard techniques, such as affinity chromatography or immunoprecipitation. In addition, antibodies are useful for detecting the presence of a variant protein of the present invention in cells or tissues to determine the pattern of expression of the variant protein among various tissues in an organism and over the course of normal development or disease progression. Further, antibodies can be used to

detect variant protein *in situ*, *in vitro*, in a bodily fluid, or in a cell lysate or supernatant in order to evaluate the amount and pattern of expression. Also, antibodies can be used to assess abnormal tissue distribution, abnormal expression during development, or expression in an abnormal condition, such as in a cardiovascular disorder or during statin treatment.

- 5 Additionally, antibody detection of circulating fragments of the full-length variant protein can be used to identify turnover.

Antibodies to the variant proteins of the present invention are also useful in pharmacogenomic analysis. Thus, antibodies against variant proteins encoded by alternative SNP alleles can be used to identify individuals that require modified treatment modalities.

- 10 Further, antibodies can be used to assess expression of the variant protein in disease states such as in active stages of the disease or in an individual with a predisposition to a disease related to the protein's function, such as a cardiovascular disorder, or during the course of a treatment regime, such as during statin treatment. Antibodies specific for a variant protein encoded by a SNP-containing nucleic acid molecule of the present invention
15 can be used to assay for the presence of the variant protein, such as to predict an individual's response to statin treatment or predisposition/susceptibility to an acute coronary event, as indicated by the presence of the variant protein.

- Antibodies are also useful as diagnostic tools for evaluating the variant proteins in conjunction with analysis by electrophoretic mobility, isoelectric point, tryptic peptide
20 digest, and other physical assays well known in the art.

Antibodies are also useful for tissue typing. Thus, where a specific variant protein has been correlated with expression in a specific tissue, antibodies that are specific for this protein can be used to identify a tissue type.

- Antibodies can also be used to assess aberrant subcellular localization of a variant
25 protein in cells in various tissues. The diagnostic uses can be applied, not only in genetic testing, but also in monitoring a treatment modality. Accordingly, where treatment is ultimately aimed at correcting the expression level or the presence of variant protein or aberrant tissue distribution or developmental expression of a variant protein, antibodies directed against the variant protein or relevant fragments can be used to monitor therapeutic
30 efficacy.

The antibodies are also useful for inhibiting variant protein function, for example, by blocking the binding of a variant protein to a binding partner. These uses can also be applied in a therapeutic context in which treatment involves inhibiting a variant protein's function. An antibody can be used, for example, to block or competitively inhibit binding, thus modulating (agonizing or antagonizing) the activity of a variant protein. Antibodies can be prepared against specific variant protein fragments containing sites required for function or against an intact variant protein that is associated with a cell or cell membrane. For *in vivo* administration, an antibody may be linked with an additional therapeutic payload such as a radionuclide, an enzyme, an immunogenic epitope, or a cytotoxic agent. Suitable cytotoxic agents include, but are not limited to, bacterial toxin such as diphtheria, and plant toxin such as ricin. The *in vivo* half-life of an antibody or a fragment thereof may be lengthened by pegylation through conjugation to polyethylene glycol (Leong *et al.*, *Cytokine* 16:106, 2001).

The invention also encompasses kits for using antibodies, such as kits for detecting the presence of a variant protein in a test sample. An exemplary kit can comprise antibodies such as a labeled or labelable antibody and a compound or agent for detecting variant proteins in a biological sample; means for determining the amount, or presence/absence of variant protein in the sample; means for comparing the amount of variant protein in the sample with a standard; and instructions for use.

Vectors and Host Cells

The present invention also provides vectors containing the SNP-containing nucleic acid molecules described herein. The term "vector" refers to a vehicle, preferably a nucleic acid molecule, which can transport a SNP-containing nucleic acid molecule. When the vector is a nucleic acid molecule, the SNP-containing nucleic acid molecule can be covalently linked to the vector nucleic acid. Such vectors include, but are not limited to, a plasmid, single or double stranded phage, a single or double stranded RNA or DNA viral vector, or artificial chromosome, such as a BAC, PAC, YAC, or MAC.

A vector can be maintained in a host cell as an extrachromosomal element where it replicates and produces additional copies of the SNP-containing nucleic acid molecules.

Alternatively, the vector may integrate into the host cell genome and produce additional copies of the SNP-containing nucleic acid molecules when the host cell replicates.

The invention provides vectors for the maintenance (cloning vectors) or vectors for expression (expression vectors) of the SNP-containing nucleic acid molecules. The vectors
5 can function in prokaryotic or eukaryotic cells or in both (shuttle vectors).

Expression vectors typically contain cis-acting regulatory regions that are operably linked in the vector to the SNP-containing nucleic acid molecules such that transcription of the SNP-containing nucleic acid molecules is allowed in a host cell. The SNP-containing nucleic acid molecules can also be introduced into the host cell with a separate nucleic acid
10 molecule capable of affecting transcription. Thus, the second nucleic acid molecule may provide a trans-acting factor interacting with the cis-regulatory control region to allow transcription of the SNP-containing nucleic acid molecules from the vector. Alternatively, a trans-acting factor may be supplied by the host cell. Finally, a trans-acting factor can be produced from the vector itself. It is understood, however, that in some embodiments,
15 transcription and/or translation of the nucleic acid molecules can occur in a cell-free system.

The regulatory sequences to which the SNP-containing nucleic acid molecules described herein can be operably linked include promoters for directing mRNA transcription. These include, but are not limited to, the left promoter from bacteriophage λ , the lac, TRP, and TAC promoters from *E. coli*, the early and late promoters from SV40, the
20 CMV immediate early promoter, the adenovirus early and late promoters, and retrovirus long-terminal repeats.

In addition to control regions that promote transcription, expression vectors may also include regions that modulate transcription, such as repressor binding sites and enhancers. Examples include the SV40 enhancer, the cytomegalovirus immediate early enhancer,
25 polyoma enhancer, adenovirus enhancers, and retrovirus LTR enhancers.

In addition to containing sites for transcription initiation and control, expression vectors can also contain sequences necessary for transcription termination and, in the transcribed region, a ribosome-binding site for translation. Other regulatory control elements for expression include initiation and termination codons as well as polyadenylation
30 signals. A person of ordinary skill in the art would be aware of the numerous regulatory sequences that are useful in expression vectors (see, e.g., Sambrook and Russell, 2000,

Molecular Cloning: A Laboratory Manual, Cold Spring Harbor Laboratory Press, Cold Spring Harbor, NY).

5 A variety of expression vectors can be used to express a SNP-containing nucleic acid molecule. Such vectors include chromosomal, episomal, and virus-derived vectors, for example, vectors derived from bacterial plasmids, from bacteriophage, from yeast episomes, from yeast chromosomal elements, including yeast artificial chromosomes, from viruses such as baculoviruses, papovaviruses such as SV40, Vaccinia viruses, adenoviruses, poxviruses, pseudorabies viruses, and retroviruses. Vectors can also be derived from combinations of these sources such as those derived from plasmid and bacteriophage genetic
10 elements, e.g., cosmids and phagemids. Appropriate cloning and expression vectors for prokaryotic and eukaryotic hosts are described in Sambrook and Russell, 2000, Molecular Cloning: A Laboratory Manual, Cold Spring Harbor Laboratory Press, Cold Spring Harbor, NY.

15 The regulatory sequence in a vector may provide constitutive expression in one or more host cells (e.g., tissue specific expression) or may provide for inducible expression in one or more cell types such as by temperature, nutrient additive, or exogenous factor, e.g., a hormone or other ligand. A variety of vectors that provide constitutive or inducible expression of a nucleic acid sequence in prokaryotic and eukaryotic host cells are well known to those of ordinary skill in the art.

20 A SNP-containing nucleic acid molecule can be inserted into the vector by methodology well-known in the art. Generally, the SNP-containing nucleic acid molecule that will ultimately be expressed is joined to an expression vector by cleaving the SNP-containing nucleic acid molecule and the expression vector with one or more restriction enzymes and then ligating the fragments together. Procedures for restriction enzyme
25 digestion and ligation are well known to those of ordinary skill in the art.

The vector containing the appropriate nucleic acid molecule can be introduced into an appropriate host cell for propagation or expression using well-known techniques. Bacterial host cells include, but are not limited to, *E. coli*, *Streptomyces*, and *Salmonella typhimurium*. Eukaryotic host cells include, but are not limited to, yeast, insect cells such as
30 *Drosophila*, animal cells such as COS and CHO cells, and plant cells.

As described herein, it may be desirable to express the variant peptide as a fusion protein. Accordingly, the invention provides fusion vectors that allow for the production of the variant peptides. Fusion vectors can, for example, increase the expression of a recombinant protein, increase the solubility of the recombinant protein, and aid in the purification of the protein by acting, for example, as a ligand for affinity purification. A proteolytic cleavage site may be introduced at the junction of the fusion moiety so that the desired variant peptide can ultimately be separated from the fusion moiety. Proteolytic enzymes suitable for such use include, but are not limited to, factor Xa, thrombin, and enterokinase. Typical fusion expression vectors include pGEX (Smith et al., *Gene* 67:31-40 (1988)), pMAL (New England Biolabs, Beverly, MA) and pRIT5 (Pharmacia, Piscataway, NJ) which fuse glutathione S-transferase (GST), maltose E binding protein, or protein A, respectively, to the target recombinant protein. Examples of suitable inducible non-fusion *E. coli* expression vectors include pTrc (Amann et al., *Gene* 69:301-315 (1988)) and pET11d (Studier et al., *Gene Expression Technology: Methods in Enzymology* 185:60-89 (1990)).

Recombinant protein expression can be maximized in a bacterial host by providing a genetic background wherein the host cell has an impaired capacity to proteolytically cleave the recombinant protein (Gottesman, S., *Gene Expression Technology: Methods in Enzymology* 185, Academic Press, San Diego, California (1990) 119-128). Alternatively, the sequence of the SNP-containing nucleic acid molecule of interest can be altered to provide preferential codon usage for a specific host cell, for example, *E. coli* (Wada et al., *Nucleic Acids Res.* 20:2111-2118 (1992)).

The SNP-containing nucleic acid molecules can also be expressed by expression vectors that are operative in yeast. Examples of vectors for expression in yeast (e.g., *S. cerevisiae*) include pYepSec1 (Baldari, et al., *EMBO J.* 6:229-234 (1987)), pMFa (Kurjan et al., *Cell* 30:933-943(1982)), pJRY88 (Schultz et al., *Gene* 54:113-123 (1987)), and pYES2 (Invitrogen Corporation, San Diego, CA).

The SNP-containing nucleic acid molecules can also be expressed in insect cells using, for example, baculovirus expression vectors. Baculovirus vectors available for expression of proteins in cultured insect cells (e.g., Sf 9 cells) include the pAc series (Smith

et al., *Mol. Cell Biol.* 3:2156-2165 (1983)) and the pVL series (Lucklow et al., *Virology* 170:31-39 (1989)).

In certain embodiments of the invention, the SNP-containing nucleic acid molecules described herein are expressed in mammalian cells using mammalian expression vectors.

5 Examples of mammalian expression vectors include pCDM8 (Seed, B. *Nature* 329:840(1987)) and pMT2PC (Kaufman et al., *EMBO J.* 6:187-195 (1987)).

The invention also encompasses vectors in which the SNP-containing nucleic acid molecules described herein are cloned into the vector in reverse orientation, but operably linked to a regulatory sequence that permits transcription of antisense RNA. Thus, an
10 antisense transcript can be produced to the SNP-containing nucleic acid sequences described herein, including both coding and non-coding regions. Expression of this antisense RNA is subject to each of the parameters described above in relation to expression of the sense RNA (regulatory sequences, constitutive or inducible expression, tissue-specific expression).

The invention also relates to recombinant host cells containing the vectors described
15 herein. Host cells therefore include, for example, prokaryotic cells, lower eukaryotic cells such as yeast, other eukaryotic cells such as insect cells, and higher eukaryotic cells such as mammalian cells.

The recombinant host cells can be prepared by introducing the vector constructs described herein into the cells by techniques readily available to persons of ordinary skill in
20 the art. These include, but are not limited to, calcium phosphate transfection, DEAE-dextran-mediated transfection, cationic lipid-mediated transfection, electroporation, transduction, infection, lipofection, and other techniques such as those described in Sambrook and Russell, 2000, *Molecular Cloning: A Laboratory Manual*, Cold Spring Harbor Laboratory, Cold Spring Harbor Laboratory Press, Cold Spring Harbor, NY).

25 Host cells can contain more than one vector. Thus, different SNP-containing nucleotide sequences can be introduced in different vectors into the same cell. Similarly, the SNP-containing nucleic acid molecules can be introduced either alone or with other nucleic acid molecules that are not related to the SNP-containing nucleic acid molecules, such as those providing trans-acting factors for expression vectors. When more than one vector is
30 introduced into a cell, the vectors can be introduced independently, co-introduced, or joined to the nucleic acid molecule vector.

In the case of bacteriophage and viral vectors, these can be introduced into cells as packaged or encapsulated virus by standard procedures for infection and transduction. Viral vectors can be replication-competent or replication-defective. In the case in which viral replication is defective, replication can occur in host cells that provide functions that complement the defects.

Vectors generally include selectable markers that enable the selection of the subpopulation of cells that contain the recombinant vector constructs. The marker can be inserted in the same vector that contains the SNP-containing nucleic acid molecules described herein or may be in a separate vector. Markers include, for example, tetracycline or ampicillin-resistance genes for prokaryotic host cells, and dihydrofolate reductase or neomycin resistance genes for eukaryotic host cells. However, any marker that provides selection for a phenotypic trait can be effective.

While the mature variant proteins can be produced in bacteria, yeast, mammalian cells, and other cells under the control of the appropriate regulatory sequences, cell-free transcription and translation systems can also be used to produce these variant proteins using RNA derived from the DNA constructs described herein.

Where secretion of the variant protein is desired, which is difficult to achieve with multi-transmembrane domain containing proteins such as G-protein-coupled receptors (GPCRs), appropriate secretion signals can be incorporated into the vector. The signal sequence can be endogenous to the peptides or heterologous to these peptides.

Where the variant protein is not secreted into the medium, the protein can be isolated from the host cell by standard disruption procedures, including freeze/thaw, sonication, mechanical disruption, use of lysing agents, and the like. The variant protein can then be recovered and purified by well-known purification methods including, for example, ammonium sulfate precipitation, acid extraction, anion or cationic exchange chromatography, phosphocellulose chromatography, hydrophobic-interaction chromatography, affinity chromatography, hydroxylapatite chromatography, lectin chromatography, or high performance liquid chromatography.

It is also understood that, depending upon the host cell in which recombinant production of the variant proteins described herein occurs, they can have various glycosylation patterns, or may be non-glycosylated, as when produced in bacteria. In

addition, the variant proteins may include an initial modified methionine in some cases as a result of a host-mediated process.

For further information regarding vectors and host cells, see *Current Protocols in Molecular Biology*, John Wiley & Sons, N.Y.

5

Uses of Vectors and Host Cells, and Transgenic Animals

Recombinant host cells that express the variant proteins described herein have a variety of uses. For example, the cells are useful for producing a variant protein that can be further purified into a preparation of desired amounts of the variant protein or fragments thereof. Thus, host cells containing expression vectors are useful for variant protein production.

Host cells are also useful for conducting cell-based assays involving the variant protein or variant protein fragments, such as those described above as well as other formats known in the art. Thus, a recombinant host cell expressing a variant protein is useful for assaying compounds that stimulate or inhibit variant protein function. Such an ability of a compound to modulate variant protein function may not be apparent from assays of the compound on the native/wild-type protein, or from cell-free assays of the compound. Recombinant host cells are also useful for assaying functional alterations in the variant proteins as compared with a known function.

Genetically-engineered host cells can be further used to produce non-human transgenic animals. A transgenic animal is preferably a non-human mammal, for example, a rodent, such as a rat or mouse, in which one or more of the cells of the animal include a transgene. A transgene is exogenous DNA containing a SNP of the present invention which is integrated into the genome of a cell from which a transgenic animal develops and which remains in the genome of the mature animal in one or more of its cell types or tissues. Such animals are useful for studying the function of a variant protein *in vivo*, and identifying and evaluating modulators of variant protein activity. Other examples of transgenic animals include, but are not limited to, non-human primates, sheep, dogs, cows, goats, chickens, and amphibians. Transgenic non-human mammals such as cows and goats can be used to produce variant proteins which can be secreted in the animal's milk and then recovered.

A transgenic animal can be produced by introducing a SNP-containing nucleic acid molecule into the male pronuclei of a fertilized oocyte, e.g., by microinjection or retroviral infection, and allowing the oocyte to develop in a pseudopregnant female foster animal.

Any nucleic acid molecules that contain one or more SNPs of the present invention can potentially be introduced as a transgene into the genome of a non-human animal.

Any of the regulatory or other sequences useful in expression vectors can form part of the transgenic sequence. This includes intronic sequences and polyadenylation signals, if not already included. A tissue-specific regulatory sequence(s) can be operably linked to the transgene to direct expression of the variant protein in particular cells or tissues.

Methods for generating transgenic animals via embryo manipulation and microinjection, particularly animals such as mice, have become conventional in the art and are described in, for example, U.S. Patent Nos. 4,736,866 and 4,870,009, both by Leder et al., U.S. Patent No. 4,873,191 by Wagner et al., and in Hogan, B., *Manipulating the Mouse Embryo*, (Cold Spring Harbor Laboratory Press, Cold Spring Harbor, N.Y., 1986). Similar methods are used for production of other transgenic animals. A transgenic founder animal can be identified based upon the presence of the transgene in its genome and/or expression of transgenic mRNA in tissues or cells of the animals. A transgenic founder animal can then be used to breed additional animals carrying the transgene. Moreover, transgenic animals carrying a transgene can further be bred to other transgenic animals carrying other transgenes. A transgenic animal also includes a non-human animal in which the entire animal or tissues in the animal have been produced using the homologously recombinant host cells described herein.

In another embodiment, transgenic non-human animals can be produced which contain selected systems that allow for regulated expression of the transgene. One example of such a system is the cre/loxP recombinase system of bacteriophage P1 (Lakso et al. *PNAS* 89:6232-6236 (1992)). Another example of a recombinase system is the FLP recombinase system of *S. cerevisiae* (O'Gorman et al. *Science* 251:1351-1355 (1991)). If a cre/loxP recombinase system is used to regulate expression of the transgene, animals containing transgenes encoding both the Cre recombinase and a selected protein are generally needed. Such animals can be provided through the construction of "double" transgenic animals, e.g.,

by mating two transgenic animals, one containing a transgene encoding a selected variant protein and the other containing a transgene encoding a recombinase.

Clones of the non-human transgenic animals described herein can also be produced according to the methods described in, for example, Wilmut, I. et al. *Nature* 385:810-813 (1997) and PCT International Publication Nos. WO 97/07668 and WO 97/07669. In brief, a cell (e.g., a somatic cell) from the transgenic animal can be isolated and induced to exit the growth cycle and enter G₀ phase. The quiescent cell can then be fused, e.g., through the use of electrical pulses, to an enucleated oocyte from an animal of the same species from which the quiescent cell is isolated. The reconstructed oocyte is then cultured such that it develops to morula or blastocyst and then transferred to pseudopregnant female foster animal. The offspring born of this female foster animal will be a clone of the animal from which the cell (e.g., a somatic cell) is isolated.

Transgenic animals containing recombinant cells that express the variant proteins described herein are useful for conducting the assays described herein in an *in vivo* context. Accordingly, the various physiological factors that are present *in vivo* and that could influence ligand or substrate binding, variant protein activation, signal transduction, or other processes or interactions, may not be evident from *in vitro* cell-free or cell-based assays. Thus, non-human transgenic animals of the present invention may be used to assay *in vivo* variant protein function as well as the activities of a therapeutic agent or compound that modulates variant protein function/activity or expression. Such animals are also suitable for assessing the effects of null mutations (i.e., mutations that substantially or completely eliminate one or more variant protein functions).

For further information regarding transgenic animals, see Houdebine, "Antibody manufacture in transgenic animals and comparisons with other systems", *Curr Opin Biotechnol.* 2002 Dec;13(6):625-9; Petters et al., "Transgenic animals as models for human disease", *Transgenic Res.* 2000;9(4-5):347-51; discussion 345-6; Wolf et al., "Use of transgenic animals in understanding molecular mechanisms of toxicity", *J Pharm Pharmacol.* 1998 Jun;50(6):567-74; Echelard, "Recombinant protein production in transgenic animals", *Curr Opin Biotechnol.* 1996 Oct;7(5):536-40; Houdebine, "Transgenic animal bioreactors", *Transgenic Res.* 2000;9(4-5):305-20; Purity et al., "Embryonic stem cells, creating transgenic animals", *Methods Cell Biol.* 1998;57:279-93; and Robl et al.,

"Artificial chromosome vectors and expression of complex proteins in transgenic animals", *Theriogenology*. 2003 Jan 1;59(1):107-13.

COMPUTER-RELATED EMBODIMENTS

5 The SNPs provided in the present invention may be "provided" in a variety of mediums to facilitate use thereof. As used in this section, "provided" refers to a manufacture, other than an isolated nucleic acid molecule, that contains SNP information of the present invention. Such a manufacture provides the SNP information in a form that allows a skilled artisan to examine the manufacture using means not directly applicable to examining the SNPs or a subset thereof as they exist in nature or in purified form. The SNP information that may be provided in such a form includes any of the SNP information provided by the present invention such as, for example, polymorphic nucleic acid and/or amino acid sequence information such as SEQ ID NOS:1-517, SEQ ID NOS:518-1034, SEQ ID NOS:13,194-13,514, SEQ ID NOS:1035-13,193, and SEQ ID NOS:13,515-85,090; information about observed SNP alleles, alternative codons, populations, allele frequencies, SNP types, and/or affected proteins; or any other information provided by the present invention in Tables 1-2 and/or the Sequence Listing.

15 In one application of this embodiment, the SNPs of the present invention can be recorded on a computer readable medium. As used herein, "computer readable medium" refers to any medium that can be read and accessed directly by a computer. Such media include, but are not limited to: magnetic storage media, such as floppy discs, hard disc storage medium, and magnetic tape; optical storage media such as CD-ROM; electrical storage media such as RAM and ROM; and hybrids of these categories such as magnetic/optical storage media. A skilled artisan can readily appreciate how any of the presently known computer readable media can be used to create a manufacture comprising computer readable medium having recorded thereon a nucleotide sequence of the present invention. One such medium is provided with the present application, namely, the present application contains computer readable medium (CD-R) that has nucleic acid sequences (and encoded protein sequences) containing SNPs provided/recorded thereon in ASCII text format in a Sequence Listing along with accompanying Tables that contain detailed SNP and sequence information (transcript

sequences are provided as SEQ ID NOS:1-517, protein sequences are provided as SEQ ID NOS:518-1034, genomic sequences are provided as SEQ ID NOS:13,194-13,514, transcript-based context sequences are provided as SEQ ID NOS:1035-13,193, and genomic-based context sequences are provided as SEQ ID NOS:13,515-85,090).

5 As used herein, "recorded" refers to a process for storing information on computer readable medium. A skilled artisan can readily adopt any of the presently known methods for recording information on computer readable medium to generate manufactures comprising the SNP information of the present invention.

10 A variety of data storage structures are available to a skilled artisan for creating a computer readable medium having recorded thereon a nucleotide or amino acid sequence of the present invention. The choice of the data storage structure will generally be based on the means chosen to access the stored information. In addition, a variety of data processor programs and formats can be used to store the nucleotide/amino acid sequence information of the present invention on computer readable medium. For example, the
15 sequence information can be represented in a word processing text file, formatted in commercially-available software such as WordPerfect and Microsoft Word, represented in the form of an ASCII file, or stored in a database application, such as OB2, Sybase, Oracle, or the like. A skilled artisan can readily adapt any number of data processor structuring formats (e.g., text file or database) in order to obtain computer readable
20 medium having recorded thereon the SNP information of the present invention.

By providing the SNPs of the present invention in computer readable form, a skilled artisan can routinely access the SNP information for a variety of purposes. Computer software is publicly available which allows a skilled artisan to access sequence information provided in a computer readable medium. Examples of publicly available
25 computer software include BLAST (Altschul et al, *J. Mol. Biol.* 215:403-410 (1990)) and BLAZE (Brutlag et al, *Comp. Chem.* 17:203-207 (1993)) search algorithms.

The present invention further provides systems, particularly computer-based systems, which contain the SNP information described herein. Such systems may be designed to store and/or analyze information on, for example, a large number of SNP
30 positions, or information on SNP genotypes from a large number of individuals. The SNP information of the present invention represents a valuable information source. The SNP

information of the present invention stored/analyzed in a computer-based system may be used for such computer-intensive applications as determining or analyzing SNP allele frequencies in a population, mapping disease genes, genotype-phenotype association studies, grouping SNPs into haplotypes, correlating SNP haplotypes with response to
5 particular drugs, or for various other bioinformatic, pharmacogenomic, drug development, or human identification/forensic applications.

As used herein, "a computer-based system" refers to the hardware means, software means, and data storage means used to analyze the SNP information of the present invention. The minimum hardware means of the computer-based systems of the
10 present invention typically comprises a central processing unit (CPU), input means, output means, and data storage means. A skilled artisan can readily appreciate that any one of the currently available computer-based systems are suitable for use in the present invention. Such a system can be changed into a system of the present invention by utilizing the SNP information provided on the CD-R, or a subset thereof, without any
15 experimentation.

As stated above, the computer-based systems of the present invention comprise a data storage means having stored therein SNPs of the present invention and the necessary hardware means and software means for supporting and implementing a search means. As used herein, "data storage means" refers to memory which can store SNP information
20 of the present invention, or a memory access means which can access manufactures having recorded thereon the SNP information of the present invention.

As used herein, "search means" refers to one or more programs or algorithms that are implemented on the computer-based system to identify or analyze SNPs in a target sequence based on the SNP information stored within the data storage means. Search
25 means can be used to determine which nucleotide is present at a particular SNP position in the target sequence. As used herein, a "target sequence" can be any DNA sequence containing the SNP position(s) to be searched or queried.

As used herein, "a target structural motif," or "target motif," refers to any rationally selected sequence or combination of sequences containing a SNP position in
30 which the sequence(s) is chosen based on a three-dimensional configuration that is formed upon the folding of the target motif. There are a variety of target motifs known in

the art. Protein target motifs include, but are not limited to, enzymatic active sites and signal sequences. Nucleic acid target motifs include, but are not limited to, promoter sequences, hairpin structures, and inducible expression elements (protein binding sequences).

5 A variety of structural formats for the input and output means can be used to input and output the information in the computer-based systems of the present invention. An exemplary format for an output means is a display that depicts the presence or absence of specified nucleotides (alleles) at particular SNP positions of interest. Such presentation can provide a rapid, binary scoring system for many SNPs simultaneously.

10 One exemplary embodiment of a computer-based system comprising SNP information of the present invention is provided in Figure 1. Figure 1 provides a block diagram of a computer system 102 that can be used to implement the present invention. The computer system 102 includes a processor 106 connected to a bus 104. Also connected to the bus 104 are a main memory 108 (preferably implemented as random access memory, RAM) and a variety of secondary storage devices 110, such as a hard
15 drive 112 and a removable medium storage device 114. The removable medium storage device 114 may represent, for example, a floppy disk drive, a CD-ROM drive, a magnetic tape drive, etc. A removable storage medium 116 (such as a floppy disk, a compact disk, a magnetic tape, etc.) containing control logic and/or data recorded therein may be
20 inserted into the removable medium storage device 114. The computer system 102 includes appropriate software for reading the control logic and/or the data from the removable storage medium 116 once inserted in the removable medium storage device 114.

25 The SNP information of the present invention may be stored in a well-known manner in the main memory 108, any of the secondary storage devices 110, and/or a removable storage medium 116. Software for accessing and processing the SNP information (such as SNP scoring tools, search tools, comparing tools, etc.) preferably resides in main memory 108 during execution.

30

EXAMPLES

The following examples are offered to illustrate, but not to limit the claimed invention.

5 **Example 1: Statistical Analysis of SNP Allele Association with Cardiovascular Disorders and Statin Response**

Study design

In order to identify genetic markers associated with acute coronary events (e.g. MI, stroke, unstable angina, congestive heart failure, etc.) or response to statin treatment
 10 for the prevention of coronary events, samples from the Cholesterol and Recurrent Events (CARE) study (a randomized multicentral double-blinded trial on secondary prevention of acute coronary events with pravastatin) (Sacks *et al.*, 1991, *Am. J. Cardiol.* 68: 1436-1446) were genotyped. A well-documented myocardial infarction (MI) was one of the enrollment criteria for entry into the CARE study. Patients were enrolled in the
 15 CARE trial from 80 participating study centers. Men and post-menopausal women were eligible for the trial if they had had an acute MI between 3 and 20 months prior to randomization, were 21 to 75 years of age, and had plasma total cholesterol levels of less than 240 mg/deciliter, LDL cholesterol levels of 115 to 174 mgs/deciliter, fasting triglyceride levels of less than 350 mgs/deciliter, fasting glucose levels of no more than
 20 220 mgs/deciliter, left ventricular ejection fractions of no less than 25 %, and no symptomatic congestive heart failure. Patients were randomized to receive either 40 mg of pravastatin once daily or a matching placebo. The primary endpoint of the trial was death from coronary heart disease and the median duration of follow-up was 5.0 years (range, 4.0 to 6.2 years). Patients enrolled in the CARE study who received placebo had
 25 a 5 year risk of having a recurrent MI (RMI) of 9.5% while those patients enrolled in the study that received pravastatin had a 5 year risk of having a RMI of only 7.2% ($p_{\text{LogRank}} = 0.0234$) (25% reduction in risk for RMI in treatment vs. placebo groups, Cox Proportional Hazard Ratio [$HR_{\text{age-adjusted}}$] = 0.75 [95% CI: 0.58-0.97, $p = 0.0256$]). Secondary endpoints of other related cardiovascular or metabolic disease events, and
 30 changes in clinical variables were also recorded in pravastatin-treated and placebo groups. Examples of secondary endpoints are listed in Tables 6-8. All individuals

included in the study had signed a written informed consent form and the study protocol was approved by the respective Institutional Review Boards (IRBs).

For genotyping SNPs in CARE patient samples, DNA was extracted from blood samples using conventional DNA extraction methods such as the QIA-amp kit from Qiagen. Allele specific primers were designed for detecting each SNP and they are shown in Table 5. Genotypes were obtained on an ABI PRISM® 7900HT Sequence Detection PCR system (Applied Biosystems, Foster City, CA) by kinetic allele-specific PCR, similar to the method described by Germer et al. (Germer S., Holland M.J., Higuchi R. 2000, *Genome Res.* 10: 258-266).

In the first analysis of samples obtained from patients enrolled in the CARE study, SNP genotype frequencies in a group of 264 patients who had a second MI during the 5 years of CARE follow-up (cases) were compared with the frequencies in the group of 1255 CARE patients who had not experienced second MI (controls). Logistic regression was used to adjust for the major epidemiologic risk factors with the specific emphasis on the interaction between the risk factors and tested SNPs to identify SNPs significantly associated with RMI when patients were stratified by sex, family history, smoking status, body mass index (BMI), ApoE status or hypertension.

To replicate initial findings, a second group of 394 CARE patients were analyzed who had a history of an MI prior to the MI at CARE enrollment (i.e., patients who had experienced a RMI at enrollment) but who had not experienced an MI during trial follow-up (cases), and 1221 of CARE MI patients without second MI were used as controls. No patients from first analysis (cases or controls) were used in this second analysis (cases or controls). There are significant clinical differences between the two analyses e.g., in the first analysis, all MI patients were in a carefully monitored clinical environment prior to their second MI, which could modulate effect of genetic polymorphisms, whereas in the second analysis, only a small portion of patients were treated by lipid lowering drugs prior to second MI. Despite these differences, numerous markers associated with RMI in the first analysis were also found to be associated with RMI in the second analysis (see Table 9).

Additionally, genetic markers identified as associated with acute coronary events or response to statin treatment for the prevention of coronary events in the CARE

samples were also genotyped in a second sample set, the West of Scotland Coronary Prevention Study (WOSCOPS) sample set. The design of the original WOSCOPS cohort and the nested case-control study have been described (Shepherd et. al, N. Eng. J. Med., Nov. 16: 333 (20), pp. 1301-7 1995; Packard et. al. N. Eng. J. Med., Oct. 19: 343 (16), pp. 1148-55, 2000). The objective of the WOSCOPS trial was to assess pravastatin efficacy at reducing risk of primary MI or coronary death among Scottish men with hypercholesterolemia (fasting LDL cholesterol > 155 mg/dl). Participants in the WOSCOPS study were 45-64 years of age and followed for an average of 4.9 years for coronary events. The nested case-control study included as cases all WOSCOPS patients who experienced a coronary event (confirmed nonfatal MI, death from coronary heart disease, or a revascularization procedure; N=580). Controls were 1160 age and smoking status-matched unaffected patients. All individuals included in the study had signed a written informed consent form and the study protocol was approved by IRBs. DNA was extracted and genotyped as described above.

Statistical analysis for association of SNPs with specific clinical endpoints

Qualitative phenotypes of the patients who were genotyped (Table 6) were analyzed using an overall logistic regression model that included an intercept, a parameter for the effect of a genotype containing two rare alleles versus a genotype containing no rare alleles, and a parameter for the effect of a genotype containing one rare allele versus a genotype containing no rare alleles. The test of the overall model is a chi-square test with five degrees of freedom for analyses containing all three genotypes, and four degrees of freedom for analyses containing two genotypes. An example of a SNP associated with increased risk for RMI is hCV529710 (Table 6). hCV529710 is strongly associated with Fatal CHD (Coronary Heart Disease)/Non-fatal MI and Fatal Atherosclerotic Cardiovascular Disease (Relative Risk = 1.5 and 2.3, and p- values <0.05 and <0.005, respectively).

Quantitative phenotypes of the patients who were genotyped (Table 7) were also analyzed using an overall generalized linear model (GLM) that included an intercept, a parameter for the effect of a genotype containing two rare alleles, and a parameter for the

effect of a genotype containing one rare allele. The test of the overall GLM model is an F-test.

Effect sizes for association of SNPs with endpoints were estimated through odds ratios in placebo treated patients only, separately for carriers of each genotype (groups of 0, 1, and 2 minor allele carriers). The effect was considered to be significant if the p-value for testing whether any of the SNP genotype parameters in overall model was < 0.05. An example of a SNP associated with increased risk for a quantitative phenotype such as very low density lipoproteins (VLDL) is hCV22274624 with a p value <0.0005.

Statistical analysis for association of SNPs with pravastatin treatment in cardiovascular events prevention (Table 8) was carried out using an overall logistic regression model that included an intercept, a parameter for the effect of a genotype containing two rare alleles versus a genotype containing no rare alleles, a parameter for the effect of a genotype containing one rare allele versus a genotype containing no rare alleles, a parameter for the effect of use of pravastatin versus the use of placebo, and parameters for the interaction effects between SNP genotypes and pravastatin use. The test of the overall model is a chi-square test with two degrees of freedom for analyses containing all three genotypes, and one degree of freedom for analyses containing two genotypes.

Effect sizes were estimated through odds ratios (pravastatin group versus placebo) for carriers of each genotype (groups of 0, 1, and 2 minor allele carriers). The effect was considered to be significant if p-value for testing whether any of the interactions between SNP genotypes and pravastatin use were < 0.05. An example of a SNP associated with a response to statin treatment in preventing an adverse coronary event is hCV2741051. When the pravastatin group is compared to the control group, individuals with one or two of the rare alleles had odds ratios of 0.43 and 0.26 respectively with a p-value of <0.05. This particular SNP is also associated with a reduced risk of stroke in the pravastatin treated group when one or two rare alleles are present in a patient (odds ratios of 0.21 and 0.23 p<0.05). Odds ratios less than one indicate that the specific SNP allele has a protective effect and odds ratios greater than one indicate that the specific SNP allele has an adverse effect.

Statistical analysis for the association of SNPs with RMI or stroke (Table 9) was also carried out using stepwise logistic regression. Relative risk (RR) and 95% confidence intervals (CI)s – 5-6 years relative risk of a RMI event or stroke given the SNP genotype were calculated by the Wald test. Certain SNPs show association of SNPs with adverse coronary events such as RMI and stroke in CARE samples. This association of certain SNPs with adverse coronary events could also be replicated by comparing associations observed in the first analysis of the CARE samples and the second analysis of the CARE samples (see above). An example of SNPs associated with increased risk for RMI are hCV517658 and hCV 8722981 with RR of 1.34 and 2.01 respectively. RR values <1 are associated with a reduced risk of the indicated outcome and RR values >1 are associated with an increased risk of the indicated outcome. An example of a SNP associated with decreased risk for RMI that replicated between the first and second analysis of the CARE data is hCV761961 that had ORs of 0.5 and 0.5 in the first and second analyses respectively. An example of a SNP associated with increased risk for RMI that replicated in the first and second analyses is hCV8851080 that had ORs of 2.7 and 1.9 in the first and second analyses respectively. An example of a SNP associated with increased risk for stroke that replicated in the first and second analyses of the CARE data is hCV11482766 that had ORs of 3.5 and 3.3 in the first and second analyses respectively.

For statistical analysis of association of SNPs with pravastatin treatment in RMI prevention (Table 10), effect sizes were estimated through genotypic RR, including 95% CIs. Homogeneity of Cochran-Mantel-Haenszel odds ratios was tested across pravastatin and placebo strata using the Wald test. A SNP was considered to have a significant association with response to pravastatin treatment if it exhibited Wald p-value < 0.05 in the allelic association test or in any of the 3 genotypic tests (dominant, recessive, additive). Table 10 shows association of SNPs predictive of statin response with cardiovascular events prevention under statin treatment, with an adjustment for conventional risk factors such as age, sex, smoking status, baseline glucose levels, BMI, history of hypertension, etc. (this adjustment supports independence of the SNP association from conventional risk factors). This table also provides the frequency data for the at risk allele in the columns labeled “Case Y PRIMER ALLELE Nucleotide

Frequency” and “Control Y PRIMER ALLELE Nucleotide Frequency”. Allele frequencies for the cases and controls ≤ 0.49 indicate that the at-risk allele is the minor allele. Allele frequencies ≥ 0.50 indicate that the at-risk allele is the major allele. An example of a SNP associated with increased risk for an adverse cardiovascular event in the placebo group using a dominant genotypic test is hCV25644901. The dominant genotype (GG or GA) had a RR of 1.92 of being associated with an adverse cardiovascular event in the placebo group. However, this same SNP was protective in the statin treated group with a RR of 0.58. An example of a SNP associated with an adverse cardiovascular event in the placebo group using the allelic association test is hCV16044337 with a RR of 1.87 for the homozygous AA genotype. This same genotype was protective in the statin treated group with a RR of 0.56.

The statistical results provided in Table 11 demonstrate association of a SNP in the CD6 gene (hCV2553030) that is predictive of statin response in the prevention of RMI, justified as a significant difference in risk associated with the SNP between placebo and statin treated strata (Breslow Day p-values < 0.05). Table 11 presents the results observed in samples taken from both the CARE and WOSCOP studies. In both studies the individuals homozygous for the minor allele were statistically different from heterozygous and major allele homozygous individuals in the pravastatin treated group vs. the placebo treated group. This SNP was associated with a reduced risk of an adverse coronary event in the CARE and WOSCOPS studies with RR or OR of 0.13 and 0.23 respectively in the two studies. Therefore, SNPs identified as useful for predicting RMI may also be useful for predicting increased risk for developing primary MI.

Table 12 shows the association of a SNP in the FCAR gene (hCV7841642) that is predictive of MI risk and response to statin treatment. Individuals who participated in both the CARE and WOSCOPS studies, who did not receive pravastatin treatment and who were heterozygous or homozygous for the major allele (AG or GG) (OR of 1.58, 1.52, 1.5, 1.47 in the respective studies) had a significantly higher risk of having an MI vs. individuals who were homozygous for the minor allele. However, individuals in the CARE study who were heterozygous or homozygous for the FCAR major allele were also statistically significantly protected by pravastatin treatment against an adverse coronary event relative to the individuals homozygous for the minor allele (OR 0.31,

0.79). Therefore, an allele found to be associated with risk for MI, RMI, stroke, or other adverse cardiovascular event, may also be useful for predicting responsiveness to statin treatment. SNPs associated with treatment response to pravastatin may also be predictive of responsiveness of an individual to other statins as a class.

5 The data presented in Table 8 based on an association of genotypes with pravastatin efficacy of the CARE samples were further analyzed and presented in Table 13. The further analysis was performed to align the data obtained from the analysis of the CARE samples, which was a prospective study, to the analysis of the WOSCOP samples, which was a case/control study. Table 13 also presents an analysis of the
10 association of genotypes with pravastatin efficacy in the WOSCOPs samples. Relative to the analysis performed on the data presented in Table 8, there are two significant differences to determine if the SNP influenced pravastatin efficacy. Data obtained from the CARE samples were separated by study design into two groups, those in the prospective study design group and those in the case/control study design group. The
15 original care study contained 16 protocol defined cardiovascular disease defined endpoints and 150 other phenotypes. The prospective study design presented in Table 13 only looks at two possible end points, those individuals who had a fatal MI, sudden death, or a definite non-fatal MI, or those individuals who had a fatal or non-fatal MI (probable or definite). In the case/control study design, in addition to only looking at cases that fell
20 into the two possible endpoints defined above, cases were only compared to matched controls, ie. controls matched by age, smoking status and did not have any adverse coronary events or died due to other causes. The control groups used to compare the data were also divided into two groups, the "all possible" control group and the "cleaner" control group. The all possible control group consists of all of the controls that were
25 white males and were matched for age and smoking status but had any disease outcome. The cleaner control group were also matched for age and smoking status but were further restricted to only those individuals that had MI as an outcome. Because the participants in the WOSCOPs trial were all white males, only data obtained from white males in the CARE study were analysed. Data from the "all possible" and "cleaner" controls were
30 compared to data obtained from the cases in the prospective study design while only data from "cleaner" controls were compared to cases in the case/control study design. The

data from the case/control cohorts were analysed using conditional logistic regression (as opposed to logistic regression used for the original analysis).

An example of a SNP associated with fatal MI/sudden death/non-fatal MI using data from the CARE study is hCV2442143. Patients with 0 rare alleles (or patients
5 homozygous for the dominant allele) had an OR of 0.42 of being associated with the adverse outcome in the presence of statin treatment. Patients with one or two rare alleles had ORs of 0.78 and 1.16 respectively of being associated with the adverse outcome. However the 95% CI for these two genotypes makes the result not statistically significant.

10 The data presented in Table 6 based on an association of genotypes with adverse cardiovascular outcomes such as fatal or non-fatal MI were further analyzed and presented in Table 14. Similar to the data presented in Table 13, the analysis was modified to align the data obtained from the CARE samples to data obtained from the WOSCOPs samples. In addition, Table 14 also presents an analysis of the association of
15 genotypes with adverse cardiovascular outcomes observed in the WOSCOPs samples. As above, there are two significant differences. Data obtained from the CARE samples were separated by study design into a prospective or a case/control study design group as defined above. Secondly, as above the control groups were divided into the all possible controls and the cleaner controls. Controls were age matched for age and smoking status
20 with the cases. The all possible controls include individuals as defined above and the cleaner controls also use individuals as defined above. As above, only data obtained from samples from white males were analysed and are presented in Table 14.

An example of a SNP associated with an adverse cardiovascular event such as a fatal MI or non-fatal MI using data from the CARE study is hCV529706. Patients with 2
25 rare alleles vs. 0 rare alleles had an OR of 2.08 of having the adverse event ($p < 0.05$).

The statistical results provided in Table 15 demonstrate the association of a SNP in the PON1 gene(hCV2548962) with pravastatin efficacy in both the CARE and WOSCOPs sample sets. The analysis was refined as described for both Tables 13 and 14. The data show that patients with 2 rare alleles were significantly protected against a
30 fatal or non-fatal MI when treated with pravastatin (ORs 0.28-0.34, $p < 0.05$).

Example 2: Statistical Analysis of SNP Combinations Associated with RMI and Predictive of Response to Statin Treatment

Multiple markers were identified in the CARE study as associated with the ability of a patient to respond to statin treatment by having a reduced risk of RMI (specifically see Tables 8 and 10). The data presented in those Tables, especially Table 10 indicate that the minor alleles of NPC1 (hCV25472673) and HSPG2 (hCV1603656) and the major allele of ABCA1 (hCV2741051) are protective against RMI in patients that receive statin treatment. The data also show that certain genotypes of the alleles identified in Table 10 are protective against RMI in patients that receive statin treatment. The homozygous minor allele or the heterozygous minor and major allele of the NPC1 gene (CC, CT) and the HSPG2 gene (TT, TC) are protective genotypes (low risk genotypes) against RMI in patients that receive statin treatment. The homozygous major allele of the ABCA1 gene (CC) is a protective genotype (low risk genotype) in patients that receive statin treatment.

The genotype data generated from the DNA of patients who participated in the CARE study was analyzed to determine the effect that pravastatin treatment had on the occurrence of RMI in patients with each of the potential genotypes (low risk, protective or high risk, non-protective) for the ABCA1 gene, the NPC1 gene and the HSPG1 gene independently. The data are presented in Table 16.

Table 16

		Age-Adjusted pravastatin effect (by genotype group)			
N	Label	RR	95% CI		p-value
1366	High risk ABCA1 genotype	0.9567	0.6709	1.3644	0.807
1441	Low risk ABCA1 genotype	0.5883	0.4249	0.8145	0.0014
Total = 2807					
1045	High risk NPC1 genotype	1.0824	0.7265	1.6127	0.6971

1755	Low risk NPC1 genotype	0.5938	0.4388	0.8035	0.0007
Total = 2800					
2375	High risk HSPG2 genotype	0.8097	0.6271	1.0453	0.1053
428	Low risk HSPG2 genotype	0.3934	0.2002	0.7729	0.0068
Total = 2803					

The data show that the low risk genotypes of the ABCA1 gene, the NPC1 gene and the HSPG2 gene are protective against RMI in patients that have received statin treatment.

- 5 The effect of pravastatin treatment on the occurrence of RMI in patients with each of the potential genotypes (protective, low risk genotype or non-protective, high risk genotype) for each of the ABCA1 gene, NPC1 gene, and HSPG2 gene alone, and combinations with the other two genes thereof are presented in Table 17.

Table 17

		Age-adjusted pravastatin effect (by genotype group)			
N	Label	RR	95% CI		p-value
436	High risk, non-protective genotypes	1.7175	0.877	3.3637	0.1148
447	Low risk, protective ABCA1 only	0.8765	0.4848	1.5848	0.6627
701	Low risk, protective NPC1 only	0.8954	0.5543	1.4462	0.6514
83	Low risk, protective HSPG2 only	0.2487	0.0304	2.0372	0.1947
784	Low risk ABCA1 and NPC1 only (pattern 2 genotype)	0.5258	0.3343	0.8271	0.0054
77	Low risk ABCA1 and HSPG2 only	1.0054	0.2593	3.8982	0.9938
144	Low risk NPC1 and HSPG2 only	0.2964	0.0652	1.3482	0.1156
122	Low risk ABCA1, NPC1 and HSPG2 (pattern 3 genotype)	0.2399	0.0704	0.8177	0.0225

Total =2794	
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The data show that patients that have a combination of the ABCA1 and NPC1 low risk genotypes (pattern 2) or patients that have a combination of the ABCA1, NPC1 and the HSPG2 low risk genotypes (pattern 3) have a significantly reduced risk of RMI if they receive pravastatin treatment relative to those patients who received placebo.

Patients in the CARE trial that had a high risk, non-protective genotype for the ABCA1 gene, the NPC1 gene and the HSPG2 gene, had the low risk ABCA1 genotype only, had the low risk ABCA1 and HSPG2 genotypes only, had the low risk NPC1 genotype only, had the low risk HSPG2 genotype only, or had the low risk NPC1 and HSPG1 genotype are collectively called pattern 0 patients. Patients in the CARE trial that had the pattern 0 genotype and received placebo had a 5 year risk of a RMI of 8.1%. Patients in the trial that had the pattern 2 genotype and received placebo had a 5 year risk of a RMI of 12.5%, or a 64 % increase over those patients that had the pattern 0 genotypes. Patients in the trial that had the pattern 3 genotype and received placebo had a 5 year risk of a RMI of 19.3 % or a 138% increase over those patients that had the pattern 0 genotypes. These data show that patients that do not receive statin treatment and have the pattern 2 or the pattern 3 genotypes have a 64% or a 138% increased risk of a RMI in a 5 year period over patients with a pattern 0 genotype (LogRank p-value = 0.0013).

Patients in the CARE trial with pattern 0 genotypes who did not receive statin treatment had a 5 year risk of a RMI of 8.1%. Patients in the CARE trial with pattern 0 genotypes who did receive pravastatin treatment had a 5 year risk of a RMI of 7.9% (N = 1888, 67.6% of the CARE population, LogRank p-value = 0.9345). Patients in the trial with pattern 2 genotypes, who did not receive statin treatment had a 5 year risk of a RMI of 12.5%. Patients in the trial with pattern 2 genotypes who did receive pravastatin treatment had a 5 year risk of a RMI of 6.8% (HR = 0.53, 95% CI: 0.33-0.85, p = 0.0081, N = 784, 28.1% of the CARE population). This is a 50% reduction in risk over a 5 year period for RMI. Patients in the trial with pattern the 3 genotype, who did not receive statin treatment had a 5 year risk of a RMI of 19.3%. Patients in the trial with the pattern

3 genotype who did receive pravastatin had a 5 year risk of a RMI of 4.6% (HR = 0.2, 95% CI = 0.06-0.8, p = 0.0209, N = 122, 4.4% of the CARE population). This is an 80% reduction in risk over a 5 year period for RMI. These data are summarized in Table 18.

5 Table 18

		RMI	No RMI	Risk	RR _{Statin}	RD _{Statin}
All	Pravastatin	106	1367	0.072	0.76	0.023
	Placebo	137	1303	0.095		
Pattern 0	Pravastatin	78	906	0.079	0.98	0.001
	Placebo	73	831	0.081		
Pattern 2	Pravastatin	25	342	0.068	0.55	0.057
	Placebo	52	365	0.125		
Pattern 3	Pravastatin	3	62	0.046	0.24	0.147
	Placebo	11	46	0.193		

Measures of prognostic value were calculated from the above data. The positive predictive value (PPV) of each genotype pattern can be calculated by dividing the number of individuals with that genotype who received placebo and had a RMI by the total number of individuals who had that genotype and received placebo. The PPV of the pattern 3 genotype is 19.3% and the PPV of the pattern 2 genotype is 12.5%. The negative predictive value (NPV) of each genotype can be calculated by dividing the total number of individuals who had those genotypes, received placebo and did not have a RMI by the total number of individuals who had that genotype and received placebo.

10 The NPV of pattern 0 is 91.9%. From these calculations, the entire population can be broken down into different absolute risk groups. The over all risk of the population to have a RMI after having an MI is 9.5%. However, for individuals with the pattern 0 genotype, the risk of a RMI is reduced to 8.1%. Individuals with pattern 2 and pattern 3 genotypes have a 12.5% and 19.3% risk of a RMI.

All publications and patents cited in this specification are herein incorporated by reference in their entirety. Various modifications and variations of the described compositions, methods and systems of the invention will be apparent to those skilled in the art without departing from the scope and spirit of the invention. Although the invention has been described in connection with specific preferred embodiments and certain working examples, it should be understood that the invention as claimed should not be unduly limited to such specific embodiments. Indeed, various modifications of the above-described modes for carrying out the invention that are obvious to those skilled in the field of molecular biology, genetics and related fields are intended to be within the scope of the following claims.

TABLE 5, page 1 of 4

Marker	Alleles	Sequence A (allele-specific primer)	Sequence B (allele-specific primer)	Sequence C (common primer)
hCV108500	C/G	AGCTGTTCTGTTCTTATGATC (SEQ ID NO: 85091)	AGCTGTTCTGTTCTTATGATG (SEQ ID NO: 85092)	GAAGTCAACAGTGAACATGTGA (SEQ ID NO: 85093)
hCV1086095	A/G	CAGTCACATGGGGAAG (SEQ ID NO: 85094)	ACTCACATGGGGAAGG (SEQ ID NO: 85095)	CCTTCCAGGTGAAGGTAC (SEQ ID NO: 85096)
hCV1122594	A/G	TCCCAATCCAGGACA (SEQ ID NO: 85097)	CCCAATCCAGGAGC (SEQ ID NO: 85098)	TGACATTTGACATCTCAAAATTTT (SEQ ID NO: 85099)
hCV1135908	C/G	CAAAATGTAAAGGTTTCATATGAG (SEQ ID NO: 85100)	CAAAATGTAAAGGTTTCATATGAC (SEQ ID NO: 85101)	GAGCTGTGTTCTTTTGTCTTA (SEQ ID NO: 85102)
hCV11482766	C/T	GGCAGCCAGGTGAG (SEQ ID NO: 85103)	GGCAGCCAGGTGAC (SEQ ID NO: 85104)	CCACGTTGTGGTGCATCTT (SEQ ID NO: 85105)
hCV11571465	C/G	GCTGGAGTTCATGTCG (SEQ ID NO: 85106)	GCTGGAGTTCATGTCGG (SEQ ID NO: 85107)	CCTTGGCTGTGGTGTACAG (SEQ ID NO: 85108)
hCV11696920	A/G	GTCTTTAGAGCCCTCTTCAGATA (SEQ ID NO: 85109)	CITTAGAGCCCTCTTCAGATG (SEQ ID NO: 85110)	CGGCTTTGGCCCTACAAG (SEQ ID NO: 85111)
hCV1180648	G/A	GGGTAAATTCAGTAAGGTTGG (SEQ ID NO: 85112)	GGGTAAATTCAGTAAGGTTGA (SEQ ID NO: 85113)	TCGCTATCCAGTGAACATATC (SEQ ID NO: 85114)
hCV11852591	C/G	GGGCTGTTGTCTCACCTC (SEQ ID NO: 85115)	GGGCTGTTGTCTCACCTG (SEQ ID NO: 85116)	TGTCATCAGATGAAGAAGAGAA (SEQ ID NO: 85117)
hCV11889257	A/G	CTCTCTTCTAGAACTGAAGAAAT (SEQ ID NO: 85118)	TCTCTTCTAGAACTGAAGAAATC (SEQ ID NO: 85119)	GGGCGGGCTAGGAGTAG (SEQ ID NO: 85120)
hCV11942529	C/T	ACTGTACCTGTTGGGG (SEQ ID NO: 85121)	GAGTGTACCTGTTGGGA (SEQ ID NO: 85122)	CCAGGTTGGGCTACTG (SEQ ID NO: 85123)
hCV11951095	T/C	CGTGACCCCTGCCGT (SEQ ID NO: 85124)	CGTGACCCCTGCCG (SEQ ID NO: 85125)	GGGCCAGCATGTGGAG (SEQ ID NO: 85126)
hCV11975296	G/T	CAGTCCATGGTTCTCTCAT (SEQ ID NO: 85127)	CAGTCCATGGTTCTCTTAC (SEQ ID NO: 85128)	CTCCACTGTCATTTCAGAG (SEQ ID NO: 85129)
hCV12020398	T/C	GGACCCCGGAAGG (SEQ ID NO: 85130)	TGAGCCCGGGAAGGA (SEQ ID NO: 85131)	GGCCCCAACAGTTGACTG (SEQ ID NO: 85132)
hCV1202863	A/G	GCGTGATGATGAATCGA (SEQ ID NO: 85133)	GCGTGATGATGAATCTGG (SEQ ID NO: 85134)	AGCCTCTCTCTGACTGTCATC (SEQ ID NO: 85135)
hCV1207984	A/C	GCAGCAGTCGCCCTT (SEQ ID NO: 85136)	GCAGCAGTCGCCCTG (SEQ ID NO: 85137)	CATTTTCTGATGTTGTTTCTAG (SEQ ID NO: 85138)
hCV12102850	C/T	GGTTACAGCTCCAGGAC (SEQ ID NO: 85139)	GGTTACAGCTCCAGAT (SEQ ID NO: 85140)	CTGATGGCCAAAGAGAGT (SEQ ID NO: 85141)
hCV12106245	A/G	GGCCTACAGCGGGT (SEQ ID NO: 85142)	CCTACAGCGGGC (SEQ ID NO: 85143)	GACGGATCTGACAGATCTTTC (SEQ ID NO: 85144)
hCV12114319	A/G	GACACTGCCCTCATGTT (SEQ ID NO: 85146)	CAGTCCATGGTTCTCTTAC (SEQ ID NO: 85149)	CTGTCTCTGAGTCTGATC (SEQ ID NO: 85147)
hCV12120554	C/T	ACTGTCTGTCTCTCTCTG (SEQ ID NO: 85148)	GACTGTCTGTCTCTCTCTA (SEQ ID NO: 85149)	TTGGCCGCAATGACTAGA (SEQ ID NO: 85150)
hCV1259530	A/G	TCGAGGTGTCTCTCTA (SEQ ID NO: 85151)	CGCAGGTGTCTCTG (SEQ ID NO: 85152)	CCCCATCCCTTCTCA (SEQ ID NO: 85153)
hCV1260328	A/G	TCCAGCTGGACAGGT (SEQ ID NO: 85154)	CCACGTGGACAGGC (SEQ ID NO: 85155)	GCCAGGATTTTCATCAGC (SEQ ID NO: 85156)
hCV1345888	C/T	CAGTTTCCATGGGTTCTACTAC (SEQ ID NO: 85157)	CAGTTTCCATGGGTTCTACTAT (SEQ ID NO: 85158)	TTATGAATGGTACAGACAAAGTAT (SEQ ID NO: 85159)
hCV1345988	T/C	CAGTTTCCATGGGTTCTACTAT (SEQ ID NO: 85160)	CAGTTTCCATGGGTTCTCTCT (SEQ ID NO: 85161)	TTATGAATGGTACAGACAAAGTAT (SEQ ID NO: 85162)
hCV1351979	A/G	CCAGTTTGGTGTCAACTAGAAA (SEQ ID NO: 85163)	CCAGTTTGGTGTCAACTAGAAG (SEQ ID NO: 85164)	TTGCCAACTGAAAACATACTA (SEQ ID NO: 85165)
hCV1366366	A/G	TCCTTAGTCCGAGTAT (SEQ ID NO: 85166)	TCCCTTAGTCCGAGTAC (SEQ ID NO: 85167)	GACTCTTTGCGAGGAATGTGT (SEQ ID NO: 85168)
hCV1376137	A/G	CTCCATCATTCGACACCA (SEQ ID NO: 85169)	TCCATCATTCGACACCG (SEQ ID NO: 85170)	CCAAATCCCTGATGTTTAAA (SEQ ID NO: 85171)
hCV1403468	A/C	ACTGGCCCTTGCAT (SEQ ID NO: 85172)	ACTGGCCCTTGCAG (SEQ ID NO: 85173)	AGAGGGAACCAACCTTA (SEQ ID NO: 85174)
hCV1465646	A/G	TCGGCTTCCGGGA (SEQ ID NO: 85175)	TCGGCTTCCGGGAG (SEQ ID NO: 85176)	CGTAGCTGTTGACCATCTTA (SEQ ID NO: 85177)
hCV15757745	C/G	AGATTTCACCCATCCATG (SEQ ID NO: 85178)	GAGATTTCACCCATCCACT (SEQ ID NO: 85179)	TGCCACTCAGAACCTCTCA (SEQ ID NO: 85180)
hCV15760070	A/T	TGTCCAGATCCACATAGAAC (SEQ ID NO: 85181)	TGTCCAGATCCACATAGAACT (SEQ ID NO: 85182)	CTTATTCGACCGGACCAT (SEQ ID NO: 85183)
hCV15852235	C/T	AAGAGTCTGAAATCTCTCTC (SEQ ID NO: 85184)	AAGAGTCTGAAATCTCTCTT (SEQ ID NO: 85185)	ATCAATTTGGTGTGAAACAAACT (SEQ ID NO: 85186)
hCV15871020	G/A	ATGTGAATAGCACTTTATCAG (SEQ ID NO: 85187)	ATGTGAATAGCACTTTATCAA (SEQ ID NO: 85188)	TGCTCCGTTGGAAGAGA (SEQ ID NO: 85189)
hCV15876071	G/A	CGACTTAAGGTTAGTGTGAC (SEQ ID NO: 85190)	CGACTTAAGGTTAGTGTGAT (SEQ ID NO: 85191)	CGCTCTGCGTACCTAAGG (SEQ ID NO: 85192)
hCV15882348	C/T	GCTGCTCTGCGCG (SEQ ID NO: 85193)	GCTGCTCTGCGCCA (SEQ ID NO: 85194)	GCCTCTGCGTACCTAAGG (SEQ ID NO: 85195)
hCV15943710	A/G	CCTCATGGAGATCTTTCA (SEQ ID NO: 85196)	CCTCATGGAGATCTTTCC (SEQ ID NO: 85197)	GAGGCCAGCGAGAGA (SEQ ID NO: 85198)
hCV15954277	A/G	TGTCGGTAAACATGGCA (SEQ ID NO: 85199)	GTGGTAAACATGGGG (SEQ ID NO: 85200)	GGTGGGTGCTGACTCTC (SEQ ID NO: 85201)
hCV15962586	C/T	GGCTGTCCCTGGGAC (SEQ ID NO: 85202)	GGCTGTCCCTGGGAT (SEQ ID NO: 85203)	GAGGAGGGGACTTTTATCA (SEQ ID NO: 85204)
hCV1603656	C/T	GGCTCTAGCTCCG (SEQ ID NO: 85205)	TGCTCCCTCAGTCCA (SEQ ID NO: 85206)	GGGCACTGCCAATCTTAG (SEQ ID NO: 85207)
hCV1603692	C/T	GGCTCTAGGGGCGC (SEQ ID NO: 85208)	AGCCTCTAGGGGCGT (SEQ ID NO: 85209)	CCCCATTTGCACAGAC (SEQ ID NO: 85210)
hCV1603697	C/T	CGGCTGCTGGGAC (SEQ ID NO: 85211)	CGGCTGCTGGGAT (SEQ ID NO: 85212)	GCCAGGGGCTGTCT (SEQ ID NO: 85213)
hCV16044337	A/G	TCCGGGTGCACATA (SEQ ID NO: 85214)	CGGGTGCACATG (SEQ ID NO: 85215)	TGGAGAGTGTGCTCATCTAC (SEQ ID NO: 85216)
hCV16047108	A/G	TGTTTTCATCAGTTGAAGT (SEQ ID NO: 85217)	TTTTCATCAGTTGAAGTGC (SEQ ID NO: 85218)	CAATTTGGCTCCCTTAAAG (SEQ ID NO: 85219)
hCV16053900	G/T	GAGCTGCTCCAGATG (SEQ ID NO: 85220)	GAGCTGCTCCAGATT (SEQ ID NO: 85221)	GGTTTCAATTTTGGTTCACAA (SEQ ID NO: 85222)
hCV16165936	C/T	CTGAGGCTATGTCCTC (SEQ ID NO: 85223)	CTGAGGCTATGTCCTT (SEQ ID NO: 85224)	AGCTCTCTTTGTTGCTACTG (SEQ ID NO: 85225)
hCV16168043	A/G	CGTTGAAGTCCCTGAT (SEQ ID NO: 85226)	CGGTTGAAGTCCCTTGAC (SEQ ID NO: 85227)	GGTTGTCAGAGACATCTGA (SEQ ID NO: 85228)
hCV16170435	G/C	ATCTCACAATGATGCTATG (SEQ ID NO: 85229)	AATCTCACAATGATGCTATC (SEQ ID NO: 85230)	CAGGTCATCTCACAGATAC (SEQ ID NO: 85231)
hCV16170900	A/G	CGCACACCAAGTTCTCAT (SEQ ID NO: 85232)	CGCACACCAAGTTCTCAC (SEQ ID NO: 85233)	GCAACTCTGGGCCACTATA (SEQ ID NO: 85234)
hCV16170901	T/C	GGTTTCATGCTATGTTTCT (SEQ ID NO: 85235)	GTTTCATGCTATGTTTCC (SEQ ID NO: 85236)	GGTACTGAATTTTAAAGGTTTTA (SEQ ID NO: 85237)
hCV16170982	C/G	CCCCACTCTCCAGC (SEQ ID NO: 85238)	CCCCACTCTCCAGG (SEQ ID NO: 85239)	GGCAAAAGCAGCTGTGAAGA (SEQ ID NO: 85240)
hCV16172087	A/C	GAGTGGCCGTACGCA (SEQ ID NO: 85241)	GAGTGGCCGTACGCC (SEQ ID NO: 85242)	GGAGGCTCAGGTGGATGTTTA (SEQ ID NO: 85243)
hCV16172249	C/G	ACTGTAATTTTAAAGGTCCTG (SEQ ID NO: 85244)	ACTGTAATTTTAAAGGTCCTC (SEQ ID NO: 85245)	GGATGTATATCATCTATCTTCCAGATATAT (SEQ ID NO: 85246)
hCV16172339	A/T	CTGGGGCTCCACCT (SEQ ID NO: 85247)	TGGGCTCCACCA (SEQ ID NO: 85248)	TGGCATGTGCCACTCA (SEQ ID NO: 85249)
hCV16172571	A/G	GGTACCATGGAGTGTACTACT (SEQ ID NO: 85250)	GTACCATGGAGTGTACTACC (SEQ ID NO: 85251)	AGGTTGGTCTTGGAGATGAC (SEQ ID NO: 85252)
hCV16179493	C/T	GGTTCGGGGCCACAC (SEQ ID NO: 85253)	GGGTTCGGGGCCACAT (SEQ ID NO: 85254)	GGGCCCCCTCAGTGAAG (SEQ ID NO: 85255)
hCV16182835	A/G	TGTTCTCTTATGATGATG (SEQ ID NO: 85256)	GTCTCTCTTATGATGATGC (SEQ ID NO: 85257)	GGCCTTCTCTCAGCTTAATA (SEQ ID NO: 85258)
hCV16185421	C/T	GCCATCATTTGCTCTAACAC (SEQ ID NO: 85259)	GCATCATTTGCTCTTAACAT (SEQ ID NO: 85260)	CGCTATTGCTTCTTGTAGTA (SEQ ID NO: 85261)
hCV16190893	C/T	CGAGTACTGCTTAGGG (SEQ ID NO: 85262)	CGCAGTACTGCTTAGGA (SEQ ID NO: 85263)	GGCACCTTATTTCTTGTAGTAA (SEQ ID NO: 85264)
hCV16192174	G/A	GAGCACCTTAACATAGATGGTG (SEQ ID NO: 85265)	TGAGCACTTAACATAGATGGTA (SEQ ID NO: 85266)	CTTGTCAAGGCACAGATAAT (SEQ ID NO: 85267)
hCV16195014	C/G	TGAAGAAGCTAAGGATGAGC (SEQ ID NO: 85268)	TGAAGAAGCTAAGGATGAGC (SEQ ID NO: 85269)	CTCTCCCTGGCTGAGTTG (SEQ ID NO: 85270)
hCV16273460	C/T	GCACCTCTTGGACAAAGC (SEQ ID NO: 85271)	TGCACCTCTTGGACAAAGCA (SEQ ID NO: 85272)	AATGACATCCCTATCTTCTG (SEQ ID NO: 85273)

TABLE 5, page 2 of 4

Marker	Alleles	Sequence A (allele-specific primer)		Sequence B (allele-specific primer)		Sequence C (common primer)	
		CT	AT	CT	AT	CT	AT
hCV16276495	CT	GTACCTTACCCATGGAAAC (SEQ ID NO: 85274)	GTACCTTACCCATGGAAAT (SEQ ID NO: 85275)	GTACCTTACCCATGGAAAT (SEQ ID NO: 85275)	GTACCTTACCCATGGAAAT (SEQ ID NO: 85275)	GTACCTTACCCATGGAAAT (SEQ ID NO: 85275)	GTACCTTACCCATGGAAAT (SEQ ID NO: 85275)
hCV16479371	CT	CTGGCTGGGTGCTACTAAC (SEQ ID NO: 85277)	CTGGCTGGGTGCTACTACT (SEQ ID NO: 85278)	CTGGCTGGGTGCTACTACT (SEQ ID NO: 85278)	CTGGCTGGGTGCTACTACT (SEQ ID NO: 85278)	CTGGCTGGGTGCTACTACT (SEQ ID NO: 85278)	CTGGCTGGGTGCTACTACT (SEQ ID NO: 85278)
hCV1662671	A/G	CAGCCAGAGCAGGAGCA (SEQ ID NO: 85280)	AGCCAGAGAGGAGGAGG (SEQ ID NO: 85281)	AGCCAGAGAGGAGGAGG (SEQ ID NO: 85281)	AGCCAGAGAGGAGGAGG (SEQ ID NO: 85281)	AGCCAGAGAGGAGGAGG (SEQ ID NO: 85281)	AGCCAGAGAGGAGGAGG (SEQ ID NO: 85281)
hCV1769781	A/G	ACAGATCAGGCAATACCA (SEQ ID NO: 85283)	ACAGATCAGGCAATATCC (SEQ ID NO: 85284)	ACAGATCAGGCAATATCC (SEQ ID NO: 85284)	ACAGATCAGGCAATATCC (SEQ ID NO: 85284)	ACAGATCAGGCAATATCC (SEQ ID NO: 85284)	ACAGATCAGGCAATATCC (SEQ ID NO: 85284)
hCV1819516	CT	CCCTGTGTGAGGATGTT (SEQ ID NO: 85286)	CCCTGTGTGAGGATGTTA (SEQ ID NO: 85287)	CCCTGTGTGAGGATGTTA (SEQ ID NO: 85287)	CCCTGTGTGAGGATGTTA (SEQ ID NO: 85287)	CCCTGTGTGAGGATGTTA (SEQ ID NO: 85287)	CCCTGTGTGAGGATGTTA (SEQ ID NO: 85287)
hCV1842400	A/G	TTGTACTTGGCTCTCT (SEQ ID NO: 85289)	TGTACTTGGCTCTCC (SEQ ID NO: 85290)	TGTACTTGGCTCTCC (SEQ ID NO: 85290)	TGTACTTGGCTCTCC (SEQ ID NO: 85290)	TGTACTTGGCTCTCC (SEQ ID NO: 85290)	TGTACTTGGCTCTCC (SEQ ID NO: 85290)
hCV190754	CT	TCAGGCTTATGCCACTC (SEQ ID NO: 85292)	TCAGGCTTATGCCACTT (SEQ ID NO: 85293)	TCAGGCTTATGCCACTT (SEQ ID NO: 85293)	TCAGGCTTATGCCACTT (SEQ ID NO: 85293)	TCAGGCTTATGCCACTT (SEQ ID NO: 85293)	TCAGGCTTATGCCACTT (SEQ ID NO: 85293)
hCV20238	GA	CACGGGCTGATGTTG (SEQ ID NO: 85295)	CAAGGGGCTGATGTTG (SEQ ID NO: 85296)	CAAGGGGCTGATGTTG (SEQ ID NO: 85296)	CAAGGGGCTGATGTTG (SEQ ID NO: 85296)	CAAGGGGCTGATGTTG (SEQ ID NO: 85296)	CAAGGGGCTGATGTTG (SEQ ID NO: 85296)
hCV2126249	CT	CAGGGGAGTAAAGTGACTC (SEQ ID NO: 85298)	GAGATGTATGCTCTCTG (SEQ ID NO: 85299)	GAGATGTATGCTCTCTG (SEQ ID NO: 85299)	GAGATGTATGCTCTCTG (SEQ ID NO: 85299)	GAGATGTATGCTCTCTG (SEQ ID NO: 85299)	GAGATGTATGCTCTCTG (SEQ ID NO: 85299)
hCV2188895	A/G	AGAAATGTACCTCTCTGTA (SEQ ID NO: 85301)	AGAAATGTACCTCTCTG (SEQ ID NO: 85302)	AGAAATGTACCTCTCTG (SEQ ID NO: 85302)	AGAAATGTACCTCTCTG (SEQ ID NO: 85302)	AGAAATGTACCTCTCTG (SEQ ID NO: 85302)	AGAAATGTACCTCTCTG (SEQ ID NO: 85302)
hCV2200985	C/G	GGCACCAGCTTCCG (SEQ ID NO: 85304)	GGCACCAGCTTCCAC (SEQ ID NO: 85305)	GGCACCAGCTTCCAC (SEQ ID NO: 85305)	GGCACCAGCTTCCAC (SEQ ID NO: 85305)	GGCACCAGCTTCCAC (SEQ ID NO: 85305)	GGCACCAGCTTCCAC (SEQ ID NO: 85305)
hCV22271841	CT	CATCAGGAGATCCACC (SEQ ID NO: 85307)	ATCATCAGGAGATGTTAC (SEQ ID NO: 85308)	ATCATCAGGAGATGTTAC (SEQ ID NO: 85308)	ATCATCAGGAGATGTTAC (SEQ ID NO: 85308)	ATCATCAGGAGATGTTAC (SEQ ID NO: 85308)	ATCATCAGGAGATGTTAC (SEQ ID NO: 85308)
hCV22272267	CT	CTGGCAGCGATGTTAT (SEQ ID NO: 85310)	CTGGCAGCGATGTTAC (SEQ ID NO: 85311)	CTGGCAGCGATGTTAC (SEQ ID NO: 85311)	CTGGCAGCGATGTTAC (SEQ ID NO: 85311)	CTGGCAGCGATGTTAC (SEQ ID NO: 85311)	CTGGCAGCGATGTTAC (SEQ ID NO: 85311)
hCV22272997	GA	GGGTAGCAGCAGGCG (SEQ ID NO: 85313)	GGGTAGCAGCAGCA (SEQ ID NO: 85314)	GGGTAGCAGCAGCA (SEQ ID NO: 85314)	GGGTAGCAGCAGCA (SEQ ID NO: 85314)	GGGTAGCAGCAGCA (SEQ ID NO: 85314)	GGGTAGCAGCAGCA (SEQ ID NO: 85314)
hCV22273204	A/G	TCAGCTTCTTCACTGCTA (SEQ ID NO: 85316)	CAGCTTCTTCACTGCTG (SEQ ID NO: 85317)	CAGCTTCTTCACTGCTG (SEQ ID NO: 85317)	CAGCTTCTTCACTGCTG (SEQ ID NO: 85317)	CAGCTTCTTCACTGCTG (SEQ ID NO: 85317)	CAGCTTCTTCACTGCTG (SEQ ID NO: 85317)
hCV22273204	CT	CCCTACAGAGGATGTCAG (SEQ ID NO: 85319)	CCCTACAGAGGATGTCAA (SEQ ID NO: 85320)	CCCTACAGAGGATGTCAA (SEQ ID NO: 85320)	CCCTACAGAGGATGTCAA (SEQ ID NO: 85320)	CCCTACAGAGGATGTCAA (SEQ ID NO: 85320)	CCCTACAGAGGATGTCAA (SEQ ID NO: 85320)
hCV22274632	A/C	TGAATGAGCATCCAAAGAA (SEQ ID NO: 85322)	TGAATGAGCATCCAAAGAC (SEQ ID NO: 85323)	TGAATGAGCATCCAAAGAC (SEQ ID NO: 85323)	TGAATGAGCATCCAAAGAC (SEQ ID NO: 85323)	TGAATGAGCATCCAAAGAC (SEQ ID NO: 85323)	TGAATGAGCATCCAAAGAC (SEQ ID NO: 85323)
hCV2351160	A/G	CCACAGTGGCTATCA (SEQ ID NO: 85325)	CCACAGTGGCTATCG (SEQ ID NO: 85326)	CCACAGTGGCTATCG (SEQ ID NO: 85326)	CCACAGTGGCTATCG (SEQ ID NO: 85326)	CCACAGTGGCTATCG (SEQ ID NO: 85326)	CCACAGTGGCTATCG (SEQ ID NO: 85326)
hCV24142143	CT	ATTAGCATCATAGCATACCAC (SEQ ID NO: 85328)	ATTAGCATCATAGCATACCAT (SEQ ID NO: 85329)	ATTAGCATCATAGCATACCAT (SEQ ID NO: 85329)	ATTAGCATCATAGCATACCAT (SEQ ID NO: 85329)	ATTAGCATCATAGCATACCAT (SEQ ID NO: 85329)	ATTAGCATCATAGCATACCAT (SEQ ID NO: 85329)
hCV24850371	A/G	TGCAAGAGGAGTAAAGTGA (SEQ ID NO: 85331)	GCAAGAGGAGTAAAGTGG (SEQ ID NO: 85332)	GCAAGAGGAGTAAAGTGG (SEQ ID NO: 85332)	GCAAGAGGAGTAAAGTGG (SEQ ID NO: 85332)	GCAAGAGGAGTAAAGTGG (SEQ ID NO: 85332)	GCAAGAGGAGTAAAGTGG (SEQ ID NO: 85332)
hCV2531085	A/G	GGCCCTCTCTGAGAA (SEQ ID NO: 85334)	GGCCCTCTCTGAAAG (SEQ ID NO: 85335)	GGCCCTCTCTGAAAG (SEQ ID NO: 85335)	GGCCCTCTCTGAAAG (SEQ ID NO: 85335)	GGCCCTCTCTGAAAG (SEQ ID NO: 85335)	GGCCCTCTCTGAAAG (SEQ ID NO: 85335)
hCV2531831	A/G	GCCAAATGTGGCGA (SEQ ID NO: 85337)	GCCAAATGTGGCGG (SEQ ID NO: 85338)	GCCAAATGTGGCGG (SEQ ID NO: 85338)	GCCAAATGTGGCGG (SEQ ID NO: 85338)	GCCAAATGTGGCGG (SEQ ID NO: 85338)	GCCAAATGTGGCGG (SEQ ID NO: 85338)
hCV25472673	CT	TGGGCTCCATCCAC (SEQ ID NO: 85340)	TGGGCTCCATCCCAT (SEQ ID NO: 85341)	TGGGCTCCATCCCAT (SEQ ID NO: 85341)	TGGGCTCCATCCCAT (SEQ ID NO: 85341)	TGGGCTCCATCCCAT (SEQ ID NO: 85341)	TGGGCTCCATCCCAT (SEQ ID NO: 85341)
hCV25474627	CT	CTCTAACATCACCCTGAC (SEQ ID NO: 85343)	CTCTAACATCACCCTGTAC (SEQ ID NO: 85344)	CTCTAACATCACCCTGTAC (SEQ ID NO: 85344)	CTCTAACATCACCCTGTAC (SEQ ID NO: 85344)	CTCTAACATCACCCTGTAC (SEQ ID NO: 85344)	CTCTAACATCACCCTGTAC (SEQ ID NO: 85344)
hCV25476553	CT	GGTACCATGGAGCTGTACT (SEQ ID NO: 85346)	GGTACCATGGAGCTGTAC (SEQ ID NO: 85347)	GGTACCATGGAGCTGTAC (SEQ ID NO: 85347)	GGTACCATGGAGCTGTAC (SEQ ID NO: 85347)	GGTACCATGGAGCTGTAC (SEQ ID NO: 85347)	GGTACCATGGAGCTGTAC (SEQ ID NO: 85347)
hCV25503030	CT	CAATATACATCCAGGATC (SEQ ID NO: 85349)	CAATATACATCCAGGATT (SEQ ID NO: 85350)	CAATATACATCCAGGATT (SEQ ID NO: 85350)	CAATATACATCCAGGATT (SEQ ID NO: 85350)	CAATATACATCCAGGATT (SEQ ID NO: 85350)	CAATATACATCCAGGATT (SEQ ID NO: 85350)
hCV25503221	CT	CGGCTTGCATCTTAC (SEQ ID NO: 85352)	CGGCTTGCATCTTAC (SEQ ID NO: 85353)	CGGCTTGCATCTTAC (SEQ ID NO: 85353)	CGGCTTGCATCTTAC (SEQ ID NO: 85353)	CGGCTTGCATCTTAC (SEQ ID NO: 85353)	CGGCTTGCATCTTAC (SEQ ID NO: 85353)
hCV25509594	A/G	GGCACTCTAGTAGTACAA (SEQ ID NO: 85355)	GGCACTCTAGTAGTACAT (SEQ ID NO: 85356)	GGCACTCTAGTAGTACAT (SEQ ID NO: 85356)	GGCACTCTAGTAGTACAT (SEQ ID NO: 85356)	GGCACTCTAGTAGTACAT (SEQ ID NO: 85356)	GGCACTCTAGTAGTACAT (SEQ ID NO: 85356)
hCV25509594	A/G	ATATATGACCTTCTCCCAT (SEQ ID NO: 85358)	ATATATGACCTTCTCCAC (SEQ ID NO: 85359)	ATATATGACCTTCTCCAC (SEQ ID NO: 85359)	ATATATGACCTTCTCCAC (SEQ ID NO: 85359)	ATATATGACCTTCTCCAC (SEQ ID NO: 85359)	ATATATGACCTTCTCCAC (SEQ ID NO: 85359)
hCV25607108	A/G	CCCTGTACTTCTAAGTACT (SEQ ID NO: 85361)	CCCTGTACTTCTAAGTACC (SEQ ID NO: 85362)	CCCTGTACTTCTAAGTACC (SEQ ID NO: 85362)	CCCTGTACTTCTAAGTACC (SEQ ID NO: 85362)	CCCTGTACTTCTAAGTACC (SEQ ID NO: 85362)	CCCTGTACTTCTAAGTACC (SEQ ID NO: 85362)
hCV25610470	A/G	CTGATCACCACGGTCT (SEQ ID NO: 85364)	ACATACACCACGGTCC (SEQ ID NO: 85365)	ACATACACCACGGTCC (SEQ ID NO: 85365)	ACATACACCACGGTCC (SEQ ID NO: 85365)	ACATACACCACGGTCC (SEQ ID NO: 85365)	ACATACACCACGGTCC (SEQ ID NO: 85365)
hCV25610774	CT	GGTCTGGTGGCAAGG (SEQ ID NO: 85367)	GGTCTGGTGGCAAGA (SEQ ID NO: 85368)	GGTCTGGTGGCAAGA (SEQ ID NO: 85368)	GGTCTGGTGGCAAGA (SEQ ID NO: 85368)	GGTCTGGTGGCAAGA (SEQ ID NO: 85368)	GGTCTGGTGGCAAGA (SEQ ID NO: 85368)
hCV25617571	CT	GGAGTGGAGATGGAGT (SEQ ID NO: 85370)	GGAGTGGAGATGGAGA (SEQ ID NO: 85371)	GGAGTGGAGATGGAGA (SEQ ID NO: 85371)	GGAGTGGAGATGGAGA (SEQ ID NO: 85371)	GGAGTGGAGATGGAGA (SEQ ID NO: 85371)	GGAGTGGAGATGGAGA (SEQ ID NO: 85371)
hCV25619493	CT	CGGCTTCCAGGAC (SEQ ID NO: 85373)	CGGCTTCCAGGAT (SEQ ID NO: 85374)	CGGCTTCCAGGAT (SEQ ID NO: 85374)	CGGCTTCCAGGAT (SEQ ID NO: 85374)	CGGCTTCCAGGAT (SEQ ID NO: 85374)	CGGCTTCCAGGAT (SEQ ID NO: 85374)
hCV25614474	A/G	CTGTTGCTCTCTCCAA (SEQ ID NO: 85376)	CTGTTGCTCTCTCCAG (SEQ ID NO: 85377)	CTGTTGCTCTCTCCAG (SEQ ID NO: 85377)	CTGTTGCTCTCTCCAG (SEQ ID NO: 85377)	CTGTTGCTCTCTCCAG (SEQ ID NO: 85377)	CTGTTGCTCTCTCCAG (SEQ ID NO: 85377)
hCV25615376	GA	ATTAAACCACTACTACTCAG (SEQ ID NO: 85379)	ATTAAACCACTACTACTCAA (SEQ ID NO: 85380)	ATTAAACCACTACTACTCAA (SEQ ID NO: 85380)	ATTAAACCACTACTACTCAA (SEQ ID NO: 85380)	ATTAAACCACTACTACTCAA (SEQ ID NO: 85380)	ATTAAACCACTACTACTCAA (SEQ ID NO: 85380)
hCV25615626	A/G	ATATACCATCTGTAGGACTTA (SEQ ID NO: 85382)	ATATACCATCTGTAGGACTTG (SEQ ID NO: 85383)	ATATACCATCTGTAGGACTTG (SEQ ID NO: 85383)	ATATACCATCTGTAGGACTTG (SEQ ID NO: 85383)	ATATACCATCTGTAGGACTTG (SEQ ID NO: 85383)	ATATACCATCTGTAGGACTTG (SEQ ID NO: 85383)
hCV25617571	CT	CCAGCAGATGGAAG (SEQ ID NO: 85385)	TGCCAGCAGATGGAAC (SEQ ID NO: 85386)	TGCCAGCAGATGGAAC (SEQ ID NO: 85386)	TGCCAGCAGATGGAAC (SEQ ID NO: 85386)	TGCCAGCAGATGGAAC (SEQ ID NO: 85386)	TGCCAGCAGATGGAAC (SEQ ID NO: 85386)
hCV25620145	CT	CACACCAAGTAAAGT (SEQ ID NO: 85388)	CACACCAAGTAAAGG (SEQ ID NO: 85389)	CACACCAAGTAAAGG (SEQ ID NO: 85389)	CACACCAAGTAAAGG (SEQ ID NO: 85389)	CACACCAAGTAAAGG (SEQ ID NO: 85389)	CACACCAAGTAAAGG (SEQ ID NO: 85389)
hCV25620774	CT	CACCTGTGCTGGAG (SEQ ID NO: 85391)	CACCTGTGCTGGAGG (SEQ ID NO: 85392)	CACCTGTGCTGGAGG (SEQ ID NO: 85392)	CACCTGTGCTGGAGG (SEQ ID NO: 85392)	CACCTGTGCTGGAGG (SEQ ID NO: 85392)	CACCTGTGCTGGAGG (SEQ ID NO: 85392)
hCV25623265	A/G	TGGAGGCTGATGGGTA (SEQ ID NO: 85394)	GGAGGCTGATGGGTG (SEQ ID NO: 85395)	GGAGGCTGATGGGTG (SEQ ID NO: 85395)	GGAGGCTGATGGGTG (SEQ ID NO: 85395)	GGAGGCTGATGGGTG (SEQ ID NO: 85395)	GGAGGCTGATGGGTG (SEQ ID NO: 85395)
hCV25627634	A/G	CACCTGCAGATGGAAC (SEQ ID NO: 85397)	CACCTGCAGATGGAAG (SEQ ID NO: 85398)	CACCTGCAGATGGAAG (SEQ ID NO: 85398)	CACCTGCAGATGGAAG (SEQ ID NO: 85398)	CACCTGCAGATGGAAG (SEQ ID NO: 85398)	CACCTGCAGATGGAAG (SEQ ID NO: 85398)
hCV25627634	C/G	CCACAGCCTGCGAT (SEQ ID NO: 85400)	CCACAGCCTGCGAC (SEQ ID NO: 85401)	CCACAGCCTGCGAC (SEQ ID NO: 85401)	CCACAGCCTGCGAC (SEQ ID NO: 85401)	CCACAGCCTGCGAC (SEQ ID NO: 85401)	CCACAGCCTGCGAC (SEQ ID NO: 85401)
hCV25629492	A/G	CATTGCTGGTTCCAG (SEQ ID NO: 85403)	CATTGCTGGTTCCACA (SEQ ID NO: 85404)	CATTGCTGGTTCCACA (SEQ ID NO: 85404)	CATTGCTGGTTCCACA (SEQ ID NO: 85404)	CATTGCTGGTTCCACA (SEQ ID NO: 85404)	CATTGCTGGTTCCACA (SEQ ID NO: 85404)
hCV25630499	CT	AGGTTGTACCTGTAGCACTAAG (SEQ ID NO: 85406)	TAGGTTGTACCTGTAGCACTAAGT (SEQ ID NO: 85407)	TAGGTTGTACCTGTAGCACTAAGT (SEQ ID NO: 85407)	TAGGTTGTACCTGTAGCACTAAGT (SEQ ID NO: 85407)	TAGGTTGTACCTGTAGCACTAAGT (SEQ ID NO: 85407)	TAGGTTGTACCTGTAGCACTAAGT (SEQ ID NO: 85407)
hCV25630686	CT	AAGATAGCCTGTACTGCTG (SEQ ID NO: 85409)	AAGATAGCCTGTACTGCTGT (SEQ ID NO: 85410)	AAGATAGCCTGTACTGCTGT (SEQ ID NO: 85410)	AAGATAGCCTGTACTGCTGT (SEQ ID NO: 85410)	AAGATAGCCTGTACTGCTGT (SEQ ID NO: 85410)	AAGATAGCCTGTACTGCTGT (SEQ ID NO: 85410)
hCV25631989	CT	CAGAAAGCCTGTACTGCTG (SEQ ID NO: 85412)	CAGAAAGCCTGTACTGCTG (SEQ ID NO: 85413)	CAGAAAGCCTGTACTGCTG (SEQ ID NO: 85413)	CAGAAAGCCTGTACTGCTG (SEQ ID NO: 85413)	CAGAAAGCCTGTACTGCTG (SEQ ID NO: 85413)	CAGAAAGCCTGTACTGCTG (SEQ ID NO: 85413)
hCV25637308	A/G	AAGAGGAAGCTACCATAT (SEQ ID NO: 85415)	GCCACTTGGCTGAAT (SEQ ID NO: 85416)	GCCACTTGGCTGAAT (SEQ ID NO: 85416)	GCCACTTGGCTGAAT (SEQ ID NO: 85416)	GCCACTTGGCTGAAT (SEQ ID NO: 85416)	GCCACTTGGCTGAAT (SEQ ID NO: 85416)
hCV25637309	AT	GGCCTTGGCTGCTGAAT (SEQ ID NO: 85418)	GATGCCAGATTCCTAG (SEQ ID NO: 85419)	GATGCCAGATTCCTAG (SEQ ID NO: 85419)	GATGCCAGATTCCTAG (SEQ ID NO: 85419)	GATGCCAGATTCCTAG (SEQ ID NO: 85419)	GATGCCAGATTCCTAG (SEQ ID NO: 85419)
hCV25640505	A/G	GGCCAGAGAGCAAAAT (SEQ ID NO: 85421)	GGCCAGAGAGCAAAAC (SEQ ID NO: 85422)	GGCCAGAGAGCAAAAC (SEQ ID NO: 85422)	GGCCAGAGAGCAAAAC (SEQ ID NO: 85422)	GGCCAGAGAGCAAAAC (SEQ ID NO: 85422)	GGCCAGAGAGCAAAAC (SEQ ID NO: 85422)
hCV25640525	A/G	CACAGCTGAGCTTCA (SEQ ID NO: 85424)	AGAGCTGAGCTTCCG (SEQ ID NO: 85425)	AGAGCTGAGCTTCCG (SEQ ID NO: 85425)	AGAGCTGAGCTTCCG (SEQ ID NO: 85425)	AGAGCTGAGCTTCCG (SEQ ID NO: 85425)	AGAGCTGAGCTTCCG (SEQ ID NO: 85425)
hCV25651174	A/G	CGCTGAGGGTCA (SEQ ID NO: 85427)	CGCTGAGGGTCC (SEQ ID NO: 85428)	CGCTGAGGGTCC (SEQ ID NO: 85428)	CGCTGAGGGTCC (SEQ ID NO: 85428)	CGCTGAGGGTCC (SEQ ID NO: 85428)	CGCTGAGGGTCC (SEQ ID NO: 85428)
hCV25654217	C/G	CCAAATGCTGTTTTGTGG (SEQ ID NO: 85430)	CCAAATGCTGTTTTGTGG (SEQ ID NO: 85431)	CCAAATGCTGTTTTGTGG (SEQ ID NO: 85431)	CCAAATGCTGTTTTGTGG (SEQ ID NO: 85431)	CCAAATGCTGTTTTGTGG (SEQ ID NO: 85431)	CCAAATGCTGTTTTGTGG (SEQ ID NO: 85431)
hCV25751017	GA	CTTATTTACAGGAAAGGC (SEQ ID NO: 85433)	CTTATTTACAGGAAAGA (SEQ ID NO: 85434)	CTTATTTACAGGAAAGA (SEQ ID NO: 85434)	CTTATTTACAGGAAAGA (SEQ ID NO: 85434)	CTTATTTACAGGAAAGA (SEQ ID NO: 85434)	CTTATTTACAGGAAAGA (SEQ ID NO: 85434)
hCV25761292	C/G	GGCAGCTACCTCTCTAG (SEQ ID NO: 85436)	GGCAGCTACCTCTCTCTAG (SEQ ID NO: 85437)	GGCAGCTACCTCTCTCTAG (SEQ ID NO: 85437)	GGCAGCTACCTCTCTCTAG (SEQ ID NO: 85437)	GGCAGCTACCTCTCTCTAG (SEQ ID NO: 85437)	GGCAGCTACCTCTCTCTAG (SEQ ID NO: 85437)
hCV25923230	A/G	CTCAGCAGCTGCTGAGT (SEQ ID NO: 85439)	TGCCAGCTGCTGAGC (SEQ ID NO: 85440)	TGCCAGCTGCTGAGC (SEQ ID NO: 85440)	TGCCAGCTGCTGAGC (SEQ ID NO: 85440)	TGCCAGCTGCTGAGC (SEQ ID NO: 85440)	TGCCAGCTGCTGAGC (SEQ ID NO: 85440)
hCV25922816	A/G	TGGCAGCTCAGGGCAT (SEQ ID NO: 85442)	TGGCAGCTCAGGGCAT (SEQ ID NO: 85443)	TGGCAGCTCAGGGCAT (SEQ ID NO: 85443)	TGGCAGCTCAGGGCAT (SEQ ID NO: 85443)	TGGCAGCTCAGGGCAT (SEQ ID NO: 85443)	TGGCAGCTCAGGGCAT (SEQ ID NO: 85443)
hCV25922816	C/G	GCTTTATCAGAGCTCTGAAGC (SEQ ID NO: 85445)	GCTTTATCAGAGCTCTGAAGG (SEQ ID NO: 85446)	GCTTTATCAGAGCTCTGAAGG (SEQ ID NO: 85446)	GCTTTATCAGAGCTCTGAAGG (SEQ ID NO: 85446)	GCTTTATCAGAGCTCTGAAGG (SEQ ID NO: 85446)	GCTTTATCAGAGCTCTGAAGG (SEQ ID NO: 85446)
hCV25928771	CT	GGCCTTGGTCTGCG (SEQ ID NO: 85448)	TGGCCTTGGTCTGCGT (SEQ ID NO: 85449)	TGGCCTTGGTCTGCGT (SEQ ID NO: 85449)	TGGCCTTGGTCTGCGT (SEQ ID NO: 85449)	TGGCCTTGGTCTGCGT (SEQ ID NO: 85449)	TGGCCTTGGTCTGCGT (SEQ ID NO: 85449)
hCV25930271	CT	GAATCTCATGTTCAAGAAATG (SEQ ID NO: 85451)	GAATCTCATGTTCAAGAAATG (SEQ ID NO: 85452)	GAATCTCATGTTCAAGAAATG (SEQ ID NO: 85452)	GAATCTCATGTTCAAGAAATG (SEQ ID NO: 85452)	GAATCTCATGTTCAAGAAATG (SEQ ID NO: 85452)	GAATCTCATGTTCAAGAAATG (SEQ ID NO: 85452)
hCV25942539	GA	GGATCCGACCGGTTGAA (SEQ ID NO: 85454)	GGATCCGACCGGTTGAA (SEQ ID NO: 85455)	GGATCCGACCGGTTGAA (SEQ ID NO: 85455)	GGATCCGACCGGTTGAA (SEQ ID NO: 85455)	GGATCCGACCGGTTGAA (SEQ ID NO: 85455)	GGATCCGACCGGTTGAA (SEQ ID NO: 85455)

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Marker	Alleles	Sequence A (allele-specific primer)	Sequence B (allele-specific primer)	Sequence C (common primer)
hCV25943544	C/G	ATGTCCTGAAATACACGTATGAC (SEQ ID NO: 85457)	ATGTCCTGAAATACACGTATGAC (SEQ ID NO: 85458)	TCCACAGCTCAATTTTCATATT (SEQ ID NO: 85459)
hCV2595925	A/G	GCCTCCCTGGGCTTCT (SEQ ID NO: 85460)	CTTCCCTGGGCTTCC (SEQ ID NO: 85461)	TGCTCATATGATGTTGTTGAACT (SEQ ID NO: 85462)
hCV25990513	G/A	AGATATCAATAGCTGGAGACAC (SEQ ID NO: 85463)	AGATAATCAATAGCTGGAGACAT (SEQ ID NO: 85464)	TGATTTGATCATCTTCTGTTGATG (SEQ ID NO: 85465)
hCV2715953	C/G	CATTGGGCCCAATGAC (SEQ ID NO: 85466)	ATTGGGCCCAATGAG (SEQ ID NO: 85467)	ATCATTTTCATGTTGAAACTCT (SEQ ID NO: 85468)
hCV2715953	C/T	GCAGCCAGTTTCTCC (SEQ ID NO: 85469)	TGCAGCCAGTTTCTCCT (SEQ ID NO: 85470)	CATGAATGCTTCCAGGTATT (SEQ ID NO: 85471)
hCV27241051	C/T	GTTCACCAAGAGAGAAATG (SEQ ID NO: 85472)	GGTTCCCAAGAGAGAAATG (SEQ ID NO: 85473)	CTTGGCCCAACAGATTAG (SEQ ID NO: 85474)
hCV27241051	A/G	TCGGTTTCTTCAGGGAT (SEQ ID NO: 85475)	TCGGTTTCTTCAGGGAT (SEQ ID NO: 85476)	GGTTCTGGAGGCGATGTC (SEQ ID NO: 85477)
hCV27282570	A/G	CCAGCAACTATGATGAATAT (SEQ ID NO: 85478)	CCAGCAACTATGATGAATAC (SEQ ID NO: 85479)	TGGATGACCTTCAGCCATGAT (SEQ ID NO: 85480)
hCV2811372	A/G	CAGCTGGACGACBACA (SEQ ID NO: 85481)	AGCTGGACGACBACG (SEQ ID NO: 85482)	CAGCTTCTCCATTAATATTT (SEQ ID NO: 85483)
hCV2983035	A/G	TTGGACCTTCACATGAA (SEQ ID NO: 85484)	TTGGACCTTCACATGAAG (SEQ ID NO: 85485)	GCATTTTCCCAATAAATATTT (SEQ ID NO: 85486)
hCV2983035	A/G	CCCTGTGATTTGGCCAT (SEQ ID NO: 85487)	CCCTGTGATTTGGCCAT (SEQ ID NO: 85488)	CCTGCTCGCTCTGTCAC (SEQ ID NO: 85489)
hCV3023236	G/T	AGAATTGTGTCGAAGAAGTTG (SEQ ID NO: 85490)	AGAATTGTGTCGAAGAAGTTT (SEQ ID NO: 85491)	AACTGGTATAATTTGAATCATATAAT (SEQ ID NO: 85492)
hCV3023236	A/G	CAGTGTGTTTGTGAT (SEQ ID NO: 85493)	AGTTGTGTTTGTGAT (SEQ ID NO: 85494)	TGCTGTGGAGGAGTCAAT (SEQ ID NO: 85495)
hCV3026206	C/G	CCGCTGTTGATTTCCAC (SEQ ID NO: 85496)	CCGCTGTTGATTTCCAC (SEQ ID NO: 85497)	TCAAGCCCTTGGCTAAGA (SEQ ID NO: 85498)
hCV304793	C/T	CCGCTGTTGATTTCCAC (SEQ ID NO: 85499)	CCGCTGTTGATTTCCAC (SEQ ID NO: 85500)	TCAGCCCTCCACAGCTT (SEQ ID NO: 85501)
hCV3112686	G/T	CTGGAAATGGTTATGGGC (SEQ ID NO: 85502)	ACTTTGCTCCGAAAGATG (SEQ ID NO: 85503)	TACAGCCCTCCACAGCTT (SEQ ID NO: 85504)
hCV3135085	G/T	CTTCAATTTGAAAGTAGCTAAT (SEQ ID NO: 85505)	TACTGGAATGGTTATGGGA (SEQ ID NO: 85506)	TTATAGGCTGAAATGACATGTC (SEQ ID NO: 85507)
hCV3187176	A/C	CTTCAATTTGAAAGTAGCTAAT (SEQ ID NO: 85508)	CTTCAATTTGAAAGTAGCTAAT (SEQ ID NO: 85509)	TTTGGTTTGGTTCACATGTC (SEQ ID NO: 85510)
hCV3210838	C/T	GTGCTATTTCTATGACGC (SEQ ID NO: 85511)	TTTGCTATTTTCTATGACGT (SEQ ID NO: 85512)	CAAAATATGCCAACAGTTTGA (SEQ ID NO: 85513)
hCV3212009	A/G	CTTCCCTTTCTAGTGTCT (SEQ ID NO: 85514)	TCTCCCTTTCTAGTGTCT (SEQ ID NO: 85515)	TGTCGGTGAGCTGTTTGTTAA (SEQ ID NO: 85516)
hCV3215409	A/G	GTGGCTCATACCAATCTCT (SEQ ID NO: 85517)	GTGGCTCATACCAATCTCT (SEQ ID NO: 85518)	GGGCTCCATCAACATCAC (SEQ ID NO: 85519)
hCV3223182	C/T	TCCCACTCACATCACTG (SEQ ID NO: 85520)	GTGGCTCATACCAATCTCT (SEQ ID NO: 85521)	AGTTCTTGGAGGCTCATCAT (SEQ ID NO: 85522)
hCV3275199	A/G	CCATGCAACCAACCAT (SEQ ID NO: 85523)	CCATGCAACCAACCAT (SEQ ID NO: 85524)	CCTCTATCCCTCTCATCTT (SEQ ID NO: 85525)
hCV334226	A/G	GAGCCTGGGCCAAT (SEQ ID NO: 85526)	GAGCCTGGGCCAAT (SEQ ID NO: 85527)	CCTAAGGCTGGAAAGATAGAG (SEQ ID NO: 85528)
hCV517658	T/C	AATGGCTTGGACATGAT (SEQ ID NO: 85529)	AATGGCTTGGACATGAT (SEQ ID NO: 85530)	CTCTGCCATGCCAAACAC (SEQ ID NO: 85531)
hCV529706	C/G	GGAGGAGCAAGGGG (SEQ ID NO: 85532)	GGAGGAGCAAGGGG (SEQ ID NO: 85533)	GGAGGATGAATGGACAGAA (SEQ ID NO: 85534)
hCV529710	C/G	CCGACCCGAATCAAGG (SEQ ID NO: 85535)	CACCATGGTCCCTGTA (SEQ ID NO: 85536)	GGCTTCCCTCCATGTC (SEQ ID NO: 85537)
hCV5687	C/T	ACCATGGTCCCTGTTG (SEQ ID NO: 85538)	CCGACCCGAATCAAGG (SEQ ID NO: 85539)	GGCTTCCCTCCATGTC (SEQ ID NO: 85540)
hCV57888	A/G	CCCTCAGTGTGATGATGAT (SEQ ID NO: 85541)	GGCTTCCCTCCATGTC (SEQ ID NO: 85542)	CCAGGCAATCCCATACAG (SEQ ID NO: 85543)
hCV600632	A/C	GCATAAGCCCAAGGTAGAAA (SEQ ID NO: 85544)	GCATAAGCCCAAGGTAGAAA (SEQ ID NO: 85545)	CCACTGGAAACTCACACAT (SEQ ID NO: 85546)
hCV7429784	A/G	GTCAATGCTCCCTCATCT (SEQ ID NO: 85547)	GTCAATGCTCCCTCATCT (SEQ ID NO: 85548)	GAGCTGCGATGTCTGTAATAGT (SEQ ID NO: 85549)
hCV7429784	A/G	GGGTCTGTTACTCAATGAA (SEQ ID NO: 85550)	GGGTCTGTTACTCAATGAT (SEQ ID NO: 85551)	TGTACAAAATGTTGTCATACATG (SEQ ID NO: 85552)
hCV7443062	T/C	GGAGCAGATGGTGTAT (SEQ ID NO: 85553)	GGAGCAGATGGTGTAT (SEQ ID NO: 85554)	GGAAATATCTGTTCTTCTGTTCT (SEQ ID NO: 85555)
hCV7449808	A/G	GGCTACTTGGCCCAT (SEQ ID NO: 85556)	GGCTACTTGGCCCAT (SEQ ID NO: 85557)	CCCTACAGCTCCACATGTC (SEQ ID NO: 85558)
hCV7490135	C/T	CGGATCTCTGCGAA (SEQ ID NO: 85559)	CGGATCTCTGCGAA (SEQ ID NO: 85560)	TGGAGAGGTGATGTA (SEQ ID NO: 85561)
hCV7492557	C/T	GACGCTCTGCGAA (SEQ ID NO: 85562)	TACCTGAGCCAGTTGCAT (SEQ ID NO: 85563)	CGTGCATGTTTGGAAATGTA (SEQ ID NO: 85564)
hCV7492557	T/A	AAGGAGGTCTGCTTAAGGA (SEQ ID NO: 85565)	AAGGAGGTCTGCTTAAGGT (SEQ ID NO: 85566)	GGCTTCCCTTAAAGAACTTACT (SEQ ID NO: 85567)
hCV7494810	C/G	CCGAGCGGACAGATG (SEQ ID NO: 85571)	CCGAGCGGACAGATG (SEQ ID NO: 85572)	CAACTGCTGGCAGATCTTC (SEQ ID NO: 85573)
hCV7499900	T/C	CACACGCAATGATGAATCT (SEQ ID NO: 85574)	CACACGCAATGATGAATCT (SEQ ID NO: 85575)	GGCGGTTCCAGACAA (SEQ ID NO: 85576)
hCV7509650	A/C	GCTCAGGACTATCTGCAGTG (SEQ ID NO: 85577)	GGCTCAGGACTATCTGCAGTA (SEQ ID NO: 85578)	TCCAGCATGACTTCAGATTC (SEQ ID NO: 85579)
hCV7514692	A/G	GGCTGAACCCGCTCT (SEQ ID NO: 85583)	GGCTGAACCCGCTCT (SEQ ID NO: 85584)	CCACCACCATCCACAG (SEQ ID NO: 85582)
hCV7514879	A/G	TCCATGCTTAAGGAATG (SEQ ID NO: 85586)	GCTGAACCCGCTCT (SEQ ID NO: 85587)	CTTTTCTGCTGCTCTGCT (SEQ ID NO: 85588)
hCV7580070	C/T	CCAAAGGCTGTCAGGC (SEQ ID NO: 85589)	TCCAAAGGCTGTCAGGC (SEQ ID NO: 85590)	CTTTTCTGCTGCTCTGCT (SEQ ID NO: 85589)
hCV7582933	C/T	CACAGTCAAGATCAAGCG (SEQ ID NO: 85592)	TCCAAAGGCTGTCAGGC (SEQ ID NO: 85593)	GGCTGCGCTCTGCTGTA (SEQ ID NO: 85597)
hCV7582933	C/T	GAGCGCTCTTCTTGAC (SEQ ID NO: 85595)	GAGCGCTCTTCTTGAC (SEQ ID NO: 85596)	CTTTTCTGCTGCTCTGCT (SEQ ID NO: 85597)
hCV7582933	C/T	GAGCGCTCTTCTTGAC (SEQ ID NO: 85598)	GAGCGCTCTTCTTGAC (SEQ ID NO: 85599)	CTTTTCTGCTGCTCTGCT (SEQ ID NO: 85599)
hCV7582933	G/C	TCCAGTCAATCTCAAGAC (SEQ ID NO: 85601)	TCCAGTCAATCTCAAGAC (SEQ ID NO: 85602)	GGCTTCCCTGCGGCTCTCT (SEQ ID NO: 85603)
hCV7841642	A/G	ACCAGCTCCAGGCTGT (SEQ ID NO: 85604)	ACCAGCTCCAGGCTGT (SEQ ID NO: 85605)	CTTATTCGCGGCTCTCT (SEQ ID NO: 85606)
hCV7900503	C/T	CAGAAAGTTCATGTTTTCG (SEQ ID NO: 85610)	ACCAGCTCCAGGCTGT (SEQ ID NO: 85607)	TGAAGTTTGGATGAGACTGAT (SEQ ID NO: 85608)
hCV791476	C/T	CCATTCATCAATCAATGATCA (SEQ ID NO: 85613)	CCATTCATCAATCAATGATCA (SEQ ID NO: 85614)	TGAAGTTTGGATGAGACTGAT (SEQ ID NO: 85609)
hCV795442	A/G	CACCTGCTCAGATGATGAT (SEQ ID NO: 85616)	CACCTGCTCAGATGATGAT (SEQ ID NO: 85617)	CCGCGGAGGAGAGTAG (SEQ ID NO: 85612)
hCV8022252	A/G	TTCACACCTGGACATG (SEQ ID NO: 85619)	ACTTTCACACCTGGACATG (SEQ ID NO: 85620)	CGGCTGCGGAGGCTGATG (SEQ ID NO: 85615)
hCV8339791	C/T	TTTACACATATCTACTGAGAG (SEQ ID NO: 85622)	TGTAAACATATCTACTGAGAG (SEQ ID NO: 85623)	GGGCTGCGGAGGCTGATG (SEQ ID NO: 85616)
hCV8400571	A/G	CCACTTCCGCTCTCTC (SEQ ID NO: 85625)	CCACTTCCGCTCTCTC (SEQ ID NO: 85626)	GGGCTGCGGAGGCTGATG (SEQ ID NO: 85615)
hCV8705506	C/G	GCAACGAGCACCTGAA (SEQ ID NO: 85628)	GCAACGAGCACCTGAA (SEQ ID NO: 85629)	GAGTGACAGGAGGCTGCTTA (SEQ ID NO: 85630)
hCV8708473	A/G	CCTCTGAGGCTGAGAG (SEQ ID NO: 85631)	CCTCTGAGGCTGAGAG (SEQ ID NO: 85632)	GTCCTGATTCCTCATTTCTTTC (SEQ ID NO: 85633)
hCV8718197	A/G	GCCTGCTGTTTGGAG (SEQ ID NO: 85634)	GCCTGCTGTTTGGAG (SEQ ID NO: 85635)	TGGACAGGAGGATTTAAAGTAG (SEQ ID NO: 85636)
hCV8722981	C/T	TGGTCTGCTCCCTGGACA (SEQ ID NO: 85637)	GGTCTGCTCCCTGGAGC (SEQ ID NO: 85638)	TGCGGTCCACAGCTGACTGAG (SEQ ID NO: 85639)

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Marker	Alleles	Sequence A (allele-specific primer)	Sequence B (allele-specific primer)	Sequence C (common primer)
hCV8726337	A/G	CACATTCACGGTCACCTT (SEQ ID NO: 85640)	CACATTCACGGTCACCTC (SEQ ID NO: 85641)	CATTGCCCGAGGCTCAA (SEQ ID NO: 85642)
hCV8737990	C/T	GTCCTTGCAAGTATCCG (SEQ ID NO: 85643)	GGTCTTGCAAGTATCCA (SEQ ID NO: 85644)	GCATCAGGCTGAGTCTTTTC (SEQ ID NO: 85645)
hCV8815434	G/T	GGTGGTCCCTTTGG (SEQ ID NO: 85646)	ACGGTGGTCCCTTTGT (SEQ ID NO: 85647)	CCTCGCAGGCGCTTCTC (SEQ ID NO: 85648)
hCV8827241	C/G	TCAAGAGSACAGTATGTTG (SEQ ID NO: 85649)	TCAAGAGACAGTATGTC (SEQ ID NO: 85650)	TGGTTAGAACTGTGAAGGAACCTA (SEQ ID NO: 85651)
hCV8845004	A/G	AGAGAGTGACACAGTAGATGT (SEQ ID NO: 85652)	GAGAGTGACAGTAGATGC (SEQ ID NO: 85653)	AAACCTGAGTTTAACTTGGTGA (SEQ ID NO: 85654)
hCV8851080	A/G	GGCACTGCCCGCTT (SEQ ID NO: 85655)	GGCACTGCCCGCTC (SEQ ID NO: 85656)	CCTCTCCCTGGAGACATACATC (SEQ ID NO: 85657)
hCV8851084	A/G	CAGTCCCGGACAGGA (SEQ ID NO: 85658)	CAGTCCCGGACAGGG (SEQ ID NO: 85659)	CCGCCGCGCCTAAG (SEQ ID NO: 85660)
hCV8851085	A/G	GCTCGTAGTTGTGCTGTCAT (SEQ ID NO: 85661)	GCTCGTAGTTGTGCTGCAC (SEQ ID NO: 85662)	CGCTTCCTGGAGAGATACAT (SEQ ID NO: 85663)
hCV8855373	A/G	AGGACTCCGCTGTCCTT (SEQ ID NO: 85664)	AGGACTTCCGCTGTCCTC (SEQ ID NO: 85665)	ACAGATGCCAGCAATACAGA (SEQ ID NO: 85666)
hCV8907537	C/G	GCCTATCCATCCTGCC (SEQ ID NO: 85667)	GCCTATCCATCCTGCG (SEQ ID NO: 85668)	GGTAGGAGGACCACTGAGAATACT (SEQ ID NO: 85669)
hCV8921137	A/T	CAGAGCGCTGCACATCAAT (SEQ ID NO: 85670)	CAGAGCGCTGCACATCAAA (SEQ ID NO: 85671)	GGCAAGGTCTCTGATCTGTAA (SEQ ID NO: 85672)
hCV8931357	A/G	CCGACAGAGGTGTGGG (SEQ ID NO: 85673)	CCGACAGAGGTGTGGT (SEQ ID NO: 85674)	CATTTTCGGGTGGAAATG (SEQ ID NO: 85675)
hCV8952817	C/G	TTATTGACACTTTCCAGTAAATATT (SEQ ID NO: 85676)	TTATTGACACTTTCCAGTAAATATC (SEQ ID NO: 85677)	AGGCACAAGCTGCAGATAA (SEQ ID NO: 85678)
hCV905013	C/G	CGCATCCAGAACATCTATG (SEQ ID NO: 85679)	CGCATCCAGAACATCTATC (SEQ ID NO: 85680)	GCAGCTTCCCATCATACACT (SEQ ID NO: 85681)
hCV9077561	G/A	ACACCTGCGCCAGTAAATC (SEQ ID NO: 85682)	GACACCTGCGCCAGTAAAT (SEQ ID NO: 85683)	CCGCTCTCCAGATTACATT (SEQ ID NO: 85684)
hCV9485713	T/C	AGAAAGGTGGGATCCAAAC (SEQ ID NO: 85685)	AGAAAGGTGGGATCCAAAT (SEQ ID NO: 85686)	AGAAACCATCATGCTGAGGT (SEQ ID NO: 85687)
hCV9505149	A/T	GCCCAGAGACAGGAAAT (SEQ ID NO: 85688)	GCCCAGAGACAGGAAAC (SEQ ID NO: 85689)	GCCTGCCCTGTGTTCA (SEQ ID NO: 85690)
hCV9546471	A/C	CTGCTGGCCGCTCCT (SEQ ID NO: 85691)	TGCTGGCCGCTCCA (SEQ ID NO: 85692)	ACTCACCTTGTCTTACT (SEQ ID NO: 85693)
hCV9546517	G/A	CTCAGGAAGCTAAAGGTGA (SEQ ID NO: 85694)	TACGGAAGCTAAAGGTGC (SEQ ID NO: 85695)	CCTAATATCCCTCCAGAACTAT (SEQ ID NO: 85696)
hCV9546517	G/A	ACATTTCAGAACCTATCTTCTC (SEQ ID NO: 85697)	ACATTTCAGAACCTATCTCTCT (SEQ ID NO: 85698)	AGTTTCATGGACACATCA (SEQ ID NO: 85699)
hCV9568595	A/T	GCTGGTCACTCCTCATCCA (SEQ ID NO: 85700)	TGCTGGTCACTCCTCATCCT (SEQ ID NO: 85701)	ACCGTCTCTGGCTTTTAAAG (SEQ ID NO: 85702)

Significant Associations Between SNP Genotypes and Qualitative Phenotypes

Public	Stratum	Phenotype	Chi-Square Test		p-value	Statistic	p-value	Chi-Square Test		p-value	Statistic	1 Rare Alleles		2 Rare Alleles		1 Rare Alleles vs. 0		Significance
			p-value	n/Alel (%)				1 Rare Alleles	2 Rare Alleles			1 Rare Alleles	2 Rare Alleles	1 Rare Alleles vs. 0				
hCV16168043	All Patients	Fatal Coronary Heart Disease	0.0231	6.8562	0.0089	34/988 (3.4%)	17/432 (3.9%)	5/43 (1.6%)	1.15 (0.62 to 2.05)	3.70 (1.22 to 9.23)	p < 0.05							
	All Patients	Coronary Artery Bypass or Revascularization	0.0037	9.2668	0.0023	216/589 (21.8%)	64/432 (14.6%)	6/43 (1.4%)	0.62 (0.46 to 0.84)	0.58 (0.23 to 1.30)	p < 0.005							
	All Patients	Hosp. for Unstable Angina	0.0013	9.465	0.0021	201/589 (20.3%)	58/432 (13.4%)	3/43 (0.7%)	0.61 (0.44 to 0.83)	0.29 (0.07 to 0.82)	p < 0.005							
hCV16168043	All Patients	Family History of CV Disease	0.0179	6.7129	0.0086	430/589 (43.5%)	156/432 (36.1%)	14/43 (3.2%)	0.74 (0.58 to 0.93)	0.63 (0.32 to 1.16)	p < 0.05							
	All Patients	Fatal Coronary Heart Disease	0.4026	5.2478	0.022	54/1454 (3.7%)	2/18 (11.1%)	12 (50.0%)	3.24 (0.68 to 15.1)	25.93 (1.02 to 660.87)	p < 0.05							
	All Patients	Cardiovascular Mortality	0.0024	4.8517	0.0276	61/1454 (4.2%)	2/18 (11.1%)	12 (50.0%)	2.68 (0.45 to 10.34)	22.84 (0.90 to 581.53)	p < 0.05							
hCV11942528	All Patients	Fatal Atherosclerotic Cardiovascular Disease	0.0024	4.8517	0.0276	61/1454 (4.2%)	2/18 (11.1%)	12 (50.0%)	2.68 (0.45 to 10.34)	22.84 (0.90 to 581.53)	p < 0.05							
	All Patients	Fatal CHD/Definite Non-fatal MI	0.0231	6.5765	0.0103	52/872 (10.6%)	78/611 (15.3%)	14/60 (15.8%)	1.53 (1.10 to 2.11)	1.58 (0.82 to 2.79)	p < 0.05							
	All Patients	Total Coronary Heart Disease	0.0237	7.1633	0.0074	24/872 (2.8%)	29/611 (5.7%)	4/60 (4.3%)	2.13 (1.23 to 3.72)	1.64 (0.48 to 4.38)	p < 0.05							
hCV529705	All Patients	Total Mortality	0.0054	9.947	0.0016	40/872 (4.6%)	49/611 (9.4%)	6/60 (6.7%)	2.16 (1.40 to 3.34)	1.49 (0.55 to 3.36)	p < 0.005							
	All Patients	Fatal Atherosclerotic Cardiovascular Disease	0.0054	9.947	0.0016	26/872 (3.0%)	34/611 (7.7%)	4/60 (4.4%)	2.32 (1.38 to 3.94)	1.51 (0.44 to 4.40)	p < 0.005							
	All Patients	Fatal Coronary Heart Disease	0.0017	4.6114	0.0318	179/1089 (16.4%)	75/535 (21.2%)	10/52 (31.3%)	1.37 (1.01 to 1.85)	2.37 (1.03 to 4.84)	p < 0.005							
hCV6022252	All Patients	Hosp. for Unstable Angina	0.0037	9.0759	0.0026	313/588 (8.5%)	31/352 (8.8%)	4/25 (25.0%)	1.02 (0.82 to 1.43)	3.59 (1.17 to 8.13)	p < 0.05							
	All Patients	CARE M: Non Q-Wave MI	0.0078	7.46	0.0063	43/1106 (6.5%)	12/347 (3.5%)	4/25 (16.0%)	0.89 (0.44 to 1.65)	4.71 (1.33 to 13.04)	p < 0.005							
	All Patients	Fatal/Non-fatal Cardiovascular Disease	0.0012	9.2108	0.0024	34/1106 (3.3%)	12/347 (3.5%)	4/25 (16.0%)	1.07 (0.53 to 2.01)	5.66 (1.59 to 15.83)	p < 0.005							
hCV11482766	All Patients	Any Report of Stroke During CARE	0.0012	9.6921	0.0019	75/1211 (6.2%)	12/255 (8.2%)	4/13 (30.8%)	1.36 (0.60 to 2.21)	3.73 (1.79 to 7.19)	p < 0.005							
	All Patients	1st Stroke Occurred During CARE	0.0012	9.6921	0.0019	75/1211 (6.2%)	12/255 (8.2%)	4/13 (30.8%)	1.36 (0.60 to 2.21)	3.36 (1.09 to 12.44)	p < 0.05							
	All Patients	Fatal/Non-fatal Cerebrovascular Disease	0.0264	4.0221	0.0449	46/1211 (41.0%)	99/255 (38.9%)	5/13 (38.5%)	1.42 (0.17 to 1.87)	1.39 (0.42 to 4.20)	p < 0.05							
hCV16276495	All Patients	Fatal/Non-fatal Atherosclerotic CV Disease	0.0046	5.9064	0.0151	37/6121 (31.0%)	89/255 (34.9%)	5/13 (38.5%)	1.08 (0.59 to 1.83)	4.82 (1.06 to 16.16)	p < 0.005							
	All Patients	History of Percutaneous Transluminal Coronary Angioplasty	0.0393	5.5134	0.0189	71/1211 (5.9%)	16/255 (6.3%)	3/13 (23.1%)	1.03 (0.40 to 1.59)	7.80 (1.56 to 25.83)	p < 0.005							
	All Patients	Any Report of Stroke Prior to or During CARE	0.0013	9.0184	0.0027	46/1211 (3.8%)	10/255 (3.9%)	3/13 (23.1%)	1.23 (0.57 to 2.40)	9.02 (1.97 to 30.65)	p < 0.005							
hCV16276495	All Patients	Any Stroke Occurred During CARE	0.0005	10.5164	0.0012	39/1211 (3.2%)	10/255 (3.9%)	3/13 (23.1%)	1.23 (0.57 to 2.40)	9.02 (1.97 to 30.65)	p < 0.005							
	All Patients	Fatal/Non-fatal Cerebrovascular Disease	0.0368	5.792	0.0161	70/1074 (6.5%)	24/368 (6.5%)	6/24 (17.6%)	0.64 (0.17 to 1.59)	3.07 (1.12 to 7.20)	p < 0.005							
	All Patients	Fatal CHD/Definite Non-fatal MI	0.15694	11.4335	0.0007	132/1187 (11.1%)	53/295 (18.6%)	0/0 (0.0%)	1.83 (1.28 to 2.58)	0/0 (0.0%)	p < 0.005							
hCV16276495	All Patients	Fatal Coronary Heart Disease	0.4141	7.2466	0.0077	39/1187 (3.2%)	19/285 (6.1%)	0/0 (0.0%)	2.16 (1.30 to 3.76)	0/0 (0.0%)	p < 0.05							
	All Patients	Non-fatal MI (def & prob)	0.8754	10.672	0.0011	149/1187 (12.5%)	57/285 (20.0%)	0/0 (0.0%)	1.63 (1.12 to 2.45)	0/0 (0.0%)	p < 0.005							
	All Patients	Fatal/Non-fatal MI (def & prob)	0.0139	5.862	0.0011	149/1187 (12.5%)	20/285 (7.0%)	0/0 (0.0%)	1.96 (1.12 to 3.34)	0/0 (0.0%)	p < 0.05							
hCV16276495	All Patients	Cardiovascular Mortality	0.0139	5.862	0.0011	149/1187 (12.5%)	20/285 (7.0%)	0/0 (0.0%)	1.96 (1.12 to 3.34)	0/0 (0.0%)	p < 0.05							
	All Patients	Fatal Atherosclerotic Cardiovascular Disease	0.0571	9.0507	0.0108	4.5709	0.0325	17/11368 (12.7%)	5/61 (6.2%)	2/3 (66.7%)	0.62 (0.21 to 1.42)	13.79 (1.32 to 297.55)	p < 0.05					
	All Patients	Fatal CHD/Definite Non-fatal MI	0.0347	6.9525	0.0139	126/407 (31.0%)	305/724 (42.1%)	1/6/331 (35.0%)	0.72 (0.55 to 0.94)	0.79 (0.51 to 1.02)	p < 0.05							
hCV16276495	All Patients	History of Coronary Artery Bypass Graft	0.0218	6.9525	0.0088	54/372 (14.5%)	100/755 (13.2%)	29/352 (8.2%)	0.92 (0.73 to 1.29)	0.57 (0.33 to 0.85)	p < 0.05							
	All Patients	Family History of CV Disease	0.70547	6.1008	0.0135	59/372 (15.9%)	127/55 (14.8%)	34/352 (9.7%)	0.92 (0.66 to 1.31)	0.57 (0.33 to 0.85)	p < 0.05							
	All Patients	Non-fatal MI (def & prob)	0.0295	6.1008	0.0135	59/372 (15.9%)	127/55 (14.8%)	34/352 (9.7%)	0.92 (0.66 to 1.31)	0.57 (0.33 to 0.85)	p < 0.05							
hCV2811372	All Patients	Fatal/Non-fatal MI (def & prob)	0.0399	5.9297	0.0149	40/372 (10.7%)	72/54 (9.5%)	20/352 (5.7%)	0.88 (0.59 to 1.33)	0.50 (0.28 to 0.88)	p < 0.05							
	All Patients	CARE M: Non Q-Wave MI	0.1914	6.4459	0.0111	41/1107 (3.7%)	12/340 (3.5%)	4/29 (13.8%)	0.95 (0.47 to 1.78)	4.16 (1.19 to 11.34)	p < 0.05							
	All Patients	Fatal Coronary Heart Disease	0.78739	9.3211	0.0023	46/1107 (4.2%)	13/340 (3.8%)	5/29 (17.2%)	0.92 (0.47 to 1.57)	4.81 (1.58 to 12.23)	p < 0.005							
hCV8339791	All Patients	Cardiovascular Mortality	0.0025	9.3211	0.0023	46/1107 (4.2%)	13/340 (3.8%)	5/29 (17.2%)	0.92 (0.47 to 1.57)	4.81 (1.58 to 12.23)	p < 0.005							
	All Patients	Fatal Atherosclerotic Cardiovascular Disease	11.9462	0.0025	9.3211	46/1107 (4.2%)	13/340 (3.8%)	5/29 (17.2%)	1.42 (0.92 to 2.20)	2.05 (1.15 to 3.53)	p < 0.05							
	All Patients	Congestive Heart Failure	6.8723	0.0326	6.1079	75/636 (11.8%)	52/629 (8.3%)	27/191 (11.5%)	1.41 (1.03 to 1.98)	2.05 (1.15 to 3.53)	p < 0.05							
hCV3135085	All Patients	History of Diabetes	0.0026	11.0773	0.0009	75/636 (11.8%)	100/629 (15.9%)	47/191 (24.6%)	1.1 (1.03 to 1.16)	4.26 (2.00 to 9.18)	p < 0.005							
	All Patients	Insulin	0.0038	10.0331	0.0015	98/636 (14.2%)	19/629 (3.0%)	11/191 (5.8%)	2.17 (1.00 to 5.07)	4.26 (2.00 to 9.18)	p < 0.005							
	All Patients	Hosp. for Cardiovascular Disease	0.0044	13.3955	0.0003	46/1100 (45.5%)	20/427 (46.8%)	31/49 (77.5%)	1.04 (0.83 to 1.31)	1.49 (0.83 to 2.52)	p < 0.005							
hCV5687	All Patients	Hosp. for Unstable Angina	0.6459	8.7005	0.0032	149/100 (16.4%)	59/427 (19.5%)	14/40 (33.0%)	1.27 (0.95 to 1.69)	2.75 (1.37 to 5.25)	p < 0.05							
	All Patients	Fatal Atherosclerotic Cardiovascular Disease	14.0718	0.0005	46/1100 (41.5%)	20/427 (48.0%)	31/49 (77.5%)	1.03 (0.82 to 1.27)	3.84 (1.86 to 6.64)	p < 0.05								
	All Patients	Total/Non-fatal Atherosclerotic CV Disease	0.0272	6.7757	0.0092	369/1000 (36.9%)	107/427 (39.1%)	24/40 (60.0%)	1.01 (0.80 to 1.29)	3.39 (1.25 to 5.91)	p < 0.05							
hCV5687	All Patients	Fatal CHD/Definite Non-fatal MI	0.0121	5.299	0.0213	61/1400 (61.4%)	28/627 (67.0%)	32/40 (80.0%)	1.28 (1.01 to 1.62)	2.52 (1.20 to 5.91)	p < 0.05							
	All Patients	CARE M: Q-Wave MI	8.8335	8.1574	0.0043	117/556 (14.6%)	57/606 (9.4%)	17/606 (2.8%)	0.61 (0.43 to 0.85)	1.14 (0.63 to 1.94)	p < 0.005							
	All Patients	Fatal CHD/Definite Non-fatal MI	0.0028	7.2394	0.0071	106/756 (15.7%)	59/606 (9.2%)	27/105 (21.9%)	0.62 (0.44 to 0.84)	1.50 (0.89 to 2.45)	p < 0.005							
hCV7900503	All Patients	Non-fatal MI (def & prob)	0.0027	8.7401	0.0031	197/556 (16.7%)	107/606 (17.7%)	30/105 (28.6%)	0.87 (0.66 to 1.15)	1.92 (1.02 to 2.55)	p < 0.005							
	All Patients	Fatal/Non-fatal MI (def & prob)	0.0027	8.7401	0.0031	197/556 (16.7%)	107/606 (17.7%)	30/105 (28.6%)	0.87 (0.66 to 1.15)	1.92 (1.02 to 2.55)	p < 0.005							
	All Patients	Coronary Artery Bypass or Revascularization	6.8382	0.0324	4.3331	354/756 (46.8%)	270/606 (44.6%)	66/105 (62.9%)	0.91 (0.70 to 1.13)	1.92 (1.27 to 2.95)	p < 0.005							
hCV7900503	All Patients	Hosp. for Cardiovascular Disease	12.0615	9.2554	0.0023	354/756 (46.8%)	270/606 (44.6%)	66/105 (62.9%)	0.91 (0.70 to 1.13)	1.92 (1.27 to 2.95)	p < 0.005							

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CX3CR1	hCV7900503	All Patients	Hosp. for Unstable Angina	7.7014	0.0213	7.5089	0.0061	125755 (16.5%)	109608 (18.0%)	29105 (27.6%)	1.11 (0.89 to 1.47)	1.93 (1.19 to 3.05)	p < 0.05
CX3CR1	hCV7900503	All Patients	Total Coronary Heart Disease Events	11.1872	0.0037	6.8372	0.0089	281755 (35.3%)	193608 (31.8%)	51705 (48.6%)	0.86 (0.69 to 1.07)	1.73 (1.15 to 2.61)	p < 0.05
CX3CR1	hCV7900503	All Patients	Fatal Coronary Heart Disease	11.1546	0.0025	6.4022	0.0037	307755 (40.2%)	226608 (36.5%)	69705 (63.3%)	0.89 (0.72 to 1.10)	1.87 (1.23 to 2.87)	p < 0.005
CX3CR1	hCV7900503	All Patients	Fatal/Non-fatal Atherosclerotic CV Disease	11.1546	0.0035	6.4222	0.0113	307755 (40.2%)	226608 (36.5%)	59705 (53.3%)	0.85 (0.68 to 1.06)	1.70 (1.13 to 2.57)	p < 0.05
DBH	hCV12020339	All Patients	Fatal CHD/Definite Non-fatal MI	6.3707	0.0414	4.6855	0.0324	1607261 (12.7%)	211198 (10.6%)	411 (95.4%)	0.82 (0.49 to 1.28)	3.93 (1.02 to 13.17)	p < 0.005
DBH	hCV12020339	All Patients	Fatal Coronary Heart Disease	6.4202	0.0404	4.5927	0.0324	1607261 (12.7%)	211198 (10.6%)	411 (95.4%)	0.77 (0.29 to 1.69)	5.50 (0.92 to 22.04)	p < 0.005
ELN	hCV12035500	All Patients	Fatal CHD/Definite Non-fatal MI	7.0192	0.0299	5.6557	0.0154	77507 (14.2%)	84721 (12.2%)	19241 (6.7%)	0.74 (0.53 to 1.03)	0.53 (0.31 to 0.87)	p < 0.05
ELN	hCV12035500	All Patients	Fatal CHD/Definite Non-fatal MI	6.4509	0.0387	6.2416	0.0125	77507 (14.2%)	84721 (12.2%)	19241 (6.7%)	0.83 (0.58 to 1.16)	0.51 (0.29 to 0.85)	p < 0.05
F8	hCV11359059	All Patients	CARE MI: Non Q-Wave MI	11.2527	0.0038	7.548	0.005	1097120 (9.1%)	19263 (7.2%)	411 (35.4%)	0.78 (0.46 to 1.26)	5.72 (1.48 to 19.25)	p < 0.005
F8	hCV11359059	All Patients	Cardiovascular Mortality	6.2697	0.0435	5.2563	0.0217	3571005 (3.5%)	26418 (6.2%)	340 (7.5%)	1.84 (1.08 to 3.09)	2.25 (0.53 to 6.63)	p < 0.05
F8B	hCV7429784	All Patients	Fatal Atherosclerotic Cardiovascular Disease	6.2897	0.0435	5.2563	0.0217	3571005 (3.5%)	26418 (6.2%)	340 (7.5%)	1.84 (1.08 to 3.09)	2.25 (0.53 to 6.63)	p < 0.05
HDLBP	hCV22274624	All Patients	Hosp. for Unstable Angina	6.3052	0.0427	5.3105	0.0222	1997058 (18.3%)	85355 (23.9%)	1039 (25.6%)	0.82 (0.62 to 1.09)	0.48 (0.25 to 0.87)	p < 0.05
HFE	hCV1085600	All Patients	History of Angina Pectoris	6.147	0.0463	6.3752	0.0116	1687088 (15.3%)	40355 (11.3%)	1299 (30.8%)	1.40 (1.05 to 1.87)	1.54 (0.70 to 3.10)	p < 0.05
HFE	hCV1085600	All Patients	History of Diabetes	11.6431	0.003	6.1772	0.0129	57694 (6.7%)	29429 (6.5%)	655 (14.3%)	0.70 (0.48 to 1.01)	2.46 (1.18 to 4.85)	p < 0.05
HFE	hCV15760070	All Patients	Total Mortality	6.6793	0.0394	6.1772	0.0129	57694 (6.7%)	29429 (6.5%)	655 (14.3%)	1.19 (0.74 to 1.89)	2.74 (1.16 to 5.78)	p < 0.05
HLA-DPA1	hCV15760070	All Patients	Coronary Artery Bypass or Revascularization	9.3952	0.002	7.003	0.0081	200994 (20.1%)	85429 (20.0%)	255 (3.6%)	1.00 (0.78 to 1.32)	0.15 (0.02 to 0.48)	p < 0.05
HLA-DPA1	hCV15760070	All Patients	History of Percutaneous Transluminal Coronary Angioplasty	8.325	0.0156	7.753	0.0054	315994 (31.7%)	135429 (31.5%)	2935 (6.0%)	0.99 (0.64 to 1.20)	2.16 (1.25 to 3.71)	p < 0.05
HLA-DPA1	hCV25551174	All Patients	History of Percutaneous Transluminal Coronary Angioplasty	7.5527	0.0076	6.5531	0.0104	137708 (19.4%)	137632 (21.7%)	7132 (5.3%)	0.88 (0.64 to 1.20)	0.46 (0.24 to 0.80)	p < 0.05
HLA-DPA1	hCV25551174	All Patients	Non-fatal MI (def & prob)	7.9592	0.0048	7.5713	0.0059	334708 (47.2%)	314632 (49.7%)	45732 (34.1%)	1.11 (0.89 to 1.37)	0.56 (0.33 to 0.85)	p < 0.005
HLA-DPA1	hCV25551174	All Patients	Coronary Artery Bypass or Revascularization	10.6508	0.0037	8.0492	0.0136	259708 (36.4%)	318632 (50.3%)	49732 (37.3%)	1.05 (0.86 to 1.31)	0.82 (0.42 to 0.90)	p < 0.005
HLA-DPA1	hCV25551174	All Patients	Hosp. for Cardiovascular Disease	9.49	0.0211	8.7506	0.0031	346708 (48.9%)	318632 (50.3%)	49732 (37.3%)	0.97 (0.78 to 1.21)	0.54 (0.35 to 0.80)	p < 0.005
HLA-DPA1	hCV25551174	All Patients	Total Cardiovascular Disease Events	8.2044	0.0138	7.9839	0.0047	342850 (33.0%)	151465 (34.6%)	1162 (17.7%)	0.94 (0.73 to 1.19)	0.36 (0.19 to 0.72)	p < 0.005
HLA-DPA1	hCV25551174	All Patients	Fatal/Non-fatal Atherosclerotic CV Disease	8.5503	0.0296	6.5972	0.0102	390850 (41.1%)	178465 (38.3%)	1562 (24.2%)	0.89 (0.71 to 1.12)	0.46 (0.25 to 0.81)	p < 0.05
HLA-DPA1	hCV8851084	All Patients	Total Coronary Heart Disease Events	7.4082	0.0246	5.7094	0.0169	174094 (19.9%)	107450 (21.1%)	576 (7.9%)	1.11 (0.88 to 1.45)	0.36 (0.14 to 0.77)	p < 0.05
HLA-DPA1	hCV8851084	All Patients	Fatal/Non-fatal Atherosclerotic CV Disease	8.0929	0.0175	7.7109	0.0071	428684 (47.9%)	241505 (47.5%)	1576 (10.7%)	0.99 (0.80 to 1.23)	0.50 (0.30 to 0.82)	p < 0.05
HLA-DPA1	hCV8851084	All Patients	Coronary Artery Bypass or Revascularization	6.441	0.0399	6.2467	0.0124	428684 (47.9%)	241505 (47.5%)	1576 (10.7%)	0.97 (0.78 to 1.21)	0.44 (0.24 to 0.76)	p < 0.05
HLA-DPA1	hCV8851084	All Patients	Hosp. for Cardiovascular Disease	8.9261	0.0035	8.4337	0.0037	367884 (41.1%)	197505 (38.9%)	1876 (23.7%)	0.95 (0.77 to 1.21)	0.53 (0.32 to 0.87)	p < 0.005
HLA-DPA1	hCV8851084	All Patients	Total Cardiovascular Disease Events	16.9406	0.0023	5.9731	0.0145	2471246 (17.4%)	38223 (18.8%)	710 (70.0%)	0.83 (0.58 to 1.19)	4.74 (1.31 to 17.16)	p < 0.005
HSPG2	hCV1603856	All Patients	Fatal/Non-fatal Atherosclerotic CV Disease	8.9933	0.0011	4.1122	0.0426	2497133 (19.0%)	39759 (22.6%)	35 (60.0%)	1.25 (0.83 to 1.84)	6.40 (1.06 to 48.85)	p < 0.05
HSPG2	hCV1603856	All Patients	Coronary Artery Bypass or Revascularization	11.8532	0.0027	6.1394	0.0325	2257133 (17.1%)	39759 (22.6%)	35 (60.0%)	1.42 (0.94 to 2.09)	7.25 (1.20 to 55.30)	p < 0.05
HSPG2	hCV1603856	All Patients	Hosp. for Unstable Angina	6.362	0.0415	4.1405	0.0419	321313 (2.4%)	5759 (3.1%)	15 (20.0%)	0.86 (0.55 to 1.30)	10.01 (0.50 to 70.04)	p < 0.05
HSPG2	hCV1603856	All Patients	History of Angina Pectoris	12.0129	0.0025	8.8943	0.0029	1697418 (13.4%)	1559 (25.4%)	259 (3.4%)	2.52 (1.33 to 4.53)	7.39 (0.29 to 187.30)	p < 0.005
IGF1R	hCV8722981	All Patients	Fatal CHD/Definite Non-fatal MI	7.2523	0.0266	8.0376	0.007	73471 (15.5%)	103691 (14.9%)	2996 (30.2%)	0.89 (0.14 to 2.05)	25.26 (0.99 to 643.88)	p < 0.05
IGF1R	hCV8722981	All Patients	Fatal/Non-fatal MI (def & prob)	10.1906	0.0061	4.6295	0.027	1004148 (13.4%)	1459 (23.7%)	12 (50.0%)	2.01 (1.05 to 3.64)	6.46 (0.26 to 163.75)	p < 0.05
IGF1R	hCV9546471	All Patients	Cardiovascular Mortality	6.9523	0.0309	5.6644	0.0173	227339 (3.0%)	33584 (5.7%)	8144 (6.3%)	1.21 (0.29 to 3.41)	22.68 (0.89 to 576.45)	p < 0.05
IL1A	hCV9546471	All Patients	Fatal Atherosclerotic Cardiovascular Disease	6.1271	0.0467	5.5334	0.0149	41739 (5.5%)	39584 (6.7%)	16744 (11.1%)	1.55 (1.13 to 3.43)	2.17 (0.93 to 4.68)	p < 0.05
IL1A	hCV9546471	All Patients	History of Congestive Heart Failure (AE)	6.6302	0.0363	6.0667	0.0138	28688 (3.2%)	30504 (6.0%)	587 (5.7%)	1.22 (0.77 to 1.82)	2.13 (1.13 to 3.84)	p < 0.05
IL1B	hCV9546471	All Patients	Fatal Atherosclerotic Cardiovascular Disease	6.6302	0.0363	6.0667	0.0138	28688 (3.2%)	30504 (6.0%)	587 (5.7%)	1.54 (1.14 to 3.30)	1.87 (0.62 to 4.58)	p < 0.05
IL1B	hCV9546471	All Patients	Cardiovascular Mortality	10.0029	0.0076	8.0376	0.0091	63471 (13.4%)	90691 (14.3%)	23313 (7.3%)	1.08 (0.77 to 1.53)	0.51 (0.31 to 0.84)	p < 0.05
IL4R	hCV2769554	All Patients	Fatal CHD/Definite Non-fatal MI	8.0376	0.017	7.0306	0.008	73471 (15.5%)	103691 (14.9%)	2996 (30.2%)	0.95 (0.69 to 1.33)	0.54 (0.33 to 0.84)	p < 0.05
IL4R	hCV2769554	All Patients	Fatal/Non-fatal MI (def & prob)	7.2966	0.026	6.1417	0.0101	165969 (19.0%)	94502 (18.7%)	5166 (53.1%)	0.98 (0.74 to 1.30)	1.85 (1.14 to 2.92)	p < 0.05
ITGA6	hCV22273204	All Patients	Coronary Artery Bypass or Revascularization	7.7796	0.0204	7.012	0.0081	133969 (9.0%)	214502 (42.6%)	207180 (11.1%)	1.15 (0.93 to 1.45)	1.77 (1.16 to 2.71)	p < 0.05
ITGA6	hCV22273204	All Patients	Family History of CV Disease	6.3122	0.0426	4.8703	0.0258	40648 (6.2%)	39545 (6.0%)	593 (16.4%)	0.98 (0.62 to 1.54)	1.90 (1.06 to 3.30)	p < 0.05
ITGA6	hCV22273204	All Patients	Fatal/Non-fatal Cerebrovascular Disease	9.539	0.0061	8.3919	0.0038	627079 (5.7%)	24384 (6.8%)	698 (15.8%)	1.15 (0.70 to 1.86)	3.94 (1.42 to 9.37)	p < 0.005
KL	hCV25950513	All Patients	Total Mortality	7.5478	0.0023	4.4464	0.035	627079 (5.7%)	24384 (6.8%)	698 (15.8%)	1.53 (1.00 to 2.30)	2.65 (0.97 to 6.13)	p < 0.05
LAMA2	hCV25950513	All Patients	Congestive Heart Failure	10.1403	0.0064	6.2037	0.0127	1097120 (9.1%)	97117 (7.7%)	34 (50.0%)	1.02 (0.47 to 1.97)	12.23 (1.46 to 102.87)	p < 0.05
LAMA2	hCV25950513	All Patients	Congestive Heart Failure	6.4704	0.0093	4.2557	0.0391	1427362 (11.7%)	337194 (17.0%)	211 (21.3%)	1.54 (1.01 to 2.30)	2.82 (0.61 to 9.88)	p < 0.05
LBP	hCV25617571	All Patients	Fatal CHD/Definite Non-fatal MI	13.1539	0.0014	6.9038	0.0086	471262 (3.2%)	147194 (7.2%)	271 (18.2%)	2.32 (1.20 to 4.24)	6.62 (0.89 to 26.71)	p < 0.05
LBP	hCV25617571	All Patients	Fatal Coronary Heart Disease	7.0693	0.0292	4.4596	0.0347	734262 (5.8%)	19194 (8.6%)	211 (18.2%)	1.77 (1.02 to 2.95)	3.62 (0.85 to 14.37)	p < 0.05
LBP	hCV25617571	All Patients	Total Mortality	9.7674	0.0076	4.7106	0.03	484262 (3.8%)	147194 (7.2%)	271 (18.2%)	1.97 (1.03 to 3.55)	5.62 (0.84 to 22.56)	p < 0.05
LBP	hCV25617571	All Patients	Cardiovascular Mortality	7.6747	0.0076	4.7106	0.03	484262 (3.8%)	147194 (7.2%)	271 (18.2%)	2.36 (1.11 to 4.57)	5.62 (0.84 to 22.56)	p < 0.05
LBP	hCV25617571	All Patients	Fatal Atherosclerotic Cardiovascular Disease	10.3748	0.0013	5.7793	0.0162	891393 (6.4%)	10772 (13.9%)	672 (8.3%)	0.00 (0.0)	4.00 (1.46 to 6.28)	p < 0.005
LPA	hCV25617571	All Patients	Fatal/Non-fatal Cerebrovascular Disease	6.1137	0.0013	8.9305	0.0028	314393 (2.2%)	672 (8.3%)	0 (0.0%)	2.68 (1.25 to 5.22)	1.58 (1.07 to 2.33)	p < 0.05
LPA	hCV25617571	All Patients	History of Stroke	8.1023	0.0446	5.3814	0.0204	83657 (5.7%)	10772 (13.9%)	517235 (21.7%)	1.33 (0.99 to 1.81)	1.57 (1.22 to 2.14)	p < 0.005
LPA	hCV25617571	All Patients	Any Report of Stroke Prior to or During CARE	15.2765	0.0005	14.3188	0.0002	1204259 (10.3%)	38199 (31.1%)	47 (67.1%)	0.65 (0.67 to 1.43)	5.17 (1.01 to 26.45)	p < 0.05
LPA	hCV150754	All Patients	Hosp. for Unstable Angina	6.3807	0.0041	5.0148	0.0251	2491256 (15.6%)	38199 (31.1%)	112 (8.3%)	1.28 (0.92 to 1.77)	0.10 (0.01 to 0.51)	p < 0.05
LPA	hCV150754	All Patients	History of Coronary Artery Bypass Graft	9.4031	0.0091	4.6978	0.0302	6017256 (46.7%)	85161 (62.8%)	112 (8.3%)	1.27 (0.92 to 1.77)	0.10 (0.01 to 0.51)	p < 0.05
MARCO	hCV2128249	All Patients	Coronary Artery Bypass or Revascularization	9.8232	0.0024	6.4648	0.0285	6181286 (48.1%)	87161 (54.0%)	112 (8.3%)	0.98 (0.62 to 1.49)	6.19 (1.36 to 31.62)	p < 0.05
MARCO	hCV2128249	All Patients	Hosp. for Cardiovascular Disease	7.4068	0.0246	5.6448	0.0175	2321310 (17.7%)	26761 (17.4%)	3692 (46.3%)	1.08 (0.64 to 1.35)	1.90 (1.20 to 3.00)	p < 0.05
MC1R	hCV11951056	All Patients	Hosp. for Unstable Angina	7.9408	0.0189	7.7188	0.0055	3141005 (31.2%)	125381 (32.8%)	3692 (46.3%)	1.08 (0.64 to 1.35)	1.90 (1.20 to 3.00)	p < 0.05
MNP27	hCV11951056	All Patients	History of Percutaneous Transluminal Coronary Angioplasty	7.9408	0.0189	7.7188	0.0055	3141005 (31.2%)	125381 (32.8%)	3692 (46.3%)	1.08 (0.64 to 1.35)	1.90 (1.20 to 3.00)	p < 0.05

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MSR1	hcv16172249	All Patients	Fatal CHD/Definite Non-fatal MI	0.0355	4.5804	0.0323	1651304 (12.7%)	167157 (10.2%)	317 (42.9%)	0.78 (0.44 to 1.31)	5.18 (1.01 to 23.08)	p < 0.05
MSR1	hcv16172249	All Patients	Fatal Coronary Heart Disease	0.0014	7.1248	0.0076	5271304 (4.0%)	37157 (1.9%)	27 (28.6%)	0.47 (0.11 to 1.29)	9.63 (1.36 to 45.84)	p < 0.05
MSR1	hcv16172249	All Patients	Cardiovascular Mortality	0.0056	6.5501	0.0105	571304 (4.4%)	5157 (3.2%)	27 (28.6%)	0.72 (0.25 to 1.66)	8.75 (1.24 to 41.56)	p < 0.05
MSR1	hcv16172249	All Patients	Fatal Atherosclerotic Cardiovascular Disease	0.0056	6.5501	0.0105	571304 (4.4%)	5157 (3.2%)	27 (28.6%)	0.72 (0.25 to 1.66)	8.75 (1.24 to 41.56)	p < 0.05
MTFHD1	hcv1376137	All Patients	Hosp. for Peripheral Arterial Disease	0.0219	6.96	0.0083	6443 (1.4%)	22732 (3.0%)	14291 (4.8%)	2.26 (0.97 to 6.17)	3.68 (1.46 to 10.30)	p < 0.05
MTFHR	hcv1202625	All Patients	Congestive Heart Failure	0.0477	5.4832	0.0184	56650 (8.6%)	52567 (7.8%)	41149 (2.7%)	0.90 (0.60 to 1.33)	0.29 (0.09 to 0.73)	p < 0.05
MYH11	hcv334226	All Patients	Fatal CHD/Definite Non-fatal MI	0.0329	4.0056	0.0453	109536 (11.0%)	71465 (14.6%)	1155 (23.0%)	1.39 (1.00 to 1.92)	2.03 (0.97 to 3.91)	p < 0.05
MYH11	hcv334226	All Patients	Non-fatal MI (def & prob)	0.0083	7.5795	0.0053	109536 (10.9%)	86485 (14.0%)	1355 (23.6%)	1.34 (0.86 to 1.85)	2.54 (1.27 to 4.76)	p < 0.05
MYH11	hcv334226	All Patients	Fatal/Non-fatal MI (def & prob)	0.0237	5.7575	0.0182	116938 (12.4%)	76485 (15.7%)	1355 (23.6%)	1.32 (0.95 to 1.80)	2.19 (1.10 to 4.16)	p < 0.05
MYH11	hcv334226	All Patients	CARE MI: Q-Wave MI	0.0064	7.3943	0.0065	616938 (6.7%)	253445 (37.1%)	2655 (47.3%)	0.80 (0.64 to 1.00)	0.47 (0.27 to 0.81)	p < 0.05
NO2SA	hcv11889257	All Patients	Total Coronary Heart Disease Events	0.0442	6.5846	0.0103	340950 (34.7%)	163445 (37.1%)	953 (17.0%)	1.11 (0.88 to 1.40)	0.39 (0.17 to 0.76)	p < 0.05
NO2SA	hcv11889257	All Patients	Fatal/Non-fatal Atherosclerotic CV Disease	0.0369	5.9281	0.0099	244560 (43.6%)	323597 (46.3%)	122208 (56.7%)	1.04 (0.83 to 1.30)	0.44 (0.22 to 0.83)	p < 0.0005
NP01	hcv25472673	All Patients	Hosp. for Cardiovascular Disease	0.0009	13.6581	0.0002	180560 (32.1%)	242697 (34.7%)	88208 (42.3%)	1.12 (0.89 to 1.40)	1.84 (1.32 to 2.51)	p < 0.05
NP01	hcv25472673	All Patients	Total Coronary Heart Disease Events	0.0316	6.8599	0.0069	180560 (46.4%)	330697 (47.3%)	125208 (60.1%)	1.08 (0.87 to 1.35)	1.65 (1.19 to 2.27)	p < 0.0005
NP01	hcv25472673	All Patients	Fatal/Non-fatal Atherosclerotic CV Disease	0.0001	13.0217	0.0003	204560 (30.4%)	274597 (39.3%)	101208 (46.6%)	1.13 (0.90 to 1.42)	1.65 (1.19 to 2.27)	p < 0.05
P2RY4	hcv25472673	All Patients	Fatal CHD/Definite Non-fatal MI	0.0329	5.1647	0.0223	1471231 (11.9%)	34234 (14.5%)	4711 (36.4%)	1.25 (0.93 to 1.85)	4.21 (1.09 to 14.13)	p < 0.05
P2RY4	hcv25472673	All Patients	Fatal Coronary Heart Disease	0.0335	5.0538	0.0246	441231 (3.6%)	11234 (4.7%)	211 (18.2%)	1.33 (0.64 to 2.52)	6.00 (0.90 to 24.13)	p < 0.05
P2RY4	hcv25472673	All Patients	Cardiovascular Mortality	0.0276	4.5705	0.0325	481231 (3.9%)	14234 (6.0%)	211 (18.2%)	1.57 (0.82 to 2.82)	5.48 (0.82 to 21.98)	p < 0.05
PDGFRA	hcv22271841	All Patients	Fatal CHD/Definite Non-fatal MI	0.0276	4.5705	0.0325	481231 (3.9%)	14234 (6.0%)	211 (18.2%)	1.57 (0.82 to 2.82)	5.48 (0.82 to 21.98)	p < 0.05
PDGFRA	hcv22271841	All Patients	Non-fatal MI (def & prob)	0.0002	13.3442	0.0003	1407181 (12.1%)	36288 (12.5%)	918 (64.4%)	1.04 (0.70 to 1.53)	5.83 (2.19 to 15.04)	p < 0.0005
PDGFRA	hcv22271841	All Patients	Fatal/Non-fatal MI (def & prob)	0.0025	9.9467	0.0016	1367181 (11.9%)	37288 (12.8%)	718 (38.6%)	1.09 (0.73 to 1.60)	4.72 (1.71 to 12.18)	p < 0.05
PEMT	hcv1448032	All Patients	Fatal/Non-fatal Atherosclerotic CV Disease	0.0086	8.4264	0.0037	1541161 (13.3%)	43288 (14.9%)	718 (38.6%)	1.13 (0.79 to 1.64)	4.16 (1.51 to 10.73)	p < 0.05
PLA2G4C	hcv16195014	All Patients	Congestive Heart Failure	0.0098	4.6217	0.0016	193462 (41.8%)	298739 (40.5%)	91275 (53.1%)	1.75 (0.95 to 3.03)	6.53 (0.90 to 33.86)	p < 0.05
PLA2G7	hcv16195014	All Patients	Fatal/Non-fatal Atherosclerotic CV Disease	< 0.001	18.7233	< 0.001	42634 (5.0%)	41534 (7.7%)	17101 (16.8%)	1.57 (1.00 to 2.46)	3.82 (2.04 to 6.90)	p < 0.0005
PLA2G7	hcv16195014	All Patients	Any Report of Stroke Prior to or During CARE	0.0204	5.2256	0.0223	39634 (4.7%)	41534 (7.7%)	9101 (9.9%)	2.22 (1.26 to 3.99)	3.79 (1.61 to 8.28)	p < 0.0005
PLA2G7	hcv16195014	All Patients	Any Report of Stroke During CARE	< 0.001	13.3535	0.0015	16834 (1.9%)	27534 (5.1%)	9101 (8.9%)	2.72 (1.47 to 5.21)	5.00 (2.07 to 11.43)	p < 0.0005
PLAT	hcv3212009	All Patients	Hosp. for Unstable Angina	0.039	6.3991	0.0115	5891125 (48.7%)	132324 (40.7%)	1020 (50.0%)	0.72 (0.56 to 0.93)	1.05 (0.43 to 2.59)	p < 0.05
PLAT	hcv3212009	All Patients	Total Coronary Heart Disease Events	0.0479	5.9512	0.0147	2161125 (19.2%)	43324 (13.3%)	420 (20.0%)	0.64 (0.45 to 0.91)	1.05 (0.30 to 2.90)	p < 0.05
PLAT	hcv3212009	All Patients	Total Cardiovascular Disease Events	0.0234	7.4548	0.0063	4121125 (38.6%)	92324 (28.4%)	720 (35.0%)	0.69 (0.52 to 0.90)	0.93 (0.35 to 2.29)	p < 0.05
PLAT	hcv3212009	All Patients	Fatal/Non-fatal Atherosclerotic CV Disease	0.0346	5.575	0.0088	5841125 (50.1%)	136324 (42.0%)	1020 (50.0%)	0.72 (0.56 to 0.92)	1.00 (0.41 to 2.44)	p < 0.05
PLAT	hcv3212009	All Patients	Fatal/Non-fatal Atherosclerotic CV Disease	0.0122	8.5038	0.0095	4691125 (41.4%)	105324 (32.4%)	920 (45.0%)	0.68 (0.52 to 0.88)	1.16 (0.46 to 2.82)	p < 0.005
PLAU	hcv3212009	All Patients	CARE MI: Q-Wave MI	0.0437	4.8623	0.0271	7121125 (23.6%)	202324 (62.3%)	1820 (80.0%)	0.96 (0.75 to 1.24)	5.22 (1.50 to 32.94)	p < 0.05
PLG	hcv16273460	All Patients	Hosp. for Peripheral Arterial Disease	0.0378	6.2128	0.0227	22988 (2.6%)	14469 (2.8%)	678 (7.7%)	1.14 (0.65 to 2.22)	3.26 (1.18 to 7.88)	p < 0.05
PON1	hcv25472673	All Patients	Hosp. for Peripheral Arterial Disease	0.0206	6.2747	0.0122	28753 (3.7%)	8579 (1.4%)	2133 (1.5%)	0.36 (0.15 to 0.77)	3.19 (1.09 to 6.01)	p < 0.05
PON1	hcv25472673	All Patients	History of Stroke	0.0001	15.8161	< 0.001	19753 (2.1%)	39579 (6.7%)	4133 (3.0%)	3.33 (1.88 to 6.18)	1.43 (0.40 to 3.97)	p < 0.0005
PON1	hcv25472673	All Patients	Any Report of Stroke During CARE	0.0004	13.5541	0.0002	14763 (1.9%)	34579 (5.9%)	4133 (3.0%)	3.29 (1.80 to 6.40)	1.64 (0.46 to 4.65)	p < 0.0005
PRKQ	hcv15954277	All Patients	Fatal CHD/Definite Non-fatal MI	0.0222	6.3909	0.0115	114817 (14.0%)	65546 (11.9%)	57106 (4.7%)	0.83 (0.60 to 1.15)	0.31 (0.11 to 0.69)	p < 0.05
PRKQ	hcv15954277	All Patients	History of Percutaneous Transluminal Coronary Angioplasty	0.0122	7.1643	0.013	248917 (30.4%)	201546 (36.8%)	30106 (28.3%)	1.34 (1.05 to 1.68)	0.91 (0.57 to 1.40)	p < 0.05
PRKQ	hcv25620145	All Patients	Congestive Heart Failure	< 0.001	12.2481	0.0005	301206 (7.5%)	18248 (7.3%)	414 (28.6%)	0.97 (0.56 to 1.60)	4.96 (1.34 to 15.16)	p < 0.05
PRKQ	hcv25620145	All Patients	Hosp. for Peripheral Arterial Disease	0.0196	3.8933	0.0483	831206 (6.9%)	10248 (4.0%)	314 (21.4%)	1.48 (0.65 to 3.03)	10.69 (2.33 to 36.38)	p < 0.005
PRKQ	hcv25620145	All Patients	History of Congestive Heart Failure (AE)	0.0047	7.0162	0.0061	181206 (15.0%)	29248 (11.7%)	5714 (42.9%)	0.57 (0.27 to 1.06)	3.69 (0.82 to 12.09)	p < 0.05
PRKQ	hcv25620145	All Patients	History of Diabetes	0.01	7.533	0.0061	1731206 (14.3%)	40248 (16.1%)	5714 (42.9%)	0.75 (0.49 to 1.12)	4.25 (1.39 to 12.35)	p < 0.05
PRKQ	hcv25620145	All Patients	Hosp. for Peripheral Arterial Disease	0.0138	6.1406	0.0132	301200 (2.9%)	9248 (3.6%)	213 (15.4%)	1.47 (0.65 to 3.01)	7.09 (1.07 to 27.93)	p < 0.05
PRKQ	hcv25620145	All Patients	Hosp. for Peripheral Arterial Disease	0.0427	5.2347	0.0221	1721200 (14.3%)	40248 (16.1%)	5713 (38.5%)	1.15 (0.78 to 1.66)	3.74 (1.12 to 11.33)	p < 0.05
PSMB9	hcv7499500	All Patients	Hosp. for Unstable Angina	0.0451	4.8294	0.028	153773 (19.8%)	99585 (16.5%)	12110 (10.9%)	0.81 (0.61 to 1.07)	0.50 (0.25 to 0.89)	p < 0.05
PSMB9	hcv7499500	All Patients	Hosp. for Unstable Angina	0.0207	7.3777	0.0066	941070 (6.8%)	163589 (4.3%)	230 (6.7%)	0.47 (0.26 to 0.79)	0.74 (0.12 to 2.52)	p < 0.05
SCARF1	hcv25613493	All Patients	Congestive Heart Failure	0.03312	9.0057	0.0081	211070 (2.0%)	14369 (3.8%)	330 (10.0%)	1.97 (0.97 to 3.88)	5.65 (1.26 to 17.38)	p < 0.005
SELL	hcv16172571	All Patients	Congestive Heart Failure	0.04757	4.2067	0.0338	1871074 (18.3%)	65362 (23.5%)	730 (30.0%)	1.37 (1.02 to 1.82)	3.89 (1.50 to 8.91)	p < 0.05
SELL	hcv16172571	All Patients	History of Angina Pectoris	0.0392	9.3741	0.0021	771073 (7.2%)	27565 (7.4%)	730 (30.0%)	1.03 (0.65 to 1.61)	3.94 (1.52 to 9.03)	p < 0.005
SELL	hcv25472627	All Patients	Congestive Heart Failure	0.046	4.1763	0.041	1671073 (18.4%)	85395 (23.3%)	930 (30.0%)	1.35 (1.01 to 1.80)	1.91 (0.82 to 4.10)	p < 0.05
SELL	hcv1975286	All Patients	Coronary Artery Bypass or Revascularization	0.0173	7.4562	0.0063	205996 (20.6%)	78422 (18.5%)	2147 (4.3%)	0.88 (0.65 to 1.17)	0.17 (0.03 to 0.56)	p < 0.05
SERPINA10	hcv15943710	All Patients	Fatal/Non-fatal Cardiovascular Disease	0.0091	5.6794	0.0172	3091451 (2.7%)	327 (11.1%)	0 (0.0%)	4.53 (1.05 to 13.67)	2.63 (1.25 to 5.10)	p < 0.05
SERPINA3	hcv2188895	All Patients	Fatal Coronary Heart Disease	0.008	8.2548	0.0041	24407 (6.9%)	28724 (3.9%)	5338 (1.5%)	0.64 (0.37 to 1.13)	0.24 (0.07 to 0.49)	p < 0.005
SERPINA3	hcv2188895	All Patients	Cardiovascular Mortality	0.0014	10.5191	0.0012	28407 (6.9%)	30724 (4.1%)	5338 (1.5%)	0.59 (0.34 to 1.00)	0.20 (0.07 to 0.49)	p < 0.05
SERPINA3	hcv2188895	All Patients	Fatal Atherosclerotic Cardiovascular Disease	0.0245	7.0093	0.0081	70407 (17.2%)	112724 (15.5%)	35338 (10.4%)	0.88 (0.64 to 1.23)	0.65 (0.36 to 0.86)	p < 0.005
SERPINA3	hcv2188895	All Patients	History of Diabetes	0.0128	8.6032	0.0034	77407 (18.9%)	90724 (12.4%)	50338 (14.8%)	0.91 (0.44 to 0.85)	1.49 (0.35 to 4.38)	p < 0.005
SERPINA3	hcv2188895	All Patients	More Than 1 Prior MI	0.0473	5.8966	0.0152	25893 (2.9%)	28503 (5.6%)	370 (4.3%)	1.97 (1.14 to 3.41)	4.49 (0.35 to 4.38)	p < 0.05
SERPINA3	hcv2188895	All Patients	Fatal Coronary Heart Disease	0.0407	5.8966	0.0152	25893 (2.9%)	28503 (5.6%)	370 (4.3%)	1.97 (1.14 to 3.41)	4.49 (0.35 to 4.38)	p < 0.05
SMTN	hcv25627634	All Patients	Fatal/Non-fatal MI (def & prob)	0.0459	4.8023	0.0284	70617 (11.3%)	104650 (15.5%)	30178 (16.9%)	1.44 (1.04 to 2.00)	1.56 (0.68 to 2.50)	p < 0.05
SREBF2	hcv16170982	All Patients	Non-fatal MI (def & prob)	0.0372	4.1648	0.0413	1491263 (11.8%)	30195 (15.3%)	378 (37.5%)	1.35 (0.87 to 2.04)	4.49 (0.91 to 18.47)	p < 0.05

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SREBF2	6.4495	0.0398	3.9908	0.0457	797/1263 (63.1%)	132/196 (67.3%)	2/8 (25.0%)	1.21 (0.88 to 1.57)	0.20 (0.03 to 0.85)	p < 0.05
TAP1	15.1025	0.0005	6.8856	0.0388	102/1379 (7.4%)	7/92 (7.8%)	2/3 (66.7%)	1.03 (0.42 to 2.14)	25.04 (2.38 to 541.07)	p < 0.05
TGFBI	6.3933	0.0409	5.0113	0.0252	20/686 (2.9%)	34/629 (5.4%)	10/162 (6.2%)	1.90 (1.09 to 3.40)	2.19 (0.97 to 4.87)	p < 0.05
TGFBI	6.3933	0.0409	5.0113	0.0252	20/686 (2.9%)	34/629 (5.4%)	10/162 (6.2%)	1.90 (1.09 to 3.40)	2.19 (0.97 to 4.87)	p < 0.05
TGFBI	10.1295	0.0063	4.8288	0.0037	81/666 (11.8%)	110/629 (17.5%)	30/162 (18.5%)	1.58 (1.16 to 2.18)	1.70 (1.06 to 2.66)	p < 0.005
TGFBI	8.1211	0.0172	6.0819	0.0037	24/686 (3.5%)	21/629 (3.3%)	13/162 (8.0%)	0.95 (0.52 to 1.73)	2.41 (1.17 to 4.76)	p < 0.05
TGFBI	8.5461	0.0139	6.7848	0.0032	20/686 (2.9%)	19/629 (3.0%)	12/162 (7.4%)	1.04 (0.55 to 1.97)	2.66 (1.24 to 5.50)	p < 0.05
THBD	10.8622	0.0046	6.0819	0.0044	113/1025 (11.0%)	86/934 (14.7%)	12/48 (25.0%)	1.39 (0.89 to 1.95)	2.88 (1.31 to 5.16)	p < 0.005
THBD	7.5852	0.0024	7.1845	0.0073	180/1025 (17.6%)	94/934 (23.9%)	11/48 (22.9%)	1.47 (1.11 to 1.95)	1.40 (0.57 to 2.16)	p < 0.05
THBD	12.6339	0.0018	8.8371	0.0031	315/1025 (30.7%)	137/934 (34.8%)	26/48 (54.2%)	1.20 (0.94 to 1.54)	2.86 (1.49 to 4.81)	p < 0.005
THBD	11.4379	0.0036	8.6122	0.0031	217/1164 (18.2%)	67/254 (26.4%)	1/18 (6.6%)	1.61 (1.17 to 2.20)	0.27 (0.02 to 1.30)	p < 0.005
THBD	10.3425	0.0057	8.823	0.003	233/1164 (19.5%)	50/254 (19.7%)	9/18 (50.0%)	1.01 (0.71 to 1.41)	4.12 (1.59 to 10.68)	p < 0.005
THBD	9.2264	0.0059	6.5997	0.0022	45/451 (10.0%)	109/715 (15.2%)	30/300 (10.0%)	1.62 (1.13 to 2.37)	1.00 (0.51 to 1.62)	p < 0.05
THBD	6.153	0.0461	6.1285	0.0133	168/451 (37.3%)	294/715 (41.1%)	139/300 (46.3%)	1.18 (0.84 to 1.50)	1.45 (1.08 to 1.96)	p < 0.05
THBD	8.072	0.0177	7.2739	0.007	159/1070 (18.6%)	76/371 (20.5%)	12/81 (38.7%)	1.13 (0.92 to 1.51)	2.76 (1.29 to 5.72)	p < 0.05
THBD	8.5655	0.0138	7.3782	0.0066	350/1070 (33.3%)	136/371 (36.7%)	18/31 (58.1%)	1.14 (0.89 to 1.46)	2.73 (1.33 to 5.75)	p < 0.05
THBD	6.1316	0.0466	4.8612	0.0275	504/1070 (47.1%)	189/371 (50.7%)	21/31 (67.7%)	1.15 (0.87 to 1.46)	2.54 (1.23 to 5.43)	p < 0.05
THBD	7.0228	0.0299	6.2028	0.0138	411/1070 (38.4%)	162/371 (43.6%)	19/31 (61.3%)	1.11 (0.87 to 1.42)	3.50 (1.15 to 8.79)	p < 0.05
THBD	8.8635	0.0131	7.5939	0.0081	483/1038 (46.5%)	188/411 (45.7%)	22/60 (73.3%)	1.53 (0.97 to 2.37)	3.45 (1.44 to 7.60)	p < 0.05
THBD	7.8468	0.0186	6.1608	0.018	673/1038 (65.0%)	248/411 (60.3%)	22/50 (73.3%)	0.96 (0.76 to 1.20)	2.97 (1.36 to 7.17)	p < 0.05
THBD	7.9203	0.0211	6.852	0.0276	56/448 (12.5%)	127/710 (17.3%)	10/317 (6.0%)	1.97 (1.18 to 3.44)	1.20 (0.50 to 2.37)	p < 0.05
THBD	6.6427	0.0361	4.852	0.0276	56/448 (12.5%)	127/710 (17.3%)	10/317 (6.0%)	1.47 (1.05 to 2.08)	1.01 (0.56 to 1.56)	p < 0.05
THBD	10.989	0.0041	9.6137	0.0019	7/448 (0.9%)	33/710 (4.6%)	19/317 (6.0%)	3.07 (1.43 to 7.62)	7.08 (2.63 to 24.59)	p < 0.0005
THBD	15.4596	0.0004	12.4232	0.0004	4/448 (0.9%)	29/710 (4.1%)	19/317 (6.0%)	4.73 (1.85 to 16.02)	4.08 (0.21 to 24.49)	p < 0.05
THBD	10.8514	0.0044	8.2057	0.0042	87/1351 (6.4%)	11/110 (10.0%)	1/7 (14.3%)	2.45 (1.14 to 4.76)	4.08 (0.21 to 24.49)	p < 0.05
THBD	7.2772	0.0263	4.3481	0.0371	53/1351 (3.9%)	10/110 (9.1%)	1/7 (14.3%)	2.45 (1.14 to 4.76)	4.08 (0.21 to 24.49)	p < 0.05
THBD	8.1772	0.0168	6.1886	0.0129	53/1351 (3.9%)	10/110 (9.1%)	1/7 (14.3%)	0.69 (0.30 to 1.36)	10.49 (1.37 to 64.15)	p < 0.05
THBD	9.8699	0.0072	5.7732	0.0107	78/1305 (6.0%)	9/167 (5.4%)	2/5 (40.0%)	0.90 (0.41 to 1.73)	16.39 (2.13 to 100.97)	p < 0.005
THBD	10.3168	0.0058	6.5212	0.0063	89/1305 (6.8%)	9/167 (5.4%)	2/5 (40.0%)	0.76 (0.26 to 1.76)	1.45 (0.26 to 1.93)	p < 0.005
THBD	7.5824	<0.001	9.1628	0.0025	51/1305 (3.9%)	5/167 (3.0%)	2/5 (40.0%)	0.50 (0.12 to 1.39)	1.84 (0.19 to 2.07)	p < 0.05
THBD	21.4279	<0.001	6.8532	0.0017	49/1305 (3.8%)	3/167 (1.8%)	2/5 (40.0%)	1.21 (0.94 to 1.54)	1.51 (1.12 to 2.04)	p < 0.05
THBD	6.3913	0.0409	7.2892	0.0121	149/478 (31.1%)	253/718 (35.2%)	113/282 (40.1%)	1.20 (0.95 to 1.53)	2.57 (1.14 to 5.26)	p < 0.05
THBD	7.3501	0.0253	7.2892	0.0121	149/478 (31.1%)	253/718 (35.2%)	113/282 (40.1%)	1.20 (0.95 to 1.53)	2.57 (1.14 to 5.26)	p < 0.05
THBD	6.4478	0.0111	6.0215	0.0141	128/1408 (9.1%)	9/44 (20.5%)	4/77 (5.2%)	0.61 (0.27 to 1.23)	0.68 (0.49 to 0.93)	p < 0.05
THBD	6.0048	0.0143	4.1898	0.0407	17/1408 (12.1%)	10/44 (22.7%)	4/77 (5.2%)	0.34 (0.10 to 0.83)	0.76 (0.54 to 1.09)	p < 0.05
THBD	6.5033	0.0387	5.7616	0.0164	85/1408 (6.0%)	62/545 (11.4%)	4/77 (5.2%)	0.32 (0.10 to 0.79)	0.78 (0.56 to 1.07)	p < 0.05
THBD	6.6933	0.0353	4.3471	0.0371	120/856 (14.0%)	60/545 (11.0%)	4/77 (5.2%)	1.56 (0.92 to 2.60)	1.53 (1.11 to 2.12)	p < 0.05
THBD	7.2997	0.0346	4.7025	0.0301	119/847 (14.0%)	79/516 (15.3%)	4/90 (4.4%)	1.49 (0.55 to 3.36)	2.11 (1.21 to 3.69)	p < 0.05
THBD	7.5905	0.0259	6.9827	0.0082	24/873 (2.7%)	29/516 (5.6%)	4/90 (4.4%)	1.52 (0.44 to 4.00)	2.30 (1.37 to 3.91)	p < 0.005
THBD	12.1574	0.0023	11.7126	0.0006	40/873 (4.6%)	34/516 (6.6%)	4/90 (4.4%)	1.52 (0.44 to 4.00)	2.30 (1.37 to 3.91)	p < 0.005
THBD	10.2172	0.008	9.7327	0.0018	26/873 (3.0%)	34/516 (6.6%)	4/90 (4.4%)	1.52 (0.44 to 4.00)	2.30 (1.37 to 3.91)	p < 0.005
THBD	10.2172	0.008	9.7327	0.0018	26/873 (3.0%)	34/516 (6.6%)	4/90 (4.4%)	1.52 (0.44 to 4.00)	2.30 (1.37 to 3.91)	p < 0.005
THBD	6.9884	0.0307	6.9003	0.0086	126/873 (12.8%)	93/516 (18.0%)	13/90 (14.4%)	1.19 (0.59 to 2.07)	1.48 (1.11 to 2.01)	p < 0.05
THBD	17.213	0.0002	15.295	<0.001	32/1131 (2.8%)	25/318 (7.9%)	7/27 (25.9%)	2.75 (0.43 to 8.79)	2.59 (1.70 to 5.01)	p < 0.0005
THBD	6.9765	0.0306	5.2376	0.0021	126/1132 (11.1%)	30/319 (6.4%)	7/27 (25.9%)	2.90 (1.08 to 6.45)	0.93 (0.54 to 1.24)	p < 0.05
THBD	6.3026	0.0428	4.6198	0.0316	572/1132 (45.2%)	168/319 (52.0%)	16/27 (59.3%)	1.76 (0.92 to 3.94)	1.31 (1.02 to 1.69)	p < 0.05
THBD	11.5495	0.0031	11.1288	0.0008	63/1132 (5.6%)	35/319 (11.0%)	2/27 (7.4%)	1.36 (0.22 to 4.70)	2.09 (1.34 to 3.21)	p < 0.005
THBD	7.827	0.0434	5.8787	0.0153	204/1132 (18.0%)	50/319 (15.7%)	10/27 (37.0%)	2.68 (1.17 to 5.84)	0.85 (0.50 to 1.18)	p < 0.05
THBD	6.2745	0.0007	4.5933	0.0263	527/1132 (46.6%)	171/319 (53.6%)	16/27 (59.3%)	1.67 (0.77 to 3.73)	1.33 (1.03 to 1.70)	p < 0.05
THBD	17.6174	0.0001	13.6085	0.0002	53/1132 (4.7%)	33/319 (10.3%)	4/27 (14.8%)	3.54 (1.01 to 9.61)	2.35 (1.48 to 3.69)	p < 0.0005
THBD	14.6273	0.0007	13.0337	0.0003	33/1132 (2.9%)	24/319 (7.5%)	2/27 (7.4%)	2.66 (0.42 to 9.47)	2.71 (1.58 to 4.64)	p < 0.0005
THBD	15.5895	0.0004	13.4449	0.0002	28/1132 (2.5%)	20/319 (6.9%)	2/27 (7.4%)	3.15 (0.49 to 11.33)	2.92 (1.63 to 5.17)	p < 0.0005
THBD	6.5487	0.0378	6.0862	0.0138	46/827 (11.8%)	72/735 (9.8%)	21/843 (6.1%)	0.49 (0.28 to 0.82)	0.81 (0.58 to 1.20)	p < 0.05
THBD	7.1515	0.0279	7.0385	0.0018	59/397 (14.9%)	96/735 (13.1%)	29/343 (8.5%)	0.53 (0.33 to 0.84)	0.86 (0.61 to 1.23)	p < 0.05
THBD	7.3794	0.025	6.9397	0.0176	63/397 (15.9%)	107/735 (14.6%)	34/343 (9.9%)	0.58 (0.37 to 0.90)	0.90 (0.65 to 1.27)	p < 0.05
THBD	6.1285	0.0467	6.1273	0.0133	33/796 (3.5%)	20/575 (3.5%)	9/101 (8.9%)	2.54 (1.15 to 5.15)	0.88 (0.49 to 1.52)	p < 0.05
THBD	8.2365	0.0163	6.0975	0.0135	33/796 (4.1%)	21/575 (3.7%)	10/101 (9.9%)	2.54 (1.15 to 5.15)	0.88 (0.49 to 1.52)	p < 0.05
THBD	8.2365	0.0163	6.0975	0.0135	33/796 (4.1%)	21/575 (3.7%)	10/101 (9.9%)	2.54 (1.15 to 5.15)	0.88 (0.49 to 1.52)	p < 0.05
THBD	9.0539	0.0108	6.9332	0.0038	42/796 (5.3%)	41/575 (7.1%)	13/101 (12.9%)	2.65 (1.32 to 5.01)	1.38 (0.88 to 2.15)	p < 0.005
THBD	6.0311	0.049	5.7126	0.0168	122/807 (15.1%)	61/572 (10.7%)	11/95 (11.6%)	0.74 (0.36 to 1.36)	0.67 (0.48 to 0.93)	p < 0.05
THBD	7.9668	0.0186	7.7732	0.0053	117/807 (14.5%)	54/572 (9.4%)	11/95 (11.6%)	0.61 (0.43 to 0.86)	0.61 (0.43 to 0.86)	p < 0.05
THBD	5.9309	0.0149	5.884	0.0153	118/1059 (11.1%)	65/411 (15.8%)		1.50 (1.08 to 2.07)		p < 0.05

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CCL4	hCV12120554 All Patients	Fatal Coronary Heart Disease	13.1864	0.0003	12.3436	0.0004	29.1056 (2.7%)	28/411 (6.8%)	2.60 (1.52 to 4.43)	p < 0.0005
CCL4	hCV12120554 All Patients	Total Mortality	9.1271	0.0025	8.8884	0.0029	55/1059 (5.2%)	39/411 (9.5%)	1.91 (1.24 to 2.92)	p < 0.0005
CCL4	hCV12120554 All Patients	Cardiovascular Mortality	13.9315	0.0002	13.0944	0.0003	33/1059 (3.1%)	31/411 (7.5%)	2.54 (1.53 to 4.20)	p < 0.0005
CCL4	hCV12120554 All Patients	Fatal Atherosclerotic Cardiovascular Disease	13.9315	0.0002	13.0944	0.0003	33/1059 (3.1%)	31/411 (7.5%)	2.54 (1.53 to 4.20)	p < 0.0005
CCL4	hCV12120554 All Patients	Fatal/Nonfatal Atherosclerotic CV Disease	4.0079	0.0043	4.0002	0.0455	401/1059 (37.9%)	179/411 (43.5%)	1.27 (1.00 to 1.59)	p < 0.05
CCL4	hCV12120554 All Patients	Coronary Artery Bypass Graft	10.3803	0.0041	10.0168	0.0016	89/930 (9.5%)	59/456 (10.1%)	1.07 (0.74 to 1.54)	p < 0.0005
CCL4	hCV12120554 All Patients	Coronary Artery Bypass or Revascularization	7.0679	0.0289	6.8357	0.01	179/930 (19.0%)	94/456 (20.6%)	1.01 (0.76 to 1.33)	p < 0.05
CCL4	hCV12120554 All Patients	Hosp. for Unstable Angina	7.0679	0.0289	6.8357	0.01	179/930 (19.0%)	94/456 (20.6%)	1.01 (0.76 to 1.33)	p < 0.05
CCL4	hCV12120554 All Patients	Congestive Heart Failure	7.2236	0.027	6.9959	0.0028	96/988 (9.7%)	86/495 (17.3%)	0.99 (0.74 to 1.32)	p < 0.05
CCL4	hCV12120554 All Patients	History of Coronary Artery Bypass Graft	7.4666	0.0239	6.9959	0.0018	21/988 (2.5%)	14/512 (2.7%)	1.11 (0.55 to 2.16)	p < 0.05
CCL4	hCV12120554 All Patients	History of Peripheral Arterial Disease	10.2377	0.006	10.0805	0.0015	21/988 (2.5%)	14/512 (2.7%)	1.11 (0.55 to 2.16)	p < 0.05
CCL4	hCV12120554 All Patients	CARE MI: Non Q-Wave MI	7.6337	0.0345	5.7915	0.0161	69/988 (7.8%)	51/512 (10.0%)	1.49 (1.16 to 1.89)	p < 0.0005
CCL4	hCV12120554 All Patients	Pericardaneous Transluminal Coronary Angioplasty	7.1211	0.0284	5.6916	0.0173	131/1166 (11.0%)	29/270 (9.6%)	1.31 (0.90 to 1.92)	p < 0.05
CCL4	hCV12120554 All Patients	Fatal MI	8.2495	0.0162	4.7645	0.0291	56/606 (9.8%)	56/73 (7.8%)	0.86 (0.54 to 1.32)	p < 0.05
CCL4	hCV12120554 All Patients	History of Percutaneous Transluminal Coronary Angioplasty	9.3565	0.0093	8.497	0.0036	30/720 (5.4%)	14/629 (2.2%)	0.90 (0.25 to 3.25)	p < 0.05
CCL4	hCV12120554 All Patients	Total Mortality	9.4509	0.0089	6.6827	0.0097	69/720 (8.3%)	30/629 (4.8%)	1.26 (0.99 to 1.60)	p < 0.0005
CCL4	hCV12120554 All Patients	Congestive Heart Failure	7.5512	0.0229	4.7724	0.0289	89/720 (12.4%)	39/629 (6.2%)	0.40 (0.21 to 0.72)	p < 0.0005
CCL4	hCV12120554 All Patients	Cardiovascular Mortality	8.1794	0.0167	8.0291	0.0046	43/720 (6.0%)	17/629 (2.7%)	0.55 (0.35 to 0.86)	p < 0.05
CCL4	hCV12120554 All Patients	Fatal Atherosclerotic Cardiovascular Disease	9.6894	0.008	9.0897	0.0026	29/484 (6.0%)	18/729 (2.5%)	0.63 (0.30 to 1.25)	p < 0.0005
CCL4	hCV12120554 All Patients	History of Percutaneous Transluminal Coronary Angioplasty	7.0096	0.0301	6.9552	0.0083	172/484 (37.1%)	21/629 (29.7%)	0.72 (0.58 to 0.92)	p < 0.0005
CCL4	hCV12120554 All Patients	Congestive Heart Failure	9.3292	0.0094	8.3031	0.0046	30/435 (6.9%)	63/744 (8.5%)	0.94 (0.62 to 1.44)	p < 0.0005
CCL4	hCV12120554 All Patients	Total Mortality	8.9741	0.0113	8.4427	0.0037	33/435 (7.6%)	14/377 (3.7%)	0.54 (0.30 to 0.97)	p < 0.0005
CCL4	hCV12120554 All Patients	Cardiovascular Mortality	10.1666	0.0061	8.823	0.003	25/363 (6.9%)	31/737 (4.2%)	0.29 (0.12 to 0.63)	p < 0.0005
CCL4	hCV12120554 All Patients	Fatal Atherosclerotic Cardiovascular Disease	9.6891	0.0083	9.0897	0.0026	29/484 (6.0%)	18/729 (2.5%)	0.59 (0.35 to 1.03)	p < 0.0005
CCL4	hCV12120554 All Patients	Coronary Artery Bypass Graft	8.215	0.0447	5.599	0.018	24/558 (5.2%)	30/717 (4.2%)	1.75 (1.22 to 2.49)	p < 0.0005
CCL4	hCV12120554 All Patients	Stroke	9.2674	0.0097	7.7503	0.0032	75/459 (16.3%)	71/718 (10.5%)	0.82 (0.46 to 1.38)	p < 0.05
CCL4	hCV12120554 All Patients	Catheterization	9.1727	0.0102	7.8217	0.0052	109/459 (23.7%)	133/718 (18.5%)	0.62 (0.44 to 0.87)	p < 0.05
CCL4	hCV12120554 All Patients	Coronary Artery Bypass or Revascularization	5.9977	0.0498	5.7793	0.0162	171/459 (37.3%)	253/718 (35.2%)	0.73 (0.55 to 0.97)	p < 0.05
CCL4	hCV12120554 All Patients	Total Coronary Heart Disease Events	8.1922	0.0161	8.5376	0.0023	190/459 (42.7%)	260/718 (36.5%)	0.92 (0.72 to 1.17)	p < 0.0005
CCL4	hCV12120554 All Patients	Fatal/Nonfatal Atherosclerotic CV Disease	8.2797	0.0169	6.9438	0.0094	29/459 (6.4%)	30/718 (4.2%)	0.89 (0.70 to 1.13)	p < 0.05
CCL4	hCV12120554 All Patients	Any Report of Stroke During CARE	6.7045	0.035	5.7556	0.0164	22/459 (4.8%)	28/718 (3.9%)	0.76 (0.44 to 1.31)	p < 0.05
CCL4	hCV12120554 All Patients	Definite Stroke Occurred During CARE	11.894	0.0025	5.7708	0.0163	52/679 (7.7%)	36/235 (15.3%)	0.75 (0.42 to 1.34)	p < 0.05
CCL4	hCV12120554 All Patients	Infarct Nonfatal MI	7.5954	0.0224	5.6238	0.0149	25/64 (0.4%)	8/679 (1.2%)	0.80 (0.54 to 1.19)	p < 0.05
CCL4	hCV12120554 All Patients	Fatal MI	8.5336	0.014	6.7904	0.0092	11/554 (1.3%)	76/719 (10.5%)	3.35 (0.84 to 22.26)	p < 0.05
CCL4	hCV12120554 All Patients	Fatal CHD/Definite Nonfatal MI	6.188	0.0453	5.8909	0.0152	13/554 (2.3%)	34/679 (5.0%)	1.01 (0.71 to 1.44)	p < 0.05
CCL4	hCV12120554 All Patients	Total Coronary Heart Disease	7.1672	0.0278	6.9439	0.0094	11/554 (1.3%)	54/679 (8.0%)	2.23 (1.20 to 4.43)	p < 0.05
CCL4	hCV12120554 All Patients	Stroke	9.0023	0.0111	8.4372	0.0037	11/554 (1.3%)	54/679 (8.0%)	1.94 (1.20 to 3.24)	p < 0.05
CCL4	hCV12120554 All Patients	Hosp. for Unstable Angina	7.0779	0.023	6.7239	0.0095	15/554 (2.7%)	39/679 (5.7%)	0.94 (0.71 to 1.25)	p < 0.05
CCL4	hCV12120554 All Patients	Cardiovascular Mortality	6.2709	0.0435	6.9375	0.0472	35/659 (5.2%)	21/620 (3.4%)	2.23 (1.24 to 4.21)	p < 0.05
CCL4	hCV12120554 All Patients	Fatal Atherosclerotic Cardiovascular Disease	6.5108	0.0386	4.0999	0.0429	35/670 (5.4%)	19/620 (3.1%)	0.64 (0.36 to 1.09)	p < 0.05
CCL4	hCV12120554 All Patients	Stroke	9.6977	0.002	5.1277	0.0025	160/1365 (13.2%)	20/78 (26.6%)	0.58 (0.31 to 0.97)	p < 0.0005
CCL4	hCV12120554 All Patients	Any Report of Stroke During CARE	9.3425	0.0022	6.8992	0.0029	160/1365 (13.2%)	20/78 (26.6%)	2.27 (1.30 to 3.86)	p < 0.0005
CCL4	hCV12120554 All Patients	Nonfatal MI (Probable/Definite)	6.6912	0.0097	6.4342	0.0112	162/1365 (11.9%)	17/78 (21.8%)	2.28 (1.30 to 3.86)	p < 0.0005
CCL4	hCV12120554 All Patients	Fatal CHD/Definite Nonfatal MI	7.0931	0.0077	6.8051	0.0091	159/1365 (11.6%)	17/78 (21.8%)	2.07 (1.17 to 3.55)	p < 0.05
CCL4	hCV12120554 All Patients	Nonfatal MI (def & prob)	9.6958	0.0017	9.4086	0.0022	178/1365 (13.0%)	20/78 (25.6%)	2.11 (1.17 to 3.63)	p < 0.0005
CCL4	hCV12120554 All Patients	History of Angina Pectoris	5.6485	0.0156	5.6948	0.017	265/1365 (19.5%)	24/78 (30.6%)	2.30 (1.32 to 3.85)	p < 0.0005
CCL4	hCV12120554 All Patients	History of Congestive Heart Failure (AE)	14.6298	0.0001	13.1769	0.0003	79/1365 (5.8%)	13/78 (16.7%)	1.84 (1.10 to 2.99)	p < 0.0005
CCL4	hCV12120554 All Patients	More Than 1 Prior MI	9.2578	0.0023	8.5444	0.0029	195/1365 (14.3%)	21/78 (26.9%)	3.26 (1.68 to 5.98)	p < 0.0005
CCL4	hCV12120554 All Patients	Congestive Heart Failure	8.9138	0.0116	7.7742	0.0053	44/650 (6.7%)	47/664 (7.1%)	2.21 (1.28 to 3.67)	p < 0.0005
CCL4	hCV12120554 All Patients	More Than 1 Prior MI	11.8625	0.0027	7.535	0.0081	97/660 (14.7%)	86/664 (13.0%)	1.07 (0.70 to 1.64)	p < 0.05
CCL4	hCV12120554 All Patients	Nonfatal MI (Probable/Definite)	11.9595	0.0025	11.823	0.0007	89/629 (14.1%)	89/629 (14.1%)	0.86 (0.63 to 1.18)	p < 0.05
CCL4	hCV12120554 All Patients	Nonfatal MI (def & prob)	10.7331	0.0058	9.8772	0.0017	79/665 (11.8%)	81/629 (12.9%)	1.23 (0.89 to 1.70)	p < 0.0005
CCL4	hCV12120554 All Patients	Definite Nonfatal MI	8.6701	0.0119	8.2722	0.004	97/665 (14.5%)	58/629 (9.2%)	1.13 (0.81 to 1.59)	p < 0.0005
CCL4	hCV12120554 All Patients	Fatal MI	11.2134	0.0037	6.3119	0.0029	25/65 (0.3%)	96/29 (1.4%)	1.12 (0.76 to 1.64)	p < 0.0005
CCL4	hCV12120554 All Patients	Coronary Artery Bypass Graft	6.4727	0.0393	6.2891	0.0013	75/629 (12.6%)	15/156 (9.6%)	4.95 (1.27 to 32.60)	p < 0.0005
CCL4	hCV12120554 All Patients	Fatal CHD/Definite Nonfatal MI	11.2734	0.0036	10.8996	0.001	73/665 (10.9%)	79/629 (12.6%)	1.56 (1.11 to 2.27)	p < 0.05
CCL4	hCV12120554 All Patients	Nonfatal MI (def & prob)	11.0705	0.0039	10.1263	0.0015	75/665 (11.2%)	79/629 (12.6%)	1.20 (0.86 to 1.69)	p < 0.0005
CCL4	hCV12120554 All Patients	Fatal/Nonfatal MI (def & prob)	12.3831	0.002	12.1027	0.0005	80/665 (11.7%)	88/629 (14.0%)	1.08 (0.77 to 1.53)	p < 0.0005
CCL4	hCV12120554 All Patients	History of Diabetes	7.2874	0.0262	7.1608	0.0076	91/665 (13.3%)	93/629 (14.8%)	1.23 (0.89 to 1.70)	p < 0.0005
CCL4	hCV12120554 All Patients	Family History of CV Disease	7.7639	0.0024	6.6659	0.0056	258/629 (41.0%)	48/156 (30.8%)	1.13 (0.83 to 1.55)	p < 0.05
CCL4	hCV12120554 All Patients	Hosp. for Unstable Angina	8.101	0.0342	5.514	0.0099	134/679 (17.4%)	98/668 (16.7%)	0.92 (0.74 to 1.15)	p < 0.05
CCL4	hCV12120554 All Patients	MI (Fatal/Nonfatal)	8.101	0.0174	7.1105	0.0077	62/573 (10.8%)	104/646 (16.1%)	0.65 (0.71 to 1.26)	p < 0.05
CCL4	hCV12120554 All Patients	MI (Fatal/Nonfatal)	8.101	0.0174	7.1105	0.0077	62/573 (10.8%)	104/646 (16.1%)	1.59 (1.13 to 2.22)	p < 0.05

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MARK3	hCV25528178	All Patients	Nonfatal MI (Probable/Definite)	7.3551	0.0067	57.5573 (9.9%)	99.646 (15.2%)	36.228 (15.6%)	1.70 (1.08 to 2.65)	1.62 (1.15 to 2.30)	p < 0.05
MARK3	hCV25528178	All Patients	Definite Nonfatal MI	6.4605	0.0111	41.573 (7.2%)	74.646 (11.5%)	22.228 (9.6%)	1.39 (0.79 to 2.30)	1.68 (1.13 to 2.52)	p < 0.05
MARK3	hCV25528178	All Patients	Nonfatal MI (def & prob)	8.4948	0.0038	61.573 (10.1%)	94.646 (14.5%)	33.228 (14.5%)	1.71 (1.20 to 2.46)	1.71 (1.20 to 2.46)	p < 0.005
MARK3	hCV25528178	All Patients	Fatal/Nonfatal MI (def & prob)	7.2345	0.0072	61.573 (10.1%)	103.646 (15.9%)	37.228 (16.2%)	1.59 (1.14 to 2.24)	1.59 (1.14 to 2.24)	p < 0.005
MARK3	hCV25528178	All Patients	MI (Fatal/Nonfatal)	10.7762	0.001	10.5972 (0.001)	52.566 (8.2%)	13.675 (16.4%)	1.72 (1.25 to 2.39)	1.72 (1.25 to 2.39)	p < 0.0005
MARK3	hCV25528178	All Patients	Nonfatal MI (Probable/Definite)	9.3659	0.0022	9.1277 (0.002)	31.766 (5.3%)	10.675 (14.2%)	1.84 (1.25 to 2.75)	1.84 (1.25 to 2.75)	p < 0.005
MARK3	hCV25528178	All Patients	Definite Nonfatal MI	5.8255	0.0153	5.8161 (0.015)	59.666 (9.9%)	12.5675 (14.2%)	1.51 (1.09 to 2.12)	1.51 (1.09 to 2.12)	p < 0.0005
MARK3	hCV25528178	All Patients	Fatal CHD/Definite Nonfatal MI	12.6825	0.0004	12.3884 (0.004)	49.666 (8.5%)	13.675 (16.4%)	1.74 (1.26 to 2.42)	1.74 (1.26 to 2.42)	p < 0.005
MARK3	hCV25528178	All Patients	Fatal/Nonfatal MI (def & prob)	11.0955	0.0009	10.8977 (0.01)	57.566 (10.1%)	14.3675 (16.3%)	1.92 (1.04 to 3.78)	1.92 (1.04 to 3.78)	p < 0.05
MARK3	hCV25528178	All Patients	1st Stroke Occurred During CARE	4.1518	0.0416	4.0187 (0.04)	13.566 (2.3%)	3.675 (4.3%)	1.55 (1.09 to 2.21)	1.55 (1.09 to 2.21)	p < 0.05
MARK3	hCV25528178	All Patients	Pericardaneous Transluminal Coronary Angioplasty	6.0292	0.0491	5.8659 (0.05)	59.666 (8.8%)	84.646 (13.0%)	1.47 (0.99 to 2.23)	1.47 (0.99 to 2.23)	p < 0.005
MARK3	hCV25528178	All Patients	Pericardaneous Transluminal Coronary Angioplasty	8.7778	0.0491	8.6068 (0.05)	36.449 (6.0%)	81.715 (11.3%)	1.14 (0.78 to 1.67)	1.14 (0.78 to 1.67)	p < 0.05
MARK3	hCV25528178	All Patients	Catheterization	8.5934	0.0117	7.5393 (0.01)	47.449 (8.5%)	84.715 (11.7%)	0.44 (0.21 to 0.82)	0.44 (0.21 to 0.82)	p < 0.05
MARK3	hCV25528178	All Patients	Total Mortality	9.7172	0.0078	9.8124 (0.008)	39.449 (6.4%)	44.715 (6.2%)	1.18 (0.95 to 1.47)	1.18 (0.95 to 1.47)	p < 0.005
MARK3	hCV25528178	All Patients	History of Hypertension	4.9169	0.0256	4.5364 (0.02)	31.766 (5.3%)	25.471 (4.5%)	0.37 (0.13 to 0.84)	0.37 (0.13 to 0.84)	p < 0.05
MARK3	hCV25528178	All Patients	Coronary Artery Bypass or Revascularization	6.1557	0.0451	4.9557 (0.05)	27.072 (4.5%)	32.2524 (6.1%)	0.64 (0.37 to 1.06)	0.64 (0.37 to 1.06)	p < 0.05
MARK3	hCV25528178	All Patients	CARE MI: Q-Wave MI	12.7655	0.0017	4.8253 (0.002)	12.0124 (10.2%)	28.176 (15.7%)	1.64 (1.04 to 2.52)	1.64 (1.04 to 2.52)	p < 0.05
MARK3	hCV25528178	All Patients	Pericardaneous Transluminal Coronary Angioplasty	7.7482	0.0208	7.4351 (0.02)	23.1724 (10.3%)	40.176 (27.0%)	5.70 (1.71 to 51.14)	5.70 (1.71 to 51.14)	p < 0.05
MARK3	hCV25528178	All Patients	Hosp. for Cardiovascular Disease	7.8955	0.0193	7.7455 (0.019)	57.1124 (16.7%)	99.176 (15.1%)	4.76 (0.70 to 93.24)	4.76 (0.70 to 93.24)	p < 0.05
MARK3	hCV25528178	All Patients	Hosp. for Unstable Angina	9.8493	0.0073	9.3457 (0.008)	42.1124 (33.3%)	45.176 (25.3%)	1.25 (0.06 to 8.48)	1.25 (0.06 to 8.48)	p < 0.05
MARK3	hCV25528178	All Patients	Total Cardiovascular Disease Events	8.7618	0.0125	8.6786 (0.013)	59.1124 (33.3%)	79.176 (44.4%)	3.00 (0.50 to 22.87)	3.00 (0.50 to 22.87)	p < 0.005
MARK3	hCV25528178	All Patients	Total Cardiovascular Disease Events	10.5763	0.005	7.0358 (0.006)	47.1124 (37.9%)	60.176 (48.3%)	4.53 (0.67 to 88.61)	4.53 (0.67 to 88.61)	p < 0.05
MARK3	hCV25528178	All Patients	Fatal MI	11.4732	0.0032	6.2891 (0.01)	11.1007 (1.1%)	2.415 (0.5%)	5.33 (1.18 to 17.69)	5.33 (1.18 to 17.69)	p < 0.05
MARK3	hCV25528178	All Patients	Fatal Coronary Heart Disease	8.2339	0.0121	7.7888 (0.013)	14.3107 (14.2%)	19.415 (11.8%)	1.34 (0.73 to 2.30)	1.34 (0.73 to 2.30)	p < 0.05
MARK3	hCV25528178	All Patients	Fatal/Nonfatal MI (def & prob)	6.555	0.0377	5.8656 (0.04)	39.1007 (9.9%)	19.415 (11.8%)	3.10 (1.14 to 7.19)	3.10 (1.14 to 7.19)	p < 0.05
MARK3	hCV25528178	All Patients	Cardiovascular Mortality	6.555	0.0377	5.8656 (0.04)	39.1007 (9.9%)	19.415 (11.8%)	1.19 (0.67 to 2.06)	1.19 (0.67 to 2.06)	p < 0.05
MARK3	hCV25528178	All Patients	Fatal Atherosclerotic Cardiovascular Disease	7.068	0.0202	6.1014 (0.02)	42.566 (16.2%)	32.674 (17.5%)	0.58 (0.35 to 0.89)	0.58 (0.35 to 0.89)	p < 0.05
MARK3	hCV25528178	All Patients	Fatal/Nonfatal Cardiovascular Disease	12.2457	0.0022	11.1265 (0.003)	14.615 (2.3%)	31.871 (16.8%)	0.55 (0.35 to 0.89)	0.55 (0.35 to 0.89)	p < 0.05
MARK3	hCV25528178	All Patients	Any Report of Stroke Prior to or During CARE	12.2457	0.0022	11.1265 (0.003)	14.615 (2.3%)	31.871 (16.8%)	2.08 (1.12 to 4.07)	2.08 (1.12 to 4.07)	p < 0.005
MARK3	hCV25528178	All Patients	Stroke	12.2457	0.0022	11.1265 (0.003)	14.615 (2.3%)	31.871 (16.8%)	1.60 (1.01 to 2.57)	1.60 (1.01 to 2.57)	p < 0.05
MARK3	hCV25528178	All Patients	Fatal/Nonfatal Cardiovascular Disease	12.2457	0.0022	11.1265 (0.003)	14.615 (2.3%)	31.871 (16.8%)	1.88 (1.16 to 3.17)	1.88 (1.16 to 3.17)	p < 0.005
MARK3	hCV25528178	All Patients	Any Report of Stroke Prior to or During CARE	12.2457	0.0022	11.1265 (0.003)	14.615 (2.3%)	31.871 (16.8%)	2.07 (1.11 to 4.06)	2.07 (1.11 to 4.06)	p < 0.005
MARK3	hCV25528178	All Patients	Stroke	12.2457	0.0022	11.1265 (0.003)	14.615 (2.3%)	31.871 (16.8%)	2.10 (1.08 to 4.34)	2.10 (1.08 to 4.34)	p < 0.005
MARK3	hCV25528178	All Patients	1st Stroke Occurred During CARE	12.2457	0.0022	11.1265 (0.003)	14.615 (2.3%)	31.871 (16.8%)	1.83 (1.00 to 3.46)	1.83 (1.00 to 3.46)	p < 0.005
MARK3	hCV25528178	All Patients	Any Report of Stroke Prior to or During CARE	12.2457	0.0022	11.1265 (0.003)	14.615 (2.3%)	31.871 (16.8%)	1.75 (1.08 to 2.90)	1.75 (1.08 to 2.90)	p < 0.005
MARK3	hCV25528178	All Patients	Stroke	12.2457	0.0022	11.1265 (0.003)	14.615 (2.3%)	31.871 (16.8%)	1.82 (1.00 to 3.45)	1.82 (1.00 to 3.45)	p < 0.005
MARK3	hCV25528178	All Patients	Any Report of Stroke Prior to or During CARE	12.2457	0.0022	11.1265 (0.003)	14.615 (2.3%)	31.871 (16.8%)	1.81 (0.95 to 3.58)	1.81 (0.95 to 3.58)	p < 0.005
MARK3	hCV25528178	All Patients	Stroke	12.2457	0.0022	11.1265 (0.003)	14.615 (2.3%)	31.871 (16.8%)	0.98 (0.51 to 1.94)	0.98 (0.51 to 1.94)	p < 0.05
MARK3	hCV25528178	All Patients	Any Report of Stroke Prior to or During CARE	12.2457	0.0022	11.1265 (0.003)	14.615 (2.3%)	31.871 (16.8%)	0.89 (0.46 to 1.78)	0.89 (0.46 to 1.78)	p < 0.05
MARK3	hCV25528178	All Patients	Stroke	12.2457	0.0022	11.1265 (0.003)	14.615 (2.3%)	31.871 (16.8%)	1.03 (0.71 to 1.51)	1.03 (0.71 to 1.51)	p < 0.05
MARK3	hCV25528178	All Patients	Pericardaneous Transluminal Coronary Angioplasty	12.2457	0.0022	11.1265 (0.003)	14.615 (2.3%)	31.871 (16.8%)	0.84 (0.56 to 1.23)	0.84 (0.56 to 1.23)	p < 0.05
MARK3	hCV25528178	All Patients	Coronary Artery Bypass Graft	12.2457	0.0022	11.1265 (0.003)	14.615 (2.3%)	31.871 (16.8%)	0.52 (0.28 to 0.91)	0.52 (0.28 to 0.91)	p < 0.05
MARK3	hCV25528178	All Patients	Any Report of Stroke Prior to or During CARE	12.2457	0.0022	11.1265 (0.003)	14.615 (2.3%)	31.871 (16.8%)	0.67 (0.42 to 1.06)	0.67 (0.42 to 1.06)	p < 0.05
MARK3	hCV25528178	All Patients	Fatal/Nonfatal Cardiovascular Disease	12.2457	0.0022	11.1265 (0.003)	14.615 (2.3%)	31.871 (16.8%)	0.94 (0.75 to 1.16)	0.94 (0.75 to 1.16)	p < 0.05
MARK3	hCV25528178	All Patients	MI (Fatal/Nonfatal)	12.2457	0.0022	11.1265 (0.003)	14.615 (2.3%)	31.871 (16.8%)	0.66 (0.48 to 0.91)	0.66 (0.48 to 0.91)	p < 0.05
MARK3	hCV25528178	All Patients	Nonfatal MI (Probable/Definite)	12.2457	0.0022	11.1265 (0.003)	14.615 (2.3%)	31.871 (16.8%)	0.67 (0.48 to 0.91)	0.67 (0.48 to 0.91)	p < 0.05
MARK3	hCV25528178	All Patients	Nonfatal MI (def & prob)	12.2457	0.0022	11.1265 (0.003)	14.615 (2.3%)	31.871 (16.8%)	0.69 (0.49 to 0.91)	0.69 (0.49 to 0.91)	p < 0.05
MARK3	hCV25528178	All Patients	Fatal/Nonfatal MI (def & prob)	12.2457	0.0022	11.1265 (0.003)	14.615 (2.3%)	31.871 (16.8%)	0.79 (0.52 to 1.00)	0.79 (0.52 to 1.00)	p < 0.05
MARK3	hCV25528178	All Patients	Pericardaneous Transluminal Coronary Angioplasty	12.2457	0.0022	11.1265 (0.003)	14.615 (2.3%)	31.871 (16.8%)	0.68 (0.47 to 0.98)	0.68 (0.47 to 0.98)	p < 0.05
MARK3	hCV25528178	All Patients	Catheterization	12.2457	0.0022	11.1265 (0.003)	14.615 (2.3%)	31.871 (16.8%)	0.54 (0.38 to 0.76)	0.54 (0.38 to 0.76)	p < 0.0005
MARK3	hCV25528178	All Patients	Pericardaneous Transluminal Coronary Angioplasty	12.2457	0.0022	11.1265 (0.003)	14.615 (2.3%)	31.871 (16.8%)	0.66 (0.50 to 0.89)	0.66 (0.50 to 0.89)	p < 0.005
MARK3	hCV25528178	All Patients	Coronary Artery Bypass or Revascularization	12.2457	0.0022	11.1265 (0.003)	14.615 (2.3%)	31.871 (16.8%)	0.75 (0.56 to 0.98)	0.75 (0.56 to 0.98)	p < 0.05
MARK3	hCV25528178	All Patients	Hosp. for Cardiovascular Disease	12.2457	0.0022	11.1265 (0.003)	14.615 (2.3%)	31.871 (16.8%)	0.75 (0.56 to 0.98)	0.75 (0.56 to 0.98)	p < 0.05
MARK3	hCV25528178	All Patients	Hosp. for Unstable Angina	12.2457	0.0022	11.1265 (0.003)	14.615 (2.3%)	31.871 (16.8%)	4.93 (1.73 to 20.71)	4.93 (1.73 to 20.71)	p < 0.05
MARK3	hCV25528178	All Patients	History of Stroke	12.2457	0.0022	11.1265 (0.003)	14.615 (2.3%)	31.871 (16.8%)	0.65 (0.45 to 0.94)	0.65 (0.45 to 0.94)	p < 0.05
MARK3	hCV25528178	All Patients	Coronary Artery Bypass Graft	12.2457	0.0022	11.1265 (0.003)	14.615 (2.3%)	31.871 (16.8%)	0.63 (0.45 to 0.88)	0.63 (0.45 to 0.88)	p < 0.05
MARK3	hCV25528178	All Patients	Catheterization	12.2457	0.0022	11.1265 (0.003)	14.615 (2.3%)	31.871 (16.8%)	0.71 (0.54 to 0.93)	0.71 (0.54 to 0.93)	p < 0.05
MARK3	hCV25528178	All Patients	Coronary Artery Bypass or Revascularization	12.2457	0.0022	11.1265 (0.003)	14.615 (2.3%)	31.871 (16.8%)	0.80 (0.60 to 1.07)	0.80 (0.60 to 1.07)	p < 0.05
MARK3	hCV25528178	All Patients	Hosp. for Unstable Angina	12.2457	0.0022	11.1265 (0.003)	14.615 (2.3%)	31.871 (16.8%)	1.08 (0.74 to 1.56)	1.08 (0.74 to 1.56)	p < 0.05
MARK3	hCV25528178	All Patients	Coronary Artery Bypass Graft	12.2457	0.0022	11.1265 (0.003)	14.615 (2.3%)	31.871 (16.8%)	0.54 (0.31 to 0.90)	0.54 (0.31 to 0.90)	p < 0.05
MARK3	hCV25528178	All Patients	Total Mortality	12.2457	0.0022	11.1265 (0.003)	14.615 (2.3%)	31.871 (16.8%)	0.90 (0.64 to 1.25)	0.90 (0.64 to 1.25)	p < 0.05
MARK3	hCV25528178	All Patients	MI (Fatal/Nonfatal)	12.2457	0.0022	11.1265 (0.003)	14.615 (2.3%)	31.871 (16.8%)	45.218 (20.6%)	45.218 (20.6%)	p < 0.05
MARK3	hCV25528178	All Patients	Nonfatal MI (Probable/Definite)	12.2457	0.0022	11.1265 (0.003)	14.615 (2.3%)	31.871 (16.8%)	1.65 (1.08 to 2.50)	1.65 (1.08 to 2.50)	p < 0.05
MARK3	hCV25528178	All Patients	Nonfatal MI (def & prob)	12.2457	0.0022	11.1265 (0.003)	14.615 (2.3%)	31.871 (16.8%)	1.71 (1.11 to 2.61)	1.71 (1.11 to 2.61)	p < 0.05

SPARCL1	hCV16827241	Fatal/Nonfatal MI (def & prob)	0.0089	5.6592	0.0174	77/577 (13.3%)	81/675 (12.0%)	44/218 (20.2%)	1.64 (1.09 to 2.46)	0.89 (0.63 to 1.24)	p < 0.005
SPARCL1	hCV16827241	All Patients	0.0113	8.2800	0.004	18/577 (32.5%)	23/675 (33.6%)	55/218 (25.2%)	1.60 (1.10 to 2.20)	1.06 (0.63 to 1.34)	p < 0.005
SPARCL1	hCV16827241	Total Coronary Heart Disease Events	0.0498	4.8295	0.0333	27/577 (46.7%)	31/675 (46.7%)	122/218 (56.0%)	1.41 (1.03 to 1.93)	0.97 (0.77 to 1.21)	p < 0.005
SPARCL1	hCV16827241	All Patients	0.0234	5.1023	0.0239	36/577 (61.9%)	52/675 (76.1%)	40/218 (18.3%)	1.13 (0.74 to 1.68)	0.89 (0.50 to 0.98)	p < 0.005
SPARCL1	hCV16827241	More Than 1 Prior MI	0.0264	5.2324	0.0222	43/495 (8.6%)	47/725 (6.1%)	11/250 (4.4%)	0.45 (0.22 to 0.86)	0.63 (0.41 to 0.98)	p < 0.005
SPARCL1	hCV24565937	Fatal/Nonfatal Cardiovascular Disease	0.0038	5.0214	0.0214	17/1465 (36.3%)	23/2725 (0.3%)	72/250 (28.8%)	0.74 (0.50 to 0.97)	0.75 (0.50 to 0.98)	p < 0.005
SPARCL1	hCV24565937	All Patients	0.0093	7.3959	0.0068	41/465 (6.9%)	40/725 (5.5%)	9/250 (3.6%)	0.30 (0.15 to 0.70)	0.60 (0.38 to 0.95)	p < 0.005
SPARCL1	hCV24565937	History of Percutaneous Transluminal Coronary Angioplasty	0.9552	0.0000	0.0000	0.0000 (0.0%)	0.0000 (0.0%)	0.0000 (0.0%)	0.0000 (0.0%)	0.0000 (0.0%)	p < 0.005
SPARCL1	hCV24565937	Any Report of Stroke Prior to or During CARE	0.9856	0.0000	0.0000	29/465 (6.2%)	26/725 (3.6%)	4/250 (1.6%)	0.29 (0.06 to 0.75)	0.58 (0.32 to 0.95)	p < 0.005
SPARCL1	hCV24565937	1st Stroke Occurred During CARE	0.0232	5.8207	0.0216	29/465 (5.4%)	23/725 (3.2%)	4/250 (1.6%)	0.29 (0.06 to 0.75)	0.58 (0.32 to 0.95)	p < 0.005
SPARCL1	hCV24565937	Total Mortality	0.0073	5.6204	0.0107	22/538 (4.1%)	52/675 (7.7%)	20/254 (7.9%)	2.00 (1.07 to 3.75)	1.95 (1.18 to 3.33)	p < 0.005
SPARCL1	hCV22272997	Cardiovascular Mortality	0.0203	6.1764	0.0126	12/538 (2.4%)	36/675 (5.3%)	15/254 (5.9%)	2.53 (1.19 to 5.49)	2.28 (1.22 to 4.47)	p < 0.005
SPARCL1	hCV22272997	Fatal/Nonfatal Cardiovascular Disease	0.7802	0.0000	0.0000	0.0000 (0.0%)	0.0000 (0.0%)	0.0000 (0.0%)	0.0000 (0.0%)	0.0000 (0.0%)	p < 0.005
SPARCL1	hCV22272997	All Patients	0.0241	6.1764	0.0126	12/538 (2.4%)	36/675 (5.3%)	15/254 (5.9%)	2.53 (1.19 to 5.49)	2.28 (1.22 to 4.47)	p < 0.005
SPARCL1	hCV22272997	More Than 1 Prior MI	0.0164	7.172	0.007	63/538 (11.7%)	109/678 (16.1%)	48/254 (18.9%)	1.76 (1.16 to 2.64)	1.44 (1.04 to 2.02)	p < 0.005
SPARCL1	hCV25615626	Percutaneous Transluminal Coronary Angioplasty	0.0079	8.0077	0.0033	52/548 (9.5%)	60/676 (10.1%)	43/248 (17.5%)	2.02 (1.30 to 3.12)	1.07 (0.87 to 1.57)	p < 0.005
SPARCL1	hCV25615626	Coronary Artery Bypass or Revascularization	0.0116	8.6407	0.0063	53/548 (9.7%)	60/676 (10.2%)	64/246 (26.0%)	1.72 (1.01 to 2.84)	1.16 (0.87 to 1.57)	p < 0.005
SPARCL1	hCV25615626	Coronary Artery Bypass or Revascularization	0.9099	0.0000	0.0000	0.0000 (0.0%)	0.0000 (0.0%)	0.0000 (0.0%)	0.0000 (0.0%)	0.0000 (0.0%)	p < 0.005
SPARCL1	hCV25615626	History of Unstable Angina	0.0286	5.8082	0.016	80/548 (14.6%)	130/676 (19.2%)	53/246 (21.5%)	1.61 (1.09 to 2.39)	1.39 (1.03 to 1.89)	p < 0.005
SPARCL1	hCV25615626	History of Angina Pectoris	7.2218	0.027	6.5325	0.018	59/548 (10.1%)	126/676 (19.1%)	64/246 (26.0%)	1.60 (1.01 to 2.28)	p < 0.005
SPARCL1	hCV25615626	History of Stroke	0.0494	5.15	0.0232	22/548 (4.0%)	35/676 (5.2%)	12/246 (4.9%)	0.40 (0.01 to 0.47)	0.54 (0.27 to 1.05)	p < 0.005
SPARCL1	hCV25615626	Any Report of Stroke Prior to or During CARE	7.8893	0.019	5.2821	22/548 (4.0%)	35/676 (5.2%)	9/246 (3.7%)	0.42 (0.19 to 0.84)	2.01 (1.05 to 3.62)	p < 0.005
SPARCL1	hCV25615626	Cardiac Revascularization	0.0093	4.9743	0.0257	17/21407 (0.2%)	14/634 (0.1%)	0.0000 (0.0%)	0.0000 (0.0%)	1.95 (1.11 to 3.02)	p < 0.005
SPARCL1	hCV25615626	CARE MI	0.0005	9.2159	0.0024	74/53 (1.3%)	34/712 (4.8%)				

* Results of the chi-square test of the SNP effect (based on the logistic regression model for placebo patients only).

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Significant Associations Between SNP Genotypes and Quantitative Phenotypes		Overall F-Test		SNP Effect F-Test		Placebo Patients mean (se) (N)		2 Rate Alleles		Significance Level	
Marker	Stratum Phenotype (at Baseline)	Statistic	p-value	Statistic	p-value	1 Rate Allele	2 Rate Alleles				
Public	hCV22274624 All Patients	5.55	0.004	5.5479	0.004	4.988 (0.016) (N= 545)	5.073 (0.036) (N= 114)			p < 0.005	
HDLBP	hCV22274624 All Patients	8	0.004	7.9953	0.004	27.873 (0.695) (N= 544)	32.000 (1.497) (N= 114)			p < 0.0005	
HDLBP	hCV22274624 All Patients	3.93	0.0198	3.9303	0.0198	0.509 (0.013) (N= 354)	0.561 (0.039) (N= 39)			p < 0.05	
HFE	hCV1085600 All Patients	7.36	0.007	7.3625	0.007	15.040 (0.050) (N= 353)	15.213 (0.181) (N= 39)			p < 0.0005	
HFE	hCV1085600 All Patients	13.49	<0.001	13.4903	<0.001	30.398 (0.093) (N= 353)	31.113 (0.281) (N= 39)			p < 0.0005	
LAMA2	hCV2592586 All Patients	6.95	0.001	6.9461	0.001	52.591 (0.623) (N= 379)	46.632 (1.984) (N= 38)			p < 0.005	
PLG	hCV2592586 All Patients	6.21	0.0021	6.2063	0.0021	123.834 (0.731) (N= 622)	123.371 (1.780) (N= 105)			p < 0.005	
MARK3	hCV2592586 All Patients	4.43	0.0121	4.4318	0.0121	0.101 (0.024) (N= 637)	0.196 (0.041) (N= 224)			p < 0.05	
MARK3	hCV2592586 All Patients	6.31	0.0019	6.3069	0.0019	0.064 (0.034) (N= 350)	0.277 (0.054) (N= 141)			p < 0.005	
MARK3	hCV2592586 All Patients	5.76	0.0165	5.7578	0.0165	0.130 (0.021) (N= 884)	0.277 (0.054) (N= 141)			p < 0.005	
PON2	hCV8952817 All Patients	4.95	0.0097	4.9545	0.0097	39.530 (0.393) (N= 524)	41.122 (0.986) (N= 83)			p < 0.05	
SOAT2	hCV15962568 All Patients	5.24	0.0054	5.242	0.0054	2.282 (0.029) (N= 704)	2.135 (0.052) (N= 218)			p < 0.05	
SOAT2	hCV15962568 All Patients	3.41	0.0335	3.4055	0.0335	39.362 (0.434) (N= 430)	42.191 (1.405) (N= 41)			p < 0.05	
SOAT2	hCV15962568 All Patients	3.9	0.0204	3.9027	0.0204	4.957 (0.019) (N= 430)	4.847 (0.060) (N= 41)			p < 0.05	
SOAT2	hCV15962568 All Patients	3.82	0.0222	3.8167	0.0222	25.888 (0.771) (N= 430)	22.561 (2.487) (N= 41)			p < 0.05	
SOAT2	hCV15962568 All Patients	4.05	0.0175	4.0544	0.0175	117.305 (3.123) (N= 430)	103.537 (10.114) (N= 41)			p < 0.05	

* Results of the Overall F-Test for the analysis of variance model in which the quantitative phenotype is a function of SNP genotype (based on placebo patients only).

** Results of the F-test of the SNP effect (based on the analysis of variance model for placebo patients only).

Least squares estimates of the mean and its standard error based on the analysis of variance model.

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[illegible]

ICV25/127673	All Patients	6.9147	0.0315	65596 (10.9%)	61650 (10.9%)	59564 (9.4%)	89697 (14.5%)	19242 (7.9%)	39208 (17.3%)	100 (0.69 to 1.45)	0.65 (0.33 to 1.11)	0.41 (0.18 to 0.94)	p < 0.05
ICV25/127673	Hisp. for Cardiovascular Disease	6.8949	0.0315	20556 (10.9%)	24450 (10.9%)	22564 (9.4%)	32367 (14.5%)	5224 (2.9%)	9924 (2.9%)	1.02 (0.61 to 1.28)	0.75 (0.47 to 1.10)	0.41 (0.18 to 0.94)	p < 0.05
ICV25/127673	All Patients	12.3727	0.0001	29566 (44.0%)	30596 (44.0%)	29566 (44.0%)	32367 (44.0%)	5224 (2.9%)	9924 (2.9%)	1.02 (0.61 to 1.28)	0.75 (0.47 to 1.10)	0.41 (0.18 to 0.94)	p < 0.05
ICV25/127673	Total Cardiovascular Disease Events	23.8979	0.0021	181956 (32.4%)	180580 (32.4%)	181956 (32.4%)	242697 (32.4%)	34790 (4.9%)	59424 (2.4%)	1.03 (0.81 to 1.29)	0.73 (0.46 to 1.15)	0.41 (0.25 to 0.77)	p < 0.0005
ICV25/127673	All Patients	36.5593	< 0.001	181956 (32.4%)	180580 (32.4%)	181956 (32.4%)	242697 (32.4%)	34790 (4.9%)	59424 (2.4%)	1.03 (0.81 to 1.29)	0.73 (0.46 to 1.15)	0.41 (0.25 to 0.77)	p < 0.0005
ICV25/127673	Fatal/Non-fatal Atherosclerotic CV Disease	26.4684	< 0.001	212556 (37.1%)	213664 (38.4%)	212556 (37.1%)	271697 (38.4%)	37924 (2.9%)	61924 (2.9%)	1.03 (0.81 to 1.29)	0.73 (0.47 to 1.13)	0.41 (0.24 to 0.71)	p < 0.0005
ICV25/127673	All Patients	4.9355	0.0077	212556 (37.1%)	213664 (38.4%)	212556 (37.1%)	271697 (38.4%)	37924 (2.9%)	61924 (2.9%)	1.03 (0.81 to 1.29)	0.73 (0.47 to 1.13)	0.41 (0.24 to 0.71)	p < 0.0005
ICV25/127673	Hisp. for Cardiovascular Disease	4.9355	0.0077	212556 (37.1%)	213664 (38.4%)	212556 (37.1%)	271697 (38.4%)	37924 (2.9%)	61924 (2.9%)	1.03 (0.81 to 1.29)	0.73 (0.47 to 1.13)	0.41 (0.24 to 0.71)	p < 0.0005
ICV25/127673	Total Cardiovascular Disease Events	19.1385	0.0185	46437 (5.9%)	18410 (5.9%)	46437 (5.9%)	30718 (5.9%)	3824 (2.5%)	16385 (3.8%)	0.77 (0.62 to 0.95)	0.58 (0.38 to 0.86)	0.41 (0.24 to 0.71)	p < 0.05
ICV25/127673	All Patients	13.4221	0.0197	75569 (12.5%)	29742 (3.9%)	75569 (12.5%)	30718 (5.9%)	3824 (2.5%)	16385 (3.8%)	0.77 (0.62 to 0.95)	0.58 (0.38 to 0.86)	0.41 (0.24 to 0.71)	p < 0.05
ICV25/127673	Cardiovascular Mortality	13.4221	0.0197	75569 (12.5%)	29742 (3.9%)	75569 (12.5%)	30718 (5.9%)	3824 (2.5%)	16385 (3.8%)	0.77 (0.62 to 0.95)	0.58 (0.38 to 0.86)	0.41 (0.24 to 0.71)	p < 0.05
ICV25/127673	All Patients	25.0799	0.0001	102693 (48.2%)	188410 (45.9%)	102693 (48.2%)	345718 (47.6%)	19324 (3.9%)	37924 (2.9%)	1.30 (1.01 to 2.39)	0.73 (0.44 to 1.20)	0.58 (0.34 to 1.03)	p < 0.05
ICV25/127673	Total Cardiovascular Disease Events	12.5678	0.0278	6.6563	0.0351	20543 (5.7%)	29742 (3.9%)	30718 (5.9%)	16385 (3.8%)	1.25 (0.66 to 2.30)	0.83 (0.47 to 1.21)	0.52 (0.30 to 0.88)	p < 0.05
ICV25/127673	All Patients	21.1468	0.0008	9.3567	0.0094	165437 (7.1%)	188410 (5.1%)	29742 (3.9%)	30718 (5.9%)	1.42 (0.81 to 1.42)	0.73 (0.45 to 1.20)	0.58 (0.34 to 0.88)	p < 0.05
ICV25/127673	Fatal/Non-fatal Atherosclerotic CV Disease	17.0558	0.0034	4.5923	0.0136	34778 (8.7%)	171402 (5.1%)	72735 (1.1%)	31275 (1.1%)	0.42 (0.27 to 0.65)	0.47 (0.45 to 1.20)	0.58 (0.34 to 0.88)	p < 0.05
ICV25/127673	All Patients	18.1127	0.0028	4.5923	0.0136	34778 (8.7%)	171402 (5.1%)	72735 (1.1%)	31275 (1.1%)	0.42 (0.27 to 0.65)	0.47 (0.45 to 1.20)	0.58 (0.34 to 0.88)	p < 0.05
ICV25/127673	Fatal/Non-fatal Atherosclerotic CV Disease	16.0056	0.0049	6.2165	0.0447	217738 (25.9%)	368783 (35.3%)	190625 (30.4%)	190570 (32.6%)	0.77 (0.62 to 0.95)	0.58 (0.38 to 1.37)	0.41 (0.23 to 0.81)	p < 0.05
ICV25/127673	All Patients	34.8995	< 0.001	7.1404	0.0281	19738 (1.9%)	14753 (1.2%)	14753 (1.2%)	39575 (6.7%)	0.95 (0.44 to 2.03)	0.32 (0.09 to 1.39)	1.65 (0.30 to 9.06)	p < 0.05
ICV25/127673	Is Stroke Occurred During CARE	28.2289	< 0.001	6.8104	0.0332	19738 (1.9%)	14753 (1.2%)	14753 (1.2%)	39575 (6.7%)	0.95 (0.44 to 2.03)	0.32 (0.09 to 1.39)	1.65 (0.30 to 9.	

IL2A	ICV16055300	All Patients	Coronary Artery Bypass Graft	0.0022	8.9376	0.0111	22/453 (4.9%)	58/459 (12.2%)	68/761 (8.9%)	72/716 (10.0%)	20/277 (7.2%)	19/267 (7.1%)	0.37 (0.22 to 0.61)	0.88 (0.38 to 2.06)	1.02 (0.37 to 2.80)	p < 0.005
IL2A	ICV16055300	All Patients	Coronary Artery Bypass or Revascularization	0.0001	8.1181	0.0014	50/463 (11.0%)	103/459 (22.7%)	123/761 (16.2%)	130/716 (18.5%)	42/277 (14.9%)	40/267 (15.0%)	0.40 (0.28 to 0.57)	0.85 (0.46 to 1.59)	0.98 (0.47 to 2.09)	p < 0.005
IL9	ICV3225168	All Patients	Nonfatal MI (Fatal/Nonfatal)	0.0001	8.2301	0.0037	29/128 (11.3%)	103/459 (22.7%)	130/761 (16.2%)	130/716 (18.5%)	42/277 (14.9%)	40/267 (15.0%)	0.41 (0.28 to 0.57)	0.85 (0.46 to 1.59)	0.98 (0.47 to 2.09)	p < 0.005
IL9	ICV3225168	All Patients	Nonfatal MI (Probable/Definite)	0.0001	8.2301	0.0037	29/128 (11.3%)	103/459 (22.7%)	130/761 (16.2%)	130/716 (18.5%)	42/277 (14.9%)	40/267 (15.0%)	0.41 (0.28 to 0.57)	0.85 (0.46 to 1.59)	0.98 (0.47 to 2.09)	p < 0.005
IL9	ICV3225168	All Patients	Nonfatal MI (def. & prob)	0.0001	8.2301	0.0037	29/128 (11.3%)	103/459 (22.7%)	130/761 (16.2%)	130/716 (18.5%)	42/277 (14.9%)	40/267 (15.0%)	0.41 (0.28 to 0.57)	0.85 (0.46 to 1.59)	0.98 (0.47 to 2.09)	p < 0.005
IL9	ICV3225168	All Patients	Fatal/Nonfatal MI (def. & prob)	0.0001	8.2301	0.0037	29/128 (11.3%)	103/459 (22.7%)	130/761 (16.2%)	130/716 (18.5%)	42/277 (14.9%)	40/267 (15.0%)	0.41 (0.28 to 0.57)	0.85 (0.46 to 1.59)	0.98 (0.47 to 2.09)	p < 0.005
IL9	ICV3225168	All Patients	Fatal/Nonfatal MI (def. & prob)	0.0001	8.2301	0.0037	29/128 (11.3%)	103/459 (22.7%)	130/761 (16.2%)	130/716 (18.5%)	42/277 (14.9%)	40/267 (15.0%)	0.41 (0.28 to 0.57)	0.85 (0.46 to 1.59)	0.98 (0.47 to 2.09)	p < 0.005
IL9	ICV3225168	All Patients	Fatal/Nonfatal MI (def. & prob)	0.0001	8.2301	0.0037	29/128 (11.3%)	103/459 (22.7%)	130/761 (16.2%)	130/716 (18.5%)	42/277 (14.9%)	40/267 (15.0%)	0.41 (0.28 to 0.57)	0.85 (0.46 to 1.59)	0.98 (0.47 to 2.09)	p < 0.005
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IL9	ICV3225168	All Patients	Fatal/Nonfatal MI (def. & prob)	0.0001	8.2301	0.0037	29/128 (11.3%)	103/459 (22.7%)	130/761 (16.2%)	130/716 (18.5%)	42/277 (14.9%)	40/267 (15.0%)	0.41 (0.28 to 0.57)	0.85 (0.46 to 1.59)	0.98 (0.47 to 2.09)	p < 0.005
IL9	ICV3225168	All Patients	Fatal/Nonfatal MI (def. & prob)	0.0001	8.2301	0.0037	29/128 (11.3%)	103/459 (22.7%)	130/761 (16.2%)	130/716 (18.5%)	42/277 (14.9%)	40/267 (15.0%)	0.41 (0.28 to 0.57)	0.85 (0.46 to 1.59)	0.98 (0.47 to 2.09)	p < 0.005
IL9	ICV3225168	All Patients	Fatal/Nonfatal MI (def. & prob)	0.0001	8.2301	0.0037	29/128 (11.3%)	103/459 (22.7%)	130/761 (16.2%)	130/716 (18.5%)	42/277 (14.9%)	40/267 (15.0%)	0.41 (0.28 to 0.57)	0.85 (0.46 to 1.59)	0.98 (0.47 to 2.09)	p < 0.005
IL9	ICV3225168	All Patients	Fatal/Nonfatal MI (def. & prob)	0.0001	8.2301	0.0037	29/128 (11.3%)	103/459 (22.7%)	130/761 (16.2%)	130/716 (18.5%)	42/277 (14.9%)	40/267 (15.0%)	0.41 (0.28 to 0.57)	0.85 (0.46 to 1.59)	0.98 (0.47 to 2.09)	p < 0.005
IL9	ICV3225168	All Patients	Fatal/Nonfatal MI (def. & prob)	0.0001	8.2301	0.0037	29/128 (11.3%)	103/459 (22.7%)	130/761 (16.2%)	130/716 (18.5%)	42/277 (14.9%)	40/267 (15.0%)	0.41 (0.28 to 0.57)	0.85 (0.46 to 1.59)	0.98 (0.47 to 2.09)	p < 0.005
IL9	ICV3225168	All Patients	Fatal/Nonfatal MI (def. & prob)	0.0001	8.2301	0.0037	29/128 (11.3%)	103/459 (22.7%)	130/761 (16.2%)	130/716 (18.5%)	42/277 (14.9%)	40/267 (15.0%)	0.41 (0.28 to 0.57)	0.85 (0.46 to 1.59)	0.98 (0.47 to 2.09)	p < 0.005
IL9	ICV3225168	All Patients	Fatal/Nonfatal MI (def. & prob)	0.0001	8.2301	0.0037	29/128 (11.3%)	103/459 (22.7%)	130/761 (16.2%)	130/716 (18.5%)	42/277 (14.9%)	40/267 (15.0%)	0.41 (0.28 to 0.57)	0.85		

Results of the Overall Score Test (chi-square test) for the logistic regression model in which the qualitative phenotype is a function of SNP genotype, treatment group, and the interaction between SNP genotype and treatment group.

** Results of the chi-square test of the interaction between SNP genotype and treatment group (based on the logistic regression model).

^{***} Results of the chi-square test of the interaction between SNP genotype and treatment group (based on the logistic regression model).

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RMI_Logistic Regression

Endpoint	Public	Marker	Genotype/ mode	Strata	Confounder	P _{risk} ^a	RR ^b	95% CI ^c	case ^d	Case AF% ^e	control ^f	Control AF% ^g
RMI(fatal MI, confirmed non-fatal MI)	A2M	hCV517658	HeI(CT)	All	statin, hx_smoke*	0.025	1.34	1.04-1.71	130	51.8	1137	44.8
RMI(fatal MI, confirmed non-fatal MI)	ENPP1	hCV1207994	HeI(CA)	All	statin	0.0706	1.28	0.98-1.66	73	28.9	616	24.2
RMI(fatal MI, confirmed non-fatal MI)	ISF1R	hCV6722361	HeI(TC)	All	statin	0.0039	2.01	1.26-3.08	17	6.7	80	3.1
RMI(fatal MI, confirmed non-fatal MI)	IRF3	hCV7798230	Rec(GG)	All	statin	0.0071	1.61	1.14-2.23	42	16.5	257	10.1
RMI(fatal MI, confirmed non-fatal MI)	LRP2	hCV16165996	Rec(TT)	All	statin	0.0324	0.45	0.21-0.93	7	2.8	160	6.3
RMI(fatal MI, confirmed non-fatal MI)	MC3R	hCV22274632	HeI(CA)	All	statin, hx_smoke*	0.0565	1.34	0.98-1.78	50	19.7	397	15.6
RMI(fatal MI, confirmed non-fatal MI)	MC3R	hCV25640926	HeI(GA)	All	statin, hx_smoke*	0.0264	1.4	1.04-1.85	51	20.1	389	15.2
RMI(fatal MI, confirmed non-fatal MI)	MC3R	hCV9465713	HeI(CT)	All	statin, hx_smoke*	0.0225	1.41	1.05-1.87	51	20.2	388	15.2

* History of smoking

^a Significance of risk estimated by Wald test^b Relative risk^c 95% confidence interval for relative risk^d Number of patients (with the corresponding genotype or mode) developed recurrent MI during 5 years of follow up^e The allele frequency of patients (with the corresponding genotype or mode) developed recurrent MI during 6 years of follow up^f Number of patients (with the corresponding genotype or mode) had MI^g The allele frequency of patients (with the corresponding genotype or mode) had MI

TABLE 9, page 2 of 3

RMI Replication Between CARE and PreCARE Sample Sets

			Analysis 1 of CARE samples										Analysis 2 of CARE Samples									
Endpoint	Genotype/ mode	Marker	Strata	P ^a ik, aa ^a	OR ^b	95%CI ^c	case ^d	AF(%) ^e	control ^f	AF(%) ^g	Control	Strata	P ^a ik, aa ^a	OR ^b	95%CI ^c	case ^d	AF(%) ^e	control ^f	AF(%) ^g	Control		
RMI(fatal MI, confirmed non-fatal MI)	Public	FABP2	hCV7161961	AGE_T1	0.01	0.50	0.3-0.9	19	40.8	110	25.2	AGE_T1	0.01	0.5	0.3-0.9	21	26.6	187	41.7			
RMI(fatal MI, confirmed non-fatal MI)	HLA-DPB1	hCV6851080	Rec(GG)	AGE_T3	0.037	2.70	1.1-6.7	10	11.1	11	4.4	AGE_T3	0.039	1.9	1.0-3.6	19	10.7	25	5.8			
RMI(fatal MI, confirmed non-fatal MI)	IL12RB1	hCV755442	Allelic(G)	BMI>30.5	0.09	0.60	0.4-1.0	29	25.0	104	34.7	BMI>30.5	0.005	0.5	0.4-0.8	33	23.2	192	35.7			
RMI(fatal MI, confirmed non-fatal MI)	KDR	hCV16192174	Allelic(A)	HYP_Y	0.03	1.80	1.1-3.1	28	23.5	45	14.4	HYP_Y	0.03	1.7	1.0-2.7	4	2.4	2	0.4			
RMI(fatal MI, confirmed non-fatal MI)	KLK81	hCV22272967	Dom(GA+AA)	HYP_Y	0.025	1.80	1.1-3.1	96	82.1	223	71.3	HYP_Y	0.034	1.3	1.0-1.7	180	53.6	500	46.9			
RMI(fatal MI, confirmed non-fatal MI)	MMP7	hCV3210858	Allelic(T)	AGE_T1	0.029	0.60	0.3-1.0	21	13.8	117	21.8	AGE_T1	0.033	0.6	0.4-1.0	23	14.8	197	22.0			
RMI(fatal MI, confirmed non-fatal MI)	WRN	hCV3020386	Rec(TT)	AGE_T1	0.06	1.3	1.0-3.4	20	26.3	43	16.3	AGE_T1	0.018	1.9	1.1-3.1	30	38.0	110	24.7			
RMI(fatal MI, confirmed non-fatal MI)	LRP2	hCV16165996	Rec(TT)	All	0.015	0.30	0.1-0.9	7	2.8	65	6.2	All	0.002	0.3	0.1-0.7	11	2.8	92	7.0			
RMI(fatal MI, confirmed non-fatal MI)	LRP8	hCV190754	He(TC)/Dom(TC+TT)	APOE4 allele	0.1	1.80	0.9-3.6	28	124	124		APOE4 allele	0.1	1.5	0.9-2.3	60	128	391				
RMI(fatal MI, confirmed non-fatal MI)	LRP8	hCV190754	He(TC)/Dom(TC+TT)	APOE4 not	0.0011	1.00	0.7-1.4	75	389	389		APOE4 not	0.98	0.7-1.4	164	164	391					
RMI(fatal MI, confirmed non-fatal MI)	KDR	hCV16192174	Dom(AA+AG)	APOE4 allele		2.80	1.4-5.4	18	51	51		APOE4 allele	1.5	0.9-2.6	26	26	43					
RMI(fatal MI, confirmed non-fatal MI)	KDR	hCV16192174	Dom(AA+AG)	APOE4 not		0.70	0.4-1.2	25	167	167		APOE4 not	1.0	0.7-1.37								
RMI(fatal MI, confirmed non-fatal MI)	KDR	hCV16192174	Dom(AA+AG)									APOE4/2	0.0048	16.6	1.28-158							
RMI(fatal MI, confirmed non-fatal MI)	KDR	hCV16192174	Dom(AA+AG)									APOE4 not	1.0	0.8-1.42								

* Significance of risk estimated by Wald test

b Odds ratio

c 95% confidence interval for odds ratio

d Number of patients (with the corresponding genotype or mode) developed recurrent MI during 5 years of follow up

e The allele frequency of patients (with the corresponding genotype or mode) developed recurrent MI during 5 years of follow up

f Number of patients (with the corresponding genotype or mode) had MI

g The allele frequency of patients (with the corresponding genotype or mode) had MI

AGE_T1 Indicate that Age<55

AGE_T13 Indicate that age>=64

HYP_Y Indicate that patients had history of hypertension

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Stroke Replication Between CARE and PreCARE Sample Sets

Endpoint	Public	Marker	Genotype/mode	Analysis 1 of CARE samples							Analysis 2 of CARE Samples								
				Strata	P risk test ^a	OR ^b	95%CI ^c	case ^d	AF(%) ^e	Control AF(%) ^f	Strata	P risk test ^a	OR ^b	95%CI ^c	case ^d	AF(%) ^e	Control AF(%) ^f		
Stroke	ACA12	hCV1361979	Dom(AA+GA)/Allele(G)	male	0.015	1.7	1.1-2.7	89	75.42	715	64.18	male	0.013	1.5	1.1-2.2	73	53.68	926	42.71
Stroke	AP0A4	hCV11482765	Rec(CC)	all	0.016	3.5	1.4-9.1	6	4.23	16	1.24	all	0.05	3.3	1.1-9.8	4	5	20	1.59
Stroke	HTR2A	hCV11656920	Rec(AA)	all	0.06	5.8	1.9-18.1	5	3.52	8	0.62	all	0.039	4.9	1.3-18.0	3	3.75	10	0.79
Stroke	ICAM1	hCV8725331	Rec(AA)	all	0.1	3	1.2-9.3	5	3.52	14	1.09	all	0.04	2.6	0.9-10.6	3	3.75	16	1.27
Stroke	ICAM1	hCV8725331	Rec(AA)	male	0.01	4.8	1.6-14.3	5	4.17	10	0.9	male	0.06	3.8	1.1-13.8	3	4.41	13	1.19
Stroke	KCNMB1	hCV3020205	Het(GC)	male	0.019	1.7	1.1-2.7	29	24.58	176	15.81	male	0.074	1.7	1.0-2.9	18	28.47	193	17.69

*Significance of risk estimated by Wald test

^b Odds ratio^c 95% confidence interval for odds ratio^d Number of patients (with the corresponding genotype or mode) developed recurrent MI during 5 years of follow up^e The allele frequency of patients (with the corresponding genotype or mode) developed recurrent MI during 5 years of follow up^f Number of patients (with the corresponding genotype or mode) had MI^g The allele frequency of patients (with the corresponding genotype or mode) had MI

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Risk of cardiovascular disease events associated with Pravastatin by genotypes												
Gene symbol	hCV	Case Y PRIMER ALLELE Nucleotide Freq*	Control Y PRIMER ALLELE Nucleotide Freq**	Stratum	Group	ptrend ^a	N ^{att^b}	N ^{unatt^c}	RR ^d	RR 95%CI ^e	P _{risk est.} ^f	P _{int.} ^g Covars ^h
ATF6	hCV25631989	0.04	0.08	Placebo	hom(TT) vs. ref(CC)		1	5	1.49	(0.25-9.00)	0.6624	none
					het(TC) vs. ref(CC)		9	185	0.42	(0.22-0.80)	0.0089	
				Statin	ref(CC)		128	1018	1.00			
					hom(TT) vs. ref(CC)		0	11	NA			
					het(TC) vs. ref(CC)		24	189	1.53	(0.99-2.34)	0.0535	
					ref(CC)		85	1066	1.00			
LAMA2	hCV16047108	0.06	0.07	Maj Hom (CC)	Statin		85	1066	0.66	(0.51-0.86)	0.0019	none
					Placebo		128	1018	1.00			
				Het (TC)	Statin		24	189	2.43	(1.165-10)	0.0189	
					Placebo		9	185	1.00			
				Min Hom (TT)	Statin		0	11	NA			
					Placebo		1	5	1.00			
				Placebo	hom(GG) vs. ref(AA)		0	7	NA			
					het(GA) vs. ref(AA)		17	147	0.98	(0.61-1.58)	0.9257	
					ref(AA)		128	1079	1.00			
					hom(GG) vs. ref(AA)		2	4	4.97	(1.57-15.70)	0.0063	
					het(GA) vs. ref(AA)		22	140	2.02	(1.30-3.14)	0.0017	
					ref(AA)		84	1168	1.00			
ITGA9	hCV25644901	0.08	0.04	Maj Hom (AA)	Statin		84	1168	0.63	(0.49-0.82)	0.0007	none
					Placebo		128	1079	1.00			
				Het (GA)	Statin		22	140	1.31	(0.72-2.37)	0.3732	
					Placebo		17	147	1.00			
				Min Hom (GG)	Statin		2	4	NA			
					Placebo		0	7	1.00			
				Placebo	dom(GA+GG) vs. ref(AA)		24	105	1.92	(1.29-2.86)	0.0013	
					ref(AA)		121	1129	1.00			
					dom(GA+GG) vs. ref(AA)		6	123	0.58	(0.26-1.31)	0.1904	
					ref(AA)		103	1192	1.00			
					Statin		103	1192	0.82	(0.64-1.06)	0.1251	
					Placebo		121	1129	1.00			
LAMA5	hCV25629492	0.38	0.36	Maj Hom (AA)	Statin		6	123	0.25	(0.11-0.59)	0.0016	none
					Placebo		24	105	1.00			
				Dom (GA+GG)	hom(GG) vs. ref(AA)	0.3885	25	172	1.26	(0.81-1.95)	0.3086	
					het(GA) vs. ref(AA)		61	532	1.02	(0.73-1.43)	0.9170	
				Placebo	ref(AA)		59	525	1.00			
					hom(GG) vs. ref(AA)	0.0193	13	193	0.64	(0.36-1.14)	0.1306	
				Statin	het(GA) vs. ref(AA)		36	595	0.58	(0.39-0.86)	0.0074	
					ref(AA)		57	520	1.00			
				Placebo	Statin		57	520	0.98	(0.69-1.38)	0.8972	
					Placebo		59	525	1.00			
					Het(GA)		36	595	0.55	(0.37-0.82)	0.0036	
					Placebo		61	532	1.00			
					Min Hom(GG)		13	193	0.50	(0.26-0.94)	0.0327	
					Statin							

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KLK14	hCV16044337	0.62	0.69	Placebo	Placebo	25	172	1.00	(1.19-2.92)	0.0063	0.0188 none
				hom(AA) vs. ref(GG)	hom(AA) vs. ref(GG)	23	117	1.87	(0.89-1.75)	0.2073	
				het(GA) vs. ref(GG)	het(GA) vs. ref(GG)	64	521	1.24	(0.25-1.28)	0.1678	
				ref(GG)	ref(GG)	57	591	1.00	(0.69-1.46)	0.9629	
				hom(AA) vs. ref(GG)	hom(AA) vs. ref(GG)	6	128	0.56			
				het(GA) vs. ref(GG)	het(GA) vs. ref(GG)	50	570	1.01			
				ref(GG)	ref(GG)	53	610	1.00			
				Maj Hom(GG)	Statin	53	610	0.91	(0.64-1.30)	0.5005	
				Placebo	Placebo	57	591	1.00			
				Het(GA)	Statin	50	570	0.74	(0.52-1.05)	0.0897	
GAPD	hCV8921288	0.75	0.81	Placebo	Placebo	64	521	1.00			0.0209 none
				Min Hom(AA)	Statin	6	128	0.27	(0.11-0.65)	0.0033	
				Placebo	Placebo	23	117	1.00			
				hom(CC) vs. ref(AA)	hom(CC) vs. ref(AA)	7	51	1.38	(0.67-2.86)	0.3819	
				het(AC) vs. ref(AA)	het(AC) vs. ref(AA)	55	363	1.51	(1.09-2.09)	0.0138	
				ref(AA)	ref(AA)	76	795	1.00			
				hom(CC) vs. ref(AA)	hom(CC) vs. ref(AA)	4	54	0.81	(0.31-2.13)	0.5634	
				het(AC) vs. ref(AA)	het(AC) vs. ref(AA)	27	391	0.76	(0.50-1.15)	0.1924	
				ref(AA)	ref(AA)	78	834	1.00			
				Maj Hom(AA)	Statin	78	834	0.98	(0.72-1.33)	0.8966	
CD6	hCV25922320	0.82	0.78	Placebo	Placebo	76	795	1.00			HX_SM OKE_1
				Het(AC)	Statin	27	391	0.49	(0.32-0.76)	0.0015	
				Placebo	Placebo	55	363	1.00			
				Min Hom(CC)	Statin	4	54	0.57	(0.18-1.85)	0.3499	
				Placebo	Placebo	7	51	1.00			
				hom(AA) vs. ref(GG)	hom(AA) vs. ref(GG)	4	60	0.53	(0.20-1.38)	0.1911	
				het(GA) vs. ref(GG)	het(GA) vs. ref(GG)	43	415	0.80	(0.57-1.12)	0.1872	
				ref(GG)	ref(GG)	98	756	1.00			
				hom(AA) vs. ref(GG)	hom(AA) vs. ref(GG)	3	57	0.79	(0.25-2.43)	0.6753	
				het(GA) vs. ref(GG)	het(GA) vs. ref(GG)	46	395	1.65	(1.14-2.38)	0.0077	
SLC18A1	hCV2715953	0.88	0.92	Placebo	Placebo	59	861	1.00			0.0274 none
				Maj Hom(GG)	Statin	59	861	0.55	(0.40-0.74)	0.0001	
				Placebo	Placebo	98	756	1.00			
				Het(GA)	Statin	46	395	1.13	(0.76-1.68)	0.5393	
				Placebo	Placebo	43	415	1.00			
				Min Hom(AA)	Statin	3	57	0.82	(0.19-3.49)	0.7846	
				Placebo	Placebo	4	60	1.00			
				hom(CC) vs. ref(GG)	hom(CC) vs. ref(GG)	4	17	1.92	(0.78-4.71)	0.1560	
				het(GC) vs. ref(GG)	het(GC) vs. ref(GG)	26	175	1.30	(0.87-1.94)	0.1950	
				ref(GG)	ref(GG)	115	1042	1.00			
PTPRJ	hCV8995373	0.86	0.82	Placebo	Placebo	0	12				0.0274 none
				Statin	Statin	14	229	0.72	(0.42-1.23)	0.9995	
				ref(GG)	ref(GG)	93	1063	1.00		0.2295	
				Maj Hom(GG)	Statin	93	1063	0.81	(0.62-1.05)	0.1121	
				Placebo	Placebo	115	1042	1.00			
				Het(GC)	Statin	14	229	0.45	(0.24-0.83)	0.0109	
				Placebo	Placebo	26	175	1.00			
				Min Hom(CC)	Statin	0	12				
				Placebo	Placebo	4	17	1.00			
				hom(AA) vs. ref(GG)	hom(AA) vs. ref(GG)	2	40	0.42	(0.11-1.65)	0.2156	

Study	Comparison	h	h ₀	h ₁	h ₂	h ₃	h ₄	h ₅	h ₆	h ₇	h ₈	h ₉	h ₁₀	h ₁₁	h ₁₂	h ₁₃	h ₁₄	h ₁₅	h ₁₆	h ₁₇	h ₁₈	h ₁₉	h ₂₀	h ₂₁	h ₂₂	h ₂₃	h ₂₄	h ₂₅	h ₂₆	h ₂₇	h ₂₈	h ₂₉	h ₃₀	h ₃₁	h ₃₂	h ₃₃	h ₃₄	h ₃₅	h ₃₆	h ₃₇	h ₃₈	h ₃₉	h ₄₀	h ₄₁	h ₄₂	h ₄₃	h ₄₄	h ₄₅	h ₄₆	h ₄₇	h ₄₈	h ₄₉	h ₅₀	h ₅₁	h ₅₂	h ₅₃	h ₅₄	h ₅₅	h ₅₆	h ₅₇	h ₅₈	h ₅₉	h ₆₀	h ₆₁	h ₆₂	h ₆₃	h ₆₄	h ₆₅	h ₆₆	h ₆₇	h ₆₈	h ₆₉	h ₇₀	h ₇₁	h ₇₂	h ₇₃	h ₇₄	h ₇₅	h ₇₆	h ₇₇	h ₇₈	h ₇₉	h ₈₀	h ₈₁	h ₈₂	h ₈₃	h ₈₄	h ₈₅	h ₈₆	h ₈₇	h ₈₈	h ₈₉	h ₉₀	h ₉₁	h ₉₂	h ₉₃	h ₉₄	h ₉₅	h ₉₆	h ₉₇	h ₉₈	h ₉₉	h ₁₀₀	h ₁₀₁	h ₁₀₂	h ₁₀₃	h ₁₀₄	h ₁₀₅	h ₁₀₆	h ₁₀₇	h ₁₀₈	h ₁₀₉	h ₁₁₀	h ₁₁₁	h ₁₁₂	h ₁₁₃	h ₁₁₄	h ₁₁₅	h ₁₁₆	h ₁₁₇	h ₁₁₈	h ₁₁₉	h ₁₂₀	h ₁₂₁	h ₁₂₂	h ₁₂₃	h ₁₂₄	h ₁₂₅	h ₁₂₆	h ₁₂₇	h ₁₂₈	h ₁₂₉	h ₁₃₀	h ₁₃₁	h ₁₃₂	h ₁₃₃	h ₁₃₄	h ₁₃₅	h ₁₃₆	h ₁₃₇	h ₁₃₈	h ₁₃₉	h ₁₄₀	h ₁₄₁	h ₁₄₂	h ₁₄₃	h ₁₄₄	h ₁₄₅	h ₁₄₆	h ₁₄₇	h ₁₄₈	h ₁₄₉	h ₁₅₀	h ₁₅₁	h ₁₅₂	h ₁₅₃	h ₁₅₄	h ₁₅₅	h ₁₅₆	h ₁₅₇	h ₁₅₈	h ₁₅₉	h ₁₆₀	h ₁₆₁	h ₁₆₂	h ₁₆₃	h ₁₆₄	h ₁₆₅	h ₁₆₆	h ₁₆₇	h ₁₆₈	h ₁₆₉	h ₁₇₀	h ₁₇₁	h ₁₇₂	h ₁₇₃	h ₁₇₄	h ₁₇₅	h ₁₇₆	h ₁₇₇	h ₁₇₈	h ₁₇₉	h ₁₈₀	h ₁₈₁	h ₁₈₂	h ₁₈₃	h ₁₈₄	h ₁₈₅	h ₁₈₆	h ₁₈₇	h ₁₈₈	h ₁₈₉	h ₁₉₀	h ₁₉₁	h ₁₉₂	h ₁₉₃	h ₁₉₄	h ₁₉₅	h ₁₉₆	h ₁₉₇	h ₁₉₈	h ₁₉₉	h ₂₀₀	h ₂₀₁	h ₂₀₂	h ₂₀₃	h ₂₀₄	h ₂₀₅	h ₂₀₆	h ₂₀₇	h ₂₀₈	h ₂₀₉	h ₂₁₀	h ₂₁₁	h ₂₁₂	h ₂₁₃	h ₂₁₄	h ₂₁₅	h ₂₁₆	h ₂₁₇	h ₂₁₈	h ₂₁₉	h ₂₂₀	h ₂₂₁	h ₂₂₂	h ₂₂₃	h ₂₂₄	h ₂₂₅	h ₂₂₆	h ₂₂₇	h ₂₂₈	h ₂₂₉	h ₂₃₀	h ₂₃₁	h ₂₃₂	h ₂₃₃	h ₂₃₄	h ₂₃₅	h ₂₃₆	h ₂₃₇	h ₂₃₈	h ₂₃₉	h ₂₄₀	h ₂₄₁	h ₂₄₂	h ₂₄₃	h ₂₄₄	h ₂₄₅	h ₂₄₆	h ₂₄₇	h ₂₄₈	h ₂₄₉	h ₂₅₀	h ₂₅₁	h ₂₅₂	h ₂₅₃	h ₂₅₄	h ₂₅₅	h ₂₅₆	h ₂₅₇	h ₂₅₈	h ₂₅₉	h ₂₆₀	h ₂₆₁	h ₂₆₂	h ₂₆₃	h ₂₆₄	h ₂₆₅	h ₂₆₆	h ₂₆₇	h ₂₆₈	h ₂₆₉	h ₂₇₀	h ₂₇₁	h ₂₇₂	h ₂₇₃	h ₂₇₄	h ₂₇₅	h ₂₇₆	h ₂₇₇	h ₂₇₈	h ₂₇₉	h ₂₈₀	h ₂₈₁	h ₂₈₂	h ₂₈₃	h ₂₈₄	h ₂₈₅	h ₂₈₆	h ₂₈₇	h ₂₈₈	h ₂₈₉	h ₂₉₀	h ₂₉₁	h ₂₉₂	h ₂₉₃	h ₂₉₄	h ₂₉₅	h ₂₉₆	h ₂₉₇	h<
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Statin	hom (AA) vs. ref (GG)	het (GA) vs. ref (GG)	ref (GG)	1	8	1.38	(0.22-8.83)	0.7350	0.0463	none
Maj Hom (GG)	Statin	0.2107	99	1129	0.82	(0.64-1.06)	0.1339			
	Placebo		116	1067	1.00					
Het (GA)	Statin		9	178	0.32	(0.16-0.66)	0.0021			
	Placebo		28	159	1.00					
Min Hom (AA)	Statin		1	8	1.33	(0.10-18.57)	0.8305			
	Placebo		1	11	1.00					
PLAB	hCV7494810	0.27	0.25	0.2988	7	83	0.85	(0.41-1.80)	0.6778	
	Placebo		65	442	1.39	(1.01-1.90)	0.0408			
	ref (CC)		73	709	1.00					
Statin	hom (GG) vs. ref (CC)	0.0605	5	78	0.68	(0.28-1.63)	0.3889			
	het (GC) vs. ref (CC)		31	491	0.67	(0.45-1.01)	0.0534			
	ref (CC)		72	744	1.00					
Maj Hom (CC)	Statin		72	744	0.94	(0.69-1.29)	0.7177			
	Placebo		73	709	1.00					
Het (GC)	Statin		31	491	0.46	(0.30-0.69)	0.0002			
	Placebo		65	442	1.00					
Min Hom (GG)	Statin		5	78	0.75	(0.25-2.27)	0.6137			
	Placebo		7	83	1.00					
LPA	hCV11225994	0.90	0.86	0.1018	3	21	1.09	(0.37-3.20)	0.8695	
	Placebo		24	300	0.65	(0.43-0.99)	0.0437			
	ref (GG)		117	907	1.00					
Statin	hom (AA) vs. ref (GG)	0.2142	5	25	2.34	(1.02-5.35)	0.0449			
	het (GA) vs. ref (GG)		24	294	1.06	(0.68-1.64)	0.8037			
	ref (GG)		76	989	1.00					
Maj Hom (GG)	Statin		76	989	0.62	(0.47-0.82)	0.0008			
	Placebo		117	907	1.00					
Het (GA)	Statin		24	294	1.02	(0.59-1.76)	0.9463			
	Placebo		24	300	1.00					
Min Hom (AA)	Statin		5	25	1.33	(0.35-5.03)	0.6709			
	Placebo		3	21	1.00					
FN1	hCV9506149	0.24	0.28	0.2100	11	91	0.92	(0.51-1.66)	0.7735	
	Placebo		48	500	0.74	(0.53-1.04)	0.0846			
	ref (AA)		86	645	1.00					
Statin	hom (TT) vs. ref (AA)	0.0985	13	97	1.72	(0.97-3.06)	0.0647			
	het (TA) vs. ref (AA)		45	525	1.15	(0.78-1.69)	0.4814			
	ref (AA)		51	691	1.00					
Maj Hom (AA)	Statin		51	691	0.58	(0.42-0.81)	0.0015			
	Placebo		86	645	1.00					
Het (TA)	Statin		45	525	0.90	(0.61-1.33)	0.6010			
	Placebo		48	500	1.00					
Min Hom (TT)	Statin		13	97	1.10	(0.51-2.33)	0.8125			
	Placebo		11	91	1.00					
PPOX	hCV25922816	0.92	0.94	0.2414	1	4	1.98	(0.34-11.53)	0.4467	
	Placebo		21	146	1.25	(0.81-1.92)	0.3216			
	ref (GG)		21	146	1.00					
Statin	hom (AA) vs. ref (GG)		0	9						
	het (GA) vs. ref (GG)		10	179	0.64	(0.34-1.20)	0.1636			

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		ref(GG)	99	1095	1.00	0.0463	none
ITGA9	Maj Hom(GG)	Statin	99	1095	0.82	(0.64-1.06)	0.1294
		Placebo	21	146	1.00		
	Het(GA)	Statin	10	179	0.42	(0.20-0.87)	0.0191
		Placebo	21	146	1.00		
	Min Hom(AA)	Statin	0	9			
		Placebo	1	4	1.00		
	Placebo	hom(GG) vs. ref(AA)	34	225	1.48	(0.96-2.28)	0.0745
		ref(AA) vs. ref(AA)	71	600	1.19	(0.83-1.72)	0.3480
		ref(AA)	40	411	1.00		
	Statin	hom(GG) vs. ref(AA)	10	240	0.54	(0.27-1.06)	0.0744
		het(GA) vs. ref(AA)	63	629	1.22	(0.82-1.91)	0.3180
		ref(AA)	36	447	1.00		
	Maj Hom(AA)	Statin	36	447	0.84	(0.55-1.29)	0.4297
		Placebo	40	411	1.00		
	Het(GA)	Statin	63	629	0.86	(0.62-1.19)	0.3603
		Placebo	71	600	1.00		
	Min Hom(GG)	Statin	10	240	0.30	(0.15-0.60)	0.0007
		Placebo	34	225	1.00		
	Placebo	hom(GG) vs. ref(CC)	29	217	1.38	(0.88-2.17)	0.1603
		het(GC) vs. ref(CC)	76	592	1.32	(0.92-1.90)	0.1351
MACF1		ref(CC)	40	424	1.00		
	Statin	hom(GG) vs. ref(CC)	12	228	0.60	(0.32-1.12)	0.1110
		het(GC) vs. ref(CC)	55	620	0.98	(0.67-1.44)	0.9179
		ref(CC)	42	466	1.00		
	Maj Hom(CC)	Statin	42	466	0.96	(0.63-1.45)	0.8310
		Placebo	40	424	1.00		
	Het(GC)	Statin	55	620	0.71	(0.51-0.99)	0.0417
		Placebo	76	592	1.00		
	Min Hom(GG)	Statin	12	228	0.42	(0.22-0.80)	0.0082
		Placebo	29	217	1.00		
IL4R	Placebo	hom(GG) vs. ref(AA)	8	46	1.46	(0.75-2.85)	0.2677
		het(GA) vs. ref(AA)	50	393	1.13	(0.82-1.57)	0.4552
		ref(AA)	86	789	1.00		
	Statin	hom(GG) vs. ref(AA)	3	56	0.61	(0.20-1.88)	0.3887
		het(GA) vs. ref(AA)	31	447	0.76	(0.51-1.14)	0.1889
		ref(AA)	75	811	1.00		
	Maj Hom(AA)	Statin	75	811	0.85	(0.63-1.14)	0.2842
		Placebo	86	789	1.00		
	Het(GA)	Statin	31	447	0.57	(0.37-0.88)	0.0109
		Placebo	50	393	1.00		
ABCA1	Min Hom(GG)	Statin	3	56	0.36	(0.10-1.27)	0.1118
		Placebo	8	46	1.00		
	Placebo	hom(TT) vs. ref(CC)	6	84	0.54	(0.24-1.16)	0.1188
		het(TC) vs. ref(CC)	49	516	0.70	(0.50-0.97)	0.0338
		ref(CC)	90	637	1.00		
	Statin	hom(TT) vs. ref(CC)	9	99	1.14	(0.57-2.19)	0.6981
		het(TC) vs. ref(CC)	48	555	1.09	(0.75-1.58)	0.6440
		ref(CC)	52	662	1.00		
	Maj Hom(CC)	Statin	52	662	0.59	(0.42-0.82)	0.0013
							0.0369 none

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ABCA1	hCV2741083	0.93	0.87	Placebo	hom(CC)vs. ref(TT)	0.0054	1	18	0.15	(0.06-2.51)	0.395	
				Placebo	het(TC)vs. ref(TT)		18	275	0.52	(0.32-0.84)	0.0063	
				Placebo	ref(TT)		126	943	1.00			
				Statin	hom(CC)vs. ref(TT)	0.3109	2	26	1.00	(0.25-3.46)	0.9946	
				Placebo	het(TC)vs. ref(TT)		30	294	1.29	(0.86-1.91)	0.2178	
				ref(TT)		77	996	1.00			0.0051	none
				Maj Hom(TT)	Statin		77	996	0.61	(0.46-0.80)	0.0003	
				Placebo		126	943	1.00				
				HeT(TC)	Statin		30	294	1.51	(0.86-2.57)	0.1517	
				Placebo		18	275	1.00				
				Min Hom(CC)	Statin		2	26	1.36	(0.12-9.07)	0.7966	
CYBA	hCV2038	0.33	0.34	Placebo	hom(AA) vs. ref(GG)	0.6072	14	149	0.81	(0.46-1.40)	0.4414	
				Placebo	het(AG) vs. ref(GG)		68	555	1.05	(0.76-1.44)	0.7862	
				Statin	ref(GG)		63	533	1.00			
				Placebo	hom(AA) vs. ref(GG)	0.0086	18	132	2.02	(1.18-3.44)	0.0102	
				Placebo	het(AG) vs. ref(GG)		55	612	1.40	(0.94-2.10)	0.1009	
				ref(GG)		36	571	1.00			0.0260	rx_smoke
				Maj Hom(GG)	Statin		36	571	0.55	(0.37-0.82)	0.0031	
				Placebo		63	533	1.00				
				HeT(AG)	Statin		55	612	0.74	(0.53-1.04)	0.0821	
				Placebo		68	555	1.00				
				Min Hom(AA)	Statin		18	132	1.38	(0.72-2.68)	0.3354	
HLA-DPB1	hCV8851085	0.81	0.77	Placebo	hom(AA) vs. ref(GG)	0.2553	4	66	0.53	(0.19-1.34)	0.6898	
				Placebo	het(GA)vs. ref(GG)		48	424	0.93	(0.66-1.29)	0.6823	
				Statin	ref(GG)		92	745	1.00			
				Placebo	hom(AA) vs. ref(GG)	0.021	8	53	1.97	(0.96-3.77)	0.0645	
				Placebo	het(GA)vs. ref(GG)		43	445	1.40	(0.95-2.02)	0.085	
				ref(GG)		58	814	1.00			0.0154	rx_smoke
				Maj Hom(GG)	Statin		58	814	0.58	(0.42-0.80)	0.0009	
				Placebo		92	745	1.00				
				HeT(GA)	Statin		43	445	0.87	(0.58-1.29)	0.0501	
				Placebo		48	424	1.00				
				Min Hom(AA)	Statin		8	53	2.19	(0.68-5.87)	0.1805	
HSPG2	hCV1603656	0.10	0.08	Placebo	hom(TT) vs. ref(CC)	0.1704	2	6	2.46	(0.60-6.24)	0.1954	
				Placebo	het(TC)vs. ref(CC)		25	177	1.23	(0.81-1.83)	0.3189	
				Statin	ref(CC)		118	1054	1.00			
				Placebo	hom(TT) vs. ref(CC)	0.1033	0	11	N/A		0.9771	
				Placebo	het(TC)vs. ref(CC)		11	196	0.65	(0.35-1.18)	0.1607	
				ref(CC)		98	1105	1.00			0.0334	rx_smoke
				Maj Hom(CC)	Statin		98	1105	0.80	(0.62-1.04)	0.0908	
				Placebo		118	1054	1.00				
				HeT(TC)	Statin		11	196	0.42	(0.21-0.84)	0.013	

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HSPG2	hCV1603692	0.08	0.06	Min Hom(TT)	Placebo	25	177	1.00	0.9745	
					Statin	0	11	N/A		
					Placebo	2	6	1.00		
					Placebo	hom(TT) vs. ref(CC)	1	4		1.98 (0.27-6.86)
						het (TC)vs. ref(CC)	21	130		1.37 (0.88-2.07)
						ref(CC)	123	1093		1.00
						hom(TT) vs. ref(CC)	0	6		N/A
					Statin	het (TC)vs. ref(CC)	8	146		0.65 (0.22-1.28)
						ref(CC)	101	1157		1.00
						Statin	101	1157		0.79 (0.61-1.02)
HSPG2	hCV1603697	0.08	0.06	Min Hom(TT)	Placebo	123	1093	1.00	0.0427	
					Statin	8	146	0.37 (0.17-0.82)		
					Placebo	21	130	1.00		
					Statin	0	6	N/A		
					Placebo	hom(TT) vs. ref(CC)	1	4		1.99 (0.34-11.59)
						het (TC)vs. ref(CC)	21	129		1.39 (0.91-2.14)
						ref(CC)	123	1102		1.00
						hom(TT) vs. ref(CC)	0	6		N/A
					Statin	het (TC)vs. ref(CC)	8	145		0.65 (0.32-1.32)
						ref(CC)	101	1162		1.00
Statin	101	1162	0.80 (0.62-1.02)							
HSPG2	hCV16172339	0.08	0.06	Min Hom(TT)	Placebo	123	1102	1.00	0.0447	
					Statin	8	145	0.37 (0.17-0.82)		
					Placebo	21	129	1.00		
					Statin	0	-6	N/A		
					Placebo	hom(TT) vs. ref(CC)	1	4		2.00 (0.27-6.94)
						het (TC)vs. ref(CC)	21	128		1.41 (0.91-2.13)
						ref(CC)	122	1100		1.00
						hom(TT) vs. ref(CC)	0	6		N/A
					Statin	het (TC)vs. ref(CC)	8	144		0.66 (0.32-1.30)
						ref(CC)	101	1160		1.00
Statin	101	1160	0.80 (0.62-1.03)							
NPC1	hCV25472673	0.53	0.62	Min Hom(TT)	Placebo	122	1100	1.00	0.0093	
					Statin	8	144	0.37 (0.16-0.82)		
					Placebo	21	128	1.00		
					Statin	0	6	N/A		
					Placebo	hom(CC) vs. ref(TT)	33	173		1.96 (1.28-2.91)
						het (TC) vs. ref(TT)	70	602		1.28 (0.88-1.82)
						ref(TT)	41	461		1.00
						hom(CC) vs. ref(TT)	18	215		0.87 (0.51-1.45)
					Statin	het(TC) vs. ref(TT)	43	601		0.76 (0.50-1.12)
						ref(TT)	48	495		1.00
Statin	48	495	1.08 (0.72-1.60)							
Het(TC)	Placebo	41	461	1.00						
	Statin	43	601	0.61 (0.44-0.92)						
	Placebo	70	602	1.00						
	Statin	18	215	0.48 (0.27-0.83)						

TABLE 11, page 1 of 1

Risk of cardiovascular disease events associated with Pravastatin, by CD6 genotype, CARE and WOSCOPS

Endpoint	Gene	Marker	Study	CD6 genotype	N		RR ^e	95%CI	p-value ^g	BP p value ^h
RMI	CD6	hCV2553030	CARE	Minor hom (TT)	RMI ^a	MI ^b				
					2	108	0.13	0.03-0.60	0.0016	0.0342
				Het (TC)	28	159				
					41	489	0.76	0.51-1.12	0.1735	
				Major hom (CC)	50	442				
					65	713	0.8	0.59-1.09	0.1518	
					85	728				
				recessive (TT)	2	108	0.13	0.03-0.60	0.0016	0.009
					10	64				
				recessive (TT+CC)ref*	106	1202	0.78	0.61-1.00	0.0478	
					135	1170				
MI			WOSCOPS	Minor hom (TT)	Cs ^c	Cn ^d	OR ^f	95%CI	p-value ^g	BP p value ^h
					7	38	0.23	0.09-0.64	0.0033	0.1126
					19	24				
				Het (TC)	62	198	0.71	0.49-1.04	0.0789	
					88	200				
				Major hom (CC)	120	305	0.66	0.50-0.87	0.0036	
					179	300				
				recessive (TT)	7	38	0.23	0.09-0.64	0.0033	0.0388
					19	24				
				recessive TC+CC)ref*	182	503	0.68	0.54-0.85	0.0007	
					267	500				

* Heterozygote and major homozygote was used as reference

^a Patients developed recurrent MI during 5years follow up^b Patients had MI before entry but didn't developed current MI during 5 years follow up^c Patients had MI^d Patients had no MI^e relative risk^f Odds ratio^g Wald test^h Breslow's Day p value

TABLE 12, page 1 of 1

Risk of cardiovascular disease events associated with FCAR genotype in untreated arms, CARE and WOSCOPS

Endpoint	Gene	Marker	FCAR genotype	RMI ^a	N	MI ^b	Unadjusted	Adjusted for Age, Smoking status, Gender *	Adjusted for Age, Smoking status, Gender, BMI, diabetes, baseline LDL and HDL ^{c,†}
RMI	FCAR	hCV7841642					OR 95% CI	OR 95% CI	OR 95% CI
			CARE						
			AA	1	11	11	0.84 (0.11-6.54)	0.87 (0.09-5.89)	0.86 (0.11-6.71)
			AG	28	159	159	1.62 (1.04-2.53)	1.58 (1.01-2.48)	1.58 (1.02-2.46)
			AA+AG	29	170	170	1.57 (1.01-2.43)	1.52 (0.96-2.37)	1.53 (1.02-2.46)
			GG	116	1067	1067	1 (ref)	1 (ref)	1 (ref)
MI			WOSCOPS §						
			AA	Cs ^c	1	3	0.67 (0.07-6.52)	0.73 (0.07-6.75)	0.75 (0.07-6.75)
			AG	54	70	70	1.5 (1.01-2.22)	1.49 (1.00-2.22)	1.49 (1.00-2.22)
			AA+AG	55	73	73	1.47 (1.00-2.16)	1.46 (0.98-2.16)	1.46 (0.98-2.16)
			GG	233	456	456	1 (ref)	1 (ref)	1 (ref)

CARE indicates Cholesterol and Recurrent Events trial; WOSCOPS, West of Scotland Coronary Prevention Study; RMI, BMI, body-mass index (kg/m²); LDL, low-density lipoprotein; HDL, high-density lipoprotein; OR, odds ratio; CI, confidence interval

* Adjusted for age (continuous for CARE, 5-year age groups for WOSCOPS), smoking (never, former, current) and gender (all male in WOSCOPS)

† Further adjusted for history of hypertension, BMI (continuous), history of diabetes, baseline LDL level (continuous), and baseline HDL level (continuous)

‡ Wald test

§ Conditional logistic regression used to account for matching of WOSCOPS cases and controls (all male) on smoking and age

|| Major homozygote (Asp/Asp) was used as reference

^ Patients developed recurrent MI during 5 years follow up

^ Patients had MI before entry but didn't develop current MI during 6 years follow up

^ Patients had MI

^ Patients had no MI

Risk of cardiovascular disease events associated with Pravastatin, by FCAR genotype, CARE and WOSCOPS

Endpoint	Gene	Marker	Study	FCAR genotype	**OR	Unadjusted	Adjusted for Age, Smoking status, Gender *	Adjusted for Age, Smoking status, Gender, BMI, diabetes, baseline LDL and HDL ^{c,†}
RMI	FCAR	hCV7841642				OR 95% CI	OR 95% CI	OR 95% CI
			CARE	AA+AG	0.32	(0.15-0.67)	0.31 (0.15-0.65)	0.31 (0.15-0.67)
				GG	0.81	(0.61-1.07)	0.79 (0.60-1.06)	0.79 (0.60-1.06)
						p interaction: 0.0163 §	p interaction: 0.0151 §	p interaction: 0.0193 §
MI			WOSCOPS	AA+AG		0.57 (0.34-0.95)	0.031 (0.32-0.93)	0.025 (0.32-0.93)
				GG		0.66 (0.52-0.84)	0.0008 (0.51-0.83)	0.0006 (0.51-0.83)
						p interaction: 0.5851 §	p interaction: 0.5480 §	

CARE indicates Cholesterol and Recurrent Events trial; WOSCOPS, West of Scotland Coronary Prevention Study; RMI, recurrent myocardial infarction; LDL, low-density lipoprotein; HDL, high-density lipoprotein; OR, odds ratio; CI, confidence interval; BMI, body-mass index (kg/m²)

* Adjusted for age (continuous in CARE, 5-year age groups in WOSCOPS), smoking (never, former, current) and gender (all male in WOSCOPS)

† Further adjusted for history of hypertension, BMI (continuous), history of diabetes, baseline LDL level (continuous), and baseline HDL level (continuous)

‡ Wald test

§ Likelihood ratio test of interaction between treatment and FCAR genotype

|| Conditional logistic regression used to account for matching of WOSCOPS cases and controls on smoking and age

**Placebo group was used as reference

TABLE 13, page 1 of 5

[illegible]

Statistically Significant Interactions Between SNP Genotypes

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Statistically Significant Interactions Between SNP Genotypes and Pravastatin Efficacy for Two CVD Cause Definitions: Fatal MI / Sudden Death / Definite Non-fatal MI and Fatal / Non-fatal MI

Statistically Significant Interactions Between SUP Genotypes and Pravastatin Efficacy for Two CVD Case Definitions: All-Patient and Patient with Prior MI / Sudden Death / Definite Non-Fatal MI and Fatal / Non-Fatal MI										
Marker	Study Design	Case Definition	Stratum	Omniv. Chi-Square Test	Interaction Effect* Chi-Square Test	0 Rare Alleles (n, %)	1 Rare Allele (n, %)	2 Rare Alleles (n, %)	Significance (p-value)	
Marker	Study Design	Case Definition	Stratum	p-value	Statistics	Placebo Patients	Pravastatin Patients	Placebo Patients	Pravastatin Patients	
NCV25515528	CARE	Prospective	FAF M	0.01	8.22	0.01	11/864 (1.3%)	118/658 (1.7%)	12/745 (0.9%)	37/148 (25.0%)
NCV25515528	CARE	Prospective	FAF M	18.1	9.22	0.01	11/864 (1.3%)	118/658 (1.7%)	12/745 (0.9%)	37/148 (25.0%)
NCV25515528	CARE	Prospective	FAF M	0.01	8.22	0.01	11/864 (1.3%)	118/658 (1.7%)	12/745 (0.9%)	37/148 (25.0%)
NCV25515528	CARE	Prospective	FAF M	18.1	9.22	0.01	11/864 (1.3%)	118/658 (1.7%)	12/745 (0.9%)	37/148 (25.0%)
NCV25515528	CARE	Prospective	FAF M	0.01	8.22	0.01	11/864 (1.3%)	118/658 (1.7%)	12/745 (0.9%)	37/148 (25.0%)
NCV25515528	CARE	Prospective	FAF M	18.1	9.22	0.01	11/864 (1.3%)	118/658 (1.7%)	12/745 (0.9%)	37/148 (25.0%)
NCV25515528	CARE	Prospective	FAF M	0.01	8.22	0.01	11/864 (1.3%)	118/658 (1.7%)	12/745 (0.9%)	37/148 (25.0%)
NCV25515528	CARE	Prospective	FAF M	18.1	9.22	0.01	11/864 (1.3%)	118/658 (1.7%)	12/745 (0.9%)	37/148 (25.0%)
NCV25515528	CARE	Prospective	FAF M	0.01	8.22	0.01	11/864 (1.3%)	118/658 (1.7%)	12/745 (0.9%)	37/148 (25.0%)
NCV25515528	CARE	Prospective	FAF M	18.1	9.22	0.01	11/864 (1.3%)	118/658 (1.7%)	12/745 (0.9%)	37/148 (25.0%)
NCV25515528	CARE	Prospective	FAF M	0.01	8.22	0.01	11/864 (1.3%)	118/658 (1.7%)	12/745 (0.9%)	37/148 (25.0%)
NCV25515528	CARE	Prospective	FAF M	18.1	9.22	0.01	11/864 (1.3%)	118/658 (1.7%)	12/745 (0.9%)	37/148 (25.0%)
NCV25515528	CARE	Prospective	FAF M	0.01	8.22	0.01	11/864 (1.3%)	118/658 (1.7%)	12/745 (0.9%)	37/148 (25.0%)
NCV25515528	CARE	Prospective	FAF M	18.1	9.22	0.01	11/864 (1.3%)	118/658 (1.7%)	12/745 (0.9%)	37/148 (25.0%)
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NCV25515528	CARE	Prospective	FAF M	18.1	9.22	0.01	11/864 (1.3%)	118/658 (1.7%)	12/745 (0.9%)	37/148 (25.0%)
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NCV25515528	CARE	Prospective	FAF M	18.1	9.22	0.01	11/864 (1.3%)	118/658 (1.7%)	12/745 (0.9%)	37/148 (25.0%)
NCV25515528	CARE	Prospective	FAF M	0.01	8.22	0.01	11/864 (1.3%)	118/658 (1.7%)	12/745 (0.9%)	37/148 (25.0%)
NCV25515528	CARE	Prospective	FAF M	18.1	9.22	0.01	11/864 (1.3%)	118/658 (1.7%)	12/745 (0.9%)	37/148 (25.0%)
NCV25515528	CARE	Prospective	FAF M	0.01	8.22	0.01	11/864 (1.3%)	118/658 (1.7%)	12/745 (0.9%)	37/148 (25.0%)
NCV25515528	CARE	Prospective	FAF M	18.1	9.22	0.01	11/864 (1.3%)	118/658 (1.7%)	12/745 (0.9%)	37/148 (25.0%)
NCV25515528	CARE	Prospective	FAF M	0.01	8.22	0.01	11/864 (1.3%)	118/658 (1.7%)	12/745 (0.9%)	37/148 (25.0%)
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NCV25515528	CARE	Prospective	FAF M	0.01	8.22	0.01	11/864 (1.3%)	118/658 (1.7%)	12/745 (0.9%)	37/148 (25.0%)
NCV25515528	CARE	Prospective	FAF M	18.1	9.22	0.01	11/864 (1.3%)	118/658 (1.7%)	12/745 (0.9%)	37/148 (25.0%)
NCV25515528	CARE	Prospective	FAF M	0.01	8.22	0.01	11/864 (1.3%)	118/658 (1.7%)	12/745 (0.9%)	37/148 (25.0%)
NCV25515528	CARE	Prospective	FAF M	18.1	9.22	0.01	11/864 (1.3%)	118/658 (1.7%)	12/745 (0.9%)	37/148 (25.0%)
NCV25515528	CARE	Prospective	FAF M	0.01	8.22	0.01	11/864 (1.3%)	118/658 (1.7%)	12/745 (0.9%)	37/148 (25.0%)
NCV25515528	CARE	Prospective	FAF M	18.1	9.22	0.01	11/864 (1.3%)	118/658 (1.7%)	12/745 (0.9%)	37/148 (25.0%)
NCV25515528	CARE	Prospective	FAF M	0.01	8.22	0.01	11/864 (1.3%)	118/658 (1.7%)	12/745 (0.9%)	37/148 (25.0%)
NCV25515528	CARE	Prospective	FAF M	18.1	9.22	0.01	11/864 (1.3%)	118/658 (1.7%)	12/745 (0.9%)	37/148 (25.0%)
NCV25515528	CARE	Prospective	FAF M	0.01	8.22	0.01	11/864 (1.3%)	118/658 (1.7%)	12/745 (0.9%)	37/148 (25.0%)
NCV25515528	CARE	Prospective	FAF							

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[illegible]

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Statistically Significant Interactions Between SNP Genotypes and Pravastatin Efficacy for Two CVD Case Definitions: Fatal MI / MI / Sudden Death / Definite Non-fatal MI and Fatal / Non-fatal MI										Pravastatin vs. Placebo Odds Ratio (95% CI)				Significance Level		
Public	Marker	Study	Study Design	Case Definition	Control Group Definition***	Stratum	Overall* Chi-Square Test	Interaction Effect** Chi-Square Test	0 Rare Alleles ntotal (%)	Pravastatin Patients	Placebo Patients	Pravastatin Patients	Placebo Patients		Patients with 0 Rare Alleles	Patients with 1 Rare Allele
* For the CARE prospective study: results of the Overall Score Test (chi-square test) for the logistic regression model to include the phenotype (case definition) is a function of the SNP genotype, treatment group, and the interaction between SNP genotype and treatment group. For case-control studies: results of the Overall Score Test (chi-square test) for the conditional logistic regression model in which the phenotype (case definition) is a function of the SNP genotype, treatment group, and the interaction between SNP genotype and treatment group and cases and controls have been matched on age and smoking status. ** For the CARE prospective study: results of the chi-square test of the interaction between SNP genotype and treatment group (based on the logistic regression model). For the case-control studies: results of the chi-square test of the interaction between SNP genotype and treatment group (based on the conditional logistic regression model). *** All Possible Controls include all controls with genotype data. Cleaner controls include controls with genotype data but with no other CVD-related events during the trial. For cases definition: "F" = MI/Sudden Death/Definite Nonfatal MI For cases definition: "F&F" = Fatal MI + Fatal & Nonfatal MI For stratum: "WM" = White Males For study: "W" = WOSCOPS.																

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Statistically Significant Associations Between SNP Genotypes and Two CVD Case Definitions: Fatal MI / Sudden Death / Definite Non-fatal MI and Fatal / Non-fatal MI										Placebo Patients									
						Overall* Chi-Square Test		SNP Effect						Odds Ratio (95% CI)					
Marker	Study	Study Design	Case Definition	Control Group	Stratum	Statistic	p-value	Statistic	p-value	0 Rare Alleles	1 Rare Allele	2 Rare Alleles	2 Rare Alleles vs. 0	1 Rare Allele vs. 0	Significance				
hcv2741083	CARE	Prospective	F M/SDNF MI All Possible	Definite	WM	6.3	0.0428	6.11	0.047	113927 (12.2%)	17253 (6.7%)	114 (7.1%)	0.55 (0.03 to 2.62)	0.52 (0.30 to 0.86)	P<0.05				
hcv2741083	CARE	Prospective	F M/SDNF MI All Possible	Cleaner	WM	7.75	0.0207	7.47	0.0239	113675 (18.7%)	17165 (7.3%)	115 (20.0%)	1.02 (0.05 to 6.99)	0.47 (0.26 to 0.79)	P<0.05				
hcv2741083	CARE	Case/Control	F M/SDNF MI All Possible	Definite	WM	7.81	0.0201	11.08	0.0258	113616 (12.3%)	17243 (7.0%)	113 (7.2%)	0.54 (0.07 to 4.24)	0.46 (0.26 to 0.79)	P<0.05				
hcv2741083	W	Case/Control	F M/SDNF MI All Possible	Definite	WM	7.55	0.0229	12.38	0.0148	143614 (23.7%)	60195 (30.8%)	715 (46.7%)	2.87 (1.05 to 8.47)	1.44 (1.00 to 2.08)	P<0.05				
hcv2741083	CARE	Case/Control	F M/SDNF MI All Possible	Cleaner	WM	7.87	0.0168	10.53	0.0324	113572 (18.9%)	17158 (7.0%)	115 (20.0%)	0.88 (0.10 to 8.16)	0.44 (0.24 to 0.79)	P<0.05				
hcv2741083	W	Case/Control	F M/SDNF MI All Possible	Cleaner	WM	6.4	0.0408	11.04	0.0281	143631 (26.9%)	60173 (34.7%)	715 (46.7%)	2.49 (0.87 to 7.10)	1.48 (1.01 to 2.12)	P<0.05				
hcv25610774	CARE	Case/Control	F M/SDNF MI All Possible	Definite	WM	6.53	0.0382	8.54	0.048	86436 (18.7%)	43262 (18.4%)	237 (5.4%)	0.19 (0.04 to 0.87)	0.81 (0.53 to 1.24)	P<0.05				
hcv25610818	CARE	Case/Control	F M/SDNF MI All Possible	Cleaner	WM	8.21	0.0049	9.97	0.041	86475 (12.7%)	43451 (10.9%)	259 (3.4%)	0.23 (0.05 to 0.97)	0.75 (0.50 to 1.11)	P<0.05				
hcv25610818	CARE	Case/Control	F M/SDNF MI All Possible	Cleaner	WM	7.34	0.0255	10.21	0.0371	86430 (20.0%)	43260 (16.5%)	259 (3.4%)	0.17 (0.04 to 0.74)	0.81 (0.53 to 1.24)	P<0.05				
hcv25610818	CARE	Case/Control	F M/SDNF MI All Possible	Cleaner	WM	6.84	0.0327	9.84	0.0414	86434 (18.9%)	43263 (16.3%)	259 (3.4%)	0.18 (0.04 to 0.80)	0.80 (0.52 to 1.24)	P<0.05				
hcv25610818	CARE	Case/Control	F M/SDNF MI All Possible	Definite	WM	6.5	0.0389	12.25	0.0158	87468 (16.5%)	51406 (12.8%)	1267 (7.8%)	2.08 (1.04 to 4.16)	1.47 (0.99 to 2.19)	P<0.05				
hcv25610818	CARE	Case/Control	F M/SDNF MI All Possible	Cleaner	WM	6.41	0.0405	11.88	0.0183	87434 (18.9%)	43263 (16.3%)	259 (3.4%)	2.30 (1.08 to 4.47)	1.44 (0.95 to 2.17)	P<0.05				
hcv25610818	CARE	Case/Control	F M/SDNF MI All Possible	Cleaner	WM	5.99	0.0499	5.85	0.0536	87436 (16.5%)	52403 (10.3%)	1242 (8.6%)	2.22 (1.05 to 4.46)	1.37 (0.91 to 2.04)	P<0.05				
hcv25610818	CARE	Case/Control	F M/SDNF MI All Possible	Cleaner	WM	6.95	0.0031	12.81	0.0117	87468 (16.5%)	52410 (12.7%)	1267 (7.8%)	2.08 (1.04 to 4.17)	1.51 (1.02 to 2.24)	P<0.05				
hcv25610818	CARE	Case/Control	F M/SDNF MI All Possible	Cleaner	WM	7.01	0.0301	12.83	0.0121	87435 (15.4%)	52258 (20.2%)	1243 (8.6%)	2.30 (1.08 to 4.87)	1.50 (0.99 to 2.27)	P<0.05				
hcv25610818	CARE	Case/Control	F M/SDNF MI All Possible	Cleaner	WM	10.07	0.0015	8.22	0.0126	129116 (11.0%)	24 (50.0%)	0 (0.0%)	3.40 (1.74 to 102.88)	0.78 (0.28 to 2.09)	P<0.05				
hcv25610818	CARE	Case/Control	F M/SDNF MI All Possible	Cleaner	WM	6.15	0.0462	8.56	0.0486	87455 (20.0%)	35247 (14.2%)	529 (17.2%)	0.78 (0.28 to 2.16)	0.57 (0.38 to 0.88)	P<0.05				
hcv75175378	CARE	Case/Control	F M/SDNF MI All Possible	Cleaner	WM	6.19	0.0452	6.51	0.0496	81455 (20.0%)	35247 (14.2%)	529 (17.2%)	0.47 (0.26 to 0.81)	0.80 (0.52 to 1.24)	P<0.05				
hcv2442143	CARE	Prospective	F M/SDNF MI All Possible	Cleaner	WM	7.17	0.0278	7	0.0302	43196 (21.9%)	67584 (18.4%)	21181 (11.5%)	0.63 (0.17 to 2.35)	0.84 (0.58 to 1.28)	P<0.05				
hcv25030334	CARE	Case/Control	F M/SDNF MI All Possible	Definite	WM	7.98	0.0185	11.92	0.018	43314 (13.7%)	67587 (18.9%)	21181 (11.5%)	0.45 (0.26 to 0.73)	0.82 (0.59 to 1.43)	P<0.05				
hcv25030334	CARE	Prospective	F M/SDNF MI All Possible	Cleaner	WM	10.16	0.0062	8.48	0.0144	98436 (16.1%)	29123 (13.0%)	37 (42.9%)	0.78 (0.17 to 3.61)	0.46 (0.23 to 0.85)	P<0.05				
hcv25030334	CARE	Case/Control	F M/SDNF MI All Possible	Definite	WM	7.89	0.0193	10.09	0.0389	98436 (16.1%)	29123 (13.0%)	37 (42.9%)	0.63 (0.17 to 2.35)	0.46 (0.23 to 0.85)	P<0.05				
hcv25030334	CARE	Case/Control	F M/SDNF MI All Possible	Cleaner	WM	8.23	0.0164	11.74	0.0194	98437 (15.3%)	29122 (13.0%)	37 (42.9%)	0.73 (0.17 to 3.61)	0.46 (0.23 to 0.85)	P<0.05				
hcv7514722	CARE	Prospective	F M/SDNF MI All Possible	Definite	WM	6.4	0.0409	8.3	0.0423	81638 (8.7%)	47319 (14.7%)	317 (6.1%)	0.82 (0.20 to 2.98)	1.61 (1.09 to 2.38)	P<0.05				
hcv7514722	CARE	Case/Control	F M/SDNF MI All Possible	Cleaner	WM	7.47	0.0239	7.35	0.0253	81639 (15.3%)	47108 (14.7%)	318 (6.7%)	1.11 (0.25 to 4.95)	1.75 (1.16 to 2.61)	P<0.05				
hcv7514722	CARE	Case/Control	F M/SDNF MI All Possible	Cleaner	WM	8.34	0.042	8.97	0.0518	81628 (9.3%)	47312 (15.1%)	306 (6.3%)	0.81 (0.24 to 2.33)	1.63 (1.10 to 2.42)	P<0.05				
hcv7514722	CARE	Case/Control	F M/SDNF MI All Possible	Cleaner	WM	7.11	0.0289	9.59	0.0479	81626 (15.4%)	47182 (14.7%)	318 (6.7%)	0.92 (0.26 to 3.33)	1.75 (1.15 to 2.68)	P<0.05				
hcv25933600	CARE	Prospective	F M/SDNF MI All Possible	Definite	WM	6.04	0.0487	5.93	0.0515	59609 (9.7%)	65481 (13.5%)	7103 (6.8%)	0.68 (0.28 to 1.44)	1.46 (1.00 to 2.12)	P<0.05				
hcv25933600	CARE	Case/Control	F M/SDNF MI All Possible	Cleaner	WM	6.28	0.043	6.21	0.0448	59386 (15.3%)	65299 (11.8%)	7103 (6.8%)	0.78 (0.30 to 1.92)	1.54 (1.04 to 2.28)	P<0.05				
hcv25933600	CARE	Case/Control	F M/SDNF MI All Possible	Definite	WM	7.68	0.0215	9.89	0.0405	124442 (26.1%)	67320 (20.9%)	1860 (36.0%)	1.38 (0.73 to 2.58)	0.67 (0.47 to 0.94)	P<0.05				
hcv781558	W	Case/Control	F M/SDNF MI All Possible	Cleaner	WM	6.12	0.0104	11.45	0.022	124595 (31.3%)	67281 (23.8%)	1841 (43.3%)	1.88 (0.86 to 3.28)	0.67 (0.47 to 0.95)	P<0.05				
hcv781558	W	Case/Control	F M/SDNF MI All Possible	Cleaner	WM	12.26	0.0005	11.88	0.0008	124595 (31.3%)	67281 (23.8%)	1841 (43.3%)	0.00 (0.0%)	2.03 (1.35 to 3.03)	P<0.005				
hcv16278465	CARE	Prospective	F M/SDNF MI All Possible	Cleaner	WM	10.7	0.0011	10.43	0.0012	91591 (15.4%)	40148 (28.6%)	0 (0.0%)	1.82 (1.23 to 3.01)	2.02 (1.31 to 3.07)	P<0.005				
hcv16278465	CARE	Case/Control	F M/SDNF MI All Possible	Cleaner	WM	9.14	0.0025	8.94	0.0028	91645 (6.9%)	40147 (27.2%)	0 (0.0%)	1.60 (1.25 to 2.80)	1.80 (1.23 to 3.01)	P<0.005				
hcv16278465	CARE	Case/Control	F M/SDNF MI All Possible	Cleaner	WM	8.34	0.0039	8.16	0.0043	91595 (15.6%)	40147 (27.2%)	0 (0.0%)	7.74 (1.42 to 42.34)	0.44 (0.18 to 0.98)	P<0.05				
hcv16278465	CARE	Case/Control	F M/SDNF MI All Possible	Cleaner	WM	13.75	0.0001	10.68	0.0048	1211058 (11.4%)	7130 (5.4%)	316 (60.0%)	8.42 (1.71 to 27.34)	0.47 (0.19 to 0.98)	P<0.05				
hcv16278465	CARE	Case/Control	F M/SDNF MI All Possible	Cleaner	WM	12.51	0.0007	8.61	0.0063	1211058 (11.4%)	7130 (5.4%)	316 (60.0%)	13.92 (1.22 to 32.70)	0.41 (0.19 to 0.91)	P<0.05				
hcv16278465	CARE	Case/Control	F M/SDNF MI All Possible	Cleaner	WM	11.84	0.0027	14.34	0.0035	1211058 (11.7%)	7174 (7.6%)	316 (60.0%)	10.11 (1.03 to 99.59)	0.48 (0.21 to 1.09)	P<0.05				
hcv16278465	CARE	Case/Control	F M/SDNF MI All Possible	Cleaner	WM	9.26	0.0068	11.17	0.0248	121057 (18.4%)	7174 (7.5%)	218 (66.7%)	15.83 (1.31 to 341.97)	0.81 (0.27 to 1.21)	P<0.05				
hcv16278465	CARE	Case/Control	F M/SDNF MI All Possible	Cleaner	WM	11.27	0.0036	8.88	0.032	1211078 (11.2%)	8112 (7.3%)	218 (66.7%)	15.98 (1.72 to 222.65)	0.62 (0.26 to 1.32)	P<0.05				
hcv25610818	CARE	Case/Control	F M/SDNF MI All Possible	Definite	WM	12.98	0.0015	11.27	0.0036	1211058 (11.4%)	8112 (7.3%)	218 (66.7%)	5.50 (1.64 to 16.79)	1.43 (0.85 to 2.33)	P<0.05				
hcv25610818	CARE	Case/Control	F M/SDNF MI All Possible	Cleaner	WM	12.07	0.0024	10.68	0.0065	1051029 (10.2%)	21891 (14.0%)	5710 (30.5%)	5.07 (1.39 to 18.61)	1.42 (0.92 to 2.17)	P<0.05				
hcv25610818	CARE	Case/Control	F M/SDNF MI All Possible	Cleaner	WM	8.98	0.0112	7.69	0.0214	1050637 (10.5%)	21891 (14.0%)	5710 (30.5%)	6.80 (2.07 to 21.11)	1.25 (0.78 to 2.16)	P<0.05				
hcv25610818	CARE	Case/Control	F M/SDNF MI All Possible	Cleaner	WM	13.52	0.0012	15.11	0.0045	1051011 (10.4%)	21148 (14.4%)	5710 (30.5%)	8.61 (1.34 to 57.17)	1.18 (0.66 to 2.00)	P<0.05				
hcv25610818	CARE	Case/Control	F M/SDNF MI All Possible	Cleaner	WM	7.02	0.0289	9.24	0.0555	105629 (18.7%)	2185 (22.1%)	5710 (30.5%)	0.48 (0.25 to 0.83)	0.98 (0.56 to 1.49)	P<0.05				
hcv25610818	CARE	Case/Control	F M/SDNF MI All Possible	Cleaner	WM	6.17	0.0456	5.85	0.0508	507258 (19.4%)	87349 (19.2%)	14735 (10.3%)	0.48 (0.25 to 0.83)	0.98 (0.56 to 1.49)	P<0.05				

TABLE 14, page 2 of 7

Statistically Significant Associations Between SNP Genotypes and Two CVD Case Definitions: Fatal MI / Sudden Death / Definite Non-fatal MI and Fatal / Non-fatal MI															Placebo Patients			Odds Ratio (95% CI)		Significance Level																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																								
Public	Marker	Study	Study Design	Case Definition	Control Group	Stratum	Statistic	p-value	SNP Effect	Statistic	p-value	SNP Effect	1 Rare Allele	2 Rare Alleles	1 Rate Allele vs 0	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles	Rate Alleles

Statistically Significant Associations Between SNP Genotypes and Two CVD Case Definitions: Fatal MI / Sudden Death / Definite Non-fatal MI and Fatal / Non-fatal MI

[illegible]

Statistically Significant Associations Between SNP Genotypes and Two CVD Case Definitions: Fatal MI / Sudden Death / Infarct Non-fatal MI and Fatal / Non-fatal MI

Statistically Significant Associations Between SNP Genotypes and Two CVD Case Definitions: Fatal MI / Sudden Death / Infarct Non-fatal MI and Fatal / Non-fatal MI															Overall Chi-Square Test															Placebo Patients															Odds Ratio (95% CI)														
Marker	Study	Study Design	Case Definition	Control Group	Stratum	Statistic	p-value	SNP Effect	n/total (%)	0 Rare Alleles	1 Rare Allele	2 Rare Alleles	≥ 3 Rare Alleles vs. 0	1 Rare Allele vs. 0	Level																																												
ICV2531431	CARE	Case/Control	F MISDNF MI All Possible	All Possible	WM	7.13	0.0283	11.84	0.0185	79/809 (9.8%)	42/514 (33.4%)	9/40 (2.0%)	1.34 (0.69 to 2.02)	P<=0.05																																													
ICV25815580	CARE	Prospective	F MISDNF MI All Possible	All Possible	WM	6.21	0.0159	4.74	0.0294	128/1187 (10.8%)	3/8 (3.7%)	0/0 (0.0%)	4.97 (1.01 to 20.47)	P<=0.05																																													
ICV25815580	CARE	Prospective	F MISDNF MI All Possible	Cleaner	WM	8.94	0.0049	4.8	0.0294	128/1187 (10.8%)	3/8 (3.7%)	0/0 (0.0%)	7.16 (1.18 to 54.77)	P<=0.05																																													
ICV25815580	CARE	Case/Control	F MISDNF MI All Possible	All Possible	WM	4.88	0.0272	4.1	0.0438	128/1186 (11.0%)	74/857 (31.5%)	0/0 (0.0%)	4.51 (1.05 to 19.38)	P<=0.05																																													
ICV25356595	CARE	Prospective	F MISDNF MI All Possible	All Possible	WM	8.83	0.0121	8.57	0.0138	26/361 (6.9%)	74/857 (31.5%)	32/268 (11.9%)	1.82 (1.06 to 3.16)	P<=0.05																																													
ICV25356595	CARE	Prospective	F MISDNF MI All Possible	Cleaner	WM	7.52	0.0233	7.35	0.0254	25/213 (11.7%)	74/859 (32.7%)	32/275 (16.3%)	1.68 (0.98 to 2.98)	P<=0.05																																													
ICV25356595	CARE	Case/Control	F MISDNF MI All Possible	All Possible	WM	8.52	0.0086	18.58	0.0054	25/213 (11.7%)	74/859 (32.7%)	32/263 (12.2%)	2.16 (1.31 to 3.54)	P<=0.05																																													
ICV25356595	CARE	Case/Control	F MISDNF MI All Possible	Cleaner	WM	7.01	0.0301	13.75	0.0081	25/210 (11.9%)	74/852 (21.0%)	32/174 (18.4%)	1.98 (1.19 to 3.33)	P<=0.05																																													
ICV25356595	CARE	Case/Control	F MISDNF MI All Possible	Cleaner	WM	9.64	0.0081	9.28	0.0087	137/587 (14.9%)	19/257 (7.5%)	1/14 (7.1%)	0.47 (0.02 to 2.95)	P<=0.05																																													
ICV27411033	CARE	Prospective	F ANF MI	All Possible	WM	10.01	0.0067	13.65	0.0085	137/589 (22.9%)	19/257 (7.5%)	1/15 (20.0%)	0.84 (0.04 to 5.76)	P<=0.05																																													
ICV27411033	CARE	Prospective	F ANF MI	All Possible	WM	10.01	0.0067	13.65	0.0085	137/589 (22.9%)	19/257 (7.5%)	1/15 (20.0%)	0.43 (0.26 to 0.74)	P<=0.05																																													
ICV27411033	CARE	Case/Control	F ANF MI	Cleaner	WM	8.65	0.0068	12.5	0.014	137/585 (23.0%)	19/260 (11.4%)	20/102 (18.6%)	1.98 (1.10 to 3.36)	P<=0.05																																													
ICV25926818	CARE	Prospective	F ANF MI	All Possible	WM	6.32	0.0424	8.21	0.0449	64/578 (11.1%)	70/847 (14.4%)	20/102 (18.6%)	1.36 (0.94 to 1.94)	P<=0.05																																													
ICV25926818	CARE	Case/Control	F ANF MI	All Possible	WM	6.13	0.0383	8.41	0.0405	64/578 (11.1%)	70/847 (14.4%)	20/102 (18.6%)	1.84 (1.09 to 3.36)	P<=0.05																																													
ICV25926818	CARE	Case/Control	F ANF MI	Cleaner	WM	6.12	0.0469	12.23	0.0157	64/569 (11.4%)	70/841 (14.6%)	20/100 (20.0%)	1.96 (1.09 to 3.46)	P<=0.05																																													
ICV25926818	CARE	Case/Control	F ANF MI	Cleaner	WM	6.09	0.0477	5.98	0.0504	11/732 (15.2%)	4/53 (7.5%)	0/0 (0.0%)	0.87 (0.46 to 0.94)	P<=0.05																																													
ICV3216558	CARE	Case/Control	F ANF MI	All Possible	WM	7.23	0.0260	12.04	0.0171	11/721 (15.4%)	4/398 (1.1%)	4/53 (7.5%)	0.43 (0.15 to 1.25)	P<=0.05																																													
ICV3216558	CARE	Case/Control	F ANF MI	Cleaner	WM	7.05	0.0295	11.71	0.0168	11/745 (28.4%)	4/352 (17.1%)	4/29 (13.8%)	0.48 (0.16 to 1.47)	P<=0.05																																													
ICV3216558	CARE	Case/Control	F ANF MI	All Possible	WM	6.04	0.0489	5.98	0.0515	11/732 (15.2%)	4/394 (10.7%)	4/52 (7.7%)	0.67 (0.40 to 0.97)	P<=0.05																																													
ICV7615376	CARE	Case/Control	F ANF MI	All Possible	WM	7.21	0.0272	11.63	0.0174	11/731 (15.2%)	4/390 (11.0%)	4/52 (7.7%)	0.64 (0.43 to 0.94)	P<=0.05																																													
ICV7615376	CARE	Case/Control	F ANF MI	Cleaner	WM	7.02	0.0299	11.63	0.0203	11/732 (15.2%)	4/394 (10.7%)	4/52 (7.7%)	0.43 (0.16 to 1.23)	P<=0.05																																													
ICV7615376	CARE	Case/Control	F ANF MI	Cleaner	WM	8.66	0.0138	8.37	0.0152	54/320 (16.9%)	70/848 (13.4%)	25/284 (8.8%)	0.40 (0.28 to 0.74)	P<=0.05																																													
ICV2442143	CARE	Prospective	F ANF MI	All Possible	WM	9.54	0.0035	9.31	0.0095	54/207 (26.1%)	70/576 (21.0%)	25/185 (13.5%)	0.44 (0.28 to 0.74)	P<=0.05																																													
ICV2442143	CARE	Case/Control	F ANF MI	All Possible	WM	10.55	0.0051	15.78	0.0033	54/314 (17.2%)	70/576 (21.0%)	25/185 (13.5%)	0.44 (0.28 to 0.74)	P<=0.05																																													
ICV2442143	CARE	Case/Control	F ANF MI	Cleaner	WM	11.9	0.0026	15.13	0.0044	54/208 (26.2%)	70/568 (21.5%)	25/183 (13.7%)	0.43 (0.25 to 0.69)	P<=0.05																																													
ICV25831989	CARE	Prospective	F ANF MI	All Possible	WM	10.47	0.0053	9.02	0.011	137/682 (14.0%)	13/176 (7.4%)	2/4 (50.0%)	6.17 (0.74 to 51.73)	P<=0.05																																													
ICV25831989	CARE	Prospective	F ANF MI	Cleaner	WM	10.82	0.0043	9.45	0.0089	137/630 (21.7%)	13/177 (11.1%)	2/3 (66.7%)	7.20 (0.88 to 155.43)	P<=0.05																																													
ICV25831989	CARE	Case/Control	F ANF MI	All Possible	WM	8.23	0.0099	12.18	0.0162	137/683 (14.2%)	13/171 (7.6%)	2/4 (50.0%)	5.84 (0.81 to 42.04)	P<=0.05																																													
ICV25831989	CARE	Case/Control	F ANF MI	Cleaner	WM	10.79	0.0045	13.53	0.0089	137/682 (22.0%)	13/174 (11.4%)	2/3 (66.7%)	6.24 (0.72 to 94.49)	P<=0.05																																													
ICV25831989	CARE	Case/Control	F ANF MI	All Possible	WM	6.1	0.0475	5.1	0.0782	12/1056 (12.7%)	33/223 (14.8%)	3/7 (42.9%)	5.18 (1.01 to 23.74)	P<=0.05																																													
ICV25831989	CARE	Case/Control	F ANF MI	Cleaner	WM	7.83	0.0102	8.74	0.0344	12/1632 (16.1%)	33/217 (26.0%)	3/5 (60.0%)	6.33 (1.04 to 48.40)	P<=0.05																																													
ICV25831989	CARE	Prospective	F ANF MI	All Possible	WM	6.14	0.0455	6.04	0.0482	102/665 (16.4%)	4/943 (9.9%)	9/65 (13.8%)	0.87 (0.39 to 1.72)	P<=0.05																																													
ICV7509590	CARE	Prospective	F ANF MI	All Possible	WM	7.14	0.0281	7.05	0.0296	102/662 (15.4%)	4/943 (9.9%)	9/65 (13.8%)	0.97 (0.39 to 1.72)	P<=0.05																																													
ICV7509590	CARE	Prospective	F ANF MI	Cleaner	WM	6.17	0.0458	6.1	0.0475	102/644 (23.6%)	4/928 (15.9%)	9/71 (12.7%)	0.79 (0.35 to 1.55)	P<=0.05																																													
ICV7509590	CARE	Case/Control	F ANF MI	All Possible	WM	6.87	0.0322	6.79	0.0338	101/645 (15.7%)	4/948 (10.3%)	9/71 (12.7%)	0.62 (0.42 to 0.88)	P<=0.05																																													
ICV11848018	CARE	Case/Control	F ANF MI	Cleaner	WM	6.43	0.0402	6.37	0.0769	72/590 (18.5%)	74/284 (25.2%)	12/75 (16.0%)	0.68 (0.44 to 1.71)	P<=0.05																																													
ICV16278495	CARE	Prospective	F ANF MI	All Possible	WM	11.61	0.0007	11.32	0.0008	112/981 (11.7%)	4/928 (20.2%)	0/0 (0.0%)	0.0 (0.0 to 0.0)	P<=0.05																																													
ICV16278495	CARE	Prospective	F ANF MI	Cleaner	WM	9.79	0.0018	9.59	0.002	112/981 (11.7%)	4/928 (20.2%)	0/0 (0.0%)	1.88 (1.25 to 2.80)	P<=0.05																																													
ICV16278495	CARE	Case/Control	F ANF MI	All Possible	WM	8.04	0.0046	7.1	0.0049	112/982 (18.3%)	4/915 (28.7%)	0/0 (0.0%)	1.78 (1.19 to 2.61)	P<=0.05																																													
ICV16278495	CARE	Case/Control	F ANF MI	Cleaner	WM	7.41	0.0095	7.23	0.0069	112/960 (18.5%)	4/915 (30.5%)	0/0 (0.0%)	1.78 (1.19 to 2.72)	P<=0.05																																													
ICV9604851	CARE	Prospective	F ANF MI	All Possible	WM	8.95	0.0114	7.15	0.028	143/1058 (13.5%)	12/130 (9.2%)	3/8 (50.0%)	6.40 (1.15 to 33.86)	P<=0.05																																													
ICV9604851	CARE	Prospective	F ANF MI	Cleaner	WM	8.89	0.0129	5.9	0.0233	143/1058 (20.9%)	12/176 (15.2%)	3/8 (75.0%)	11.43 (1.47 to 231.98)	P<=0.05																																													
ICV9604851	CARE	Case/Control	F ANF MI	All Possible	WM	7.77	0.0205	10.61	0.0314	143/1037 (13.6%)	12/127 (9.4%)	3/9 (50.0%)	5.25 (1.03 to 26.81)	P<=0.05																																													
ICV3268420	CARE	Prospective	F ANF MI	All Possible	WM	8.54	0.0133	5.58	0.0615	145/1079 (13.4%)	11/110 (10.0%)	2/3 (66.7%)	12.88 (1.23 to 278.04)	P<=0.05																																													
ICV3268420	CARE	Case/Control	F ANF MI	All Possible	WM	8.57	0.0138	8.8	0.0662	145/1057 (13.7%)	11/110 (10.0%)	2/3 (66.7%)	13.59 (1.21 to 152.35)	P<=0.05																																													
ICV25637309	CARE	Prospective	F ANF MI	Cleaner	WM	6.63	0.0362	6.46	0.0386	55/263 (20.9%)	83/567 (23.2%)	18/140 (12.9%)	0.58 (0.31 to 0.98)	P<=0.05																																													
ICV29202015	CARE	Case/Control	F ANF MI	All Possible	WM	6.04	0.0487	5.92	0.0545	144/1018 (14.1%)	13/172 (7.5%)	1/4 (25.0%)	2.02 (0.10 to 15.92)	P<=0.05																																													
ICV29202015	CARE	Case/Control	F ANF MI	Cleaner	WM	7.21	0.0272	8.82	0.0435	148/1018 (30.9%)	87/288 (23.3%)	17/43 (39.5%)	1.43 (0.74 to 2.75)	P<=0.05																																													
ICV2553030	W	Case/Control	F ANF MI	Cleaner	WM	7.84	0.0189	9.07	0.0319	148/433 (34.5%)	87/263 (25.5%)	17/41 (41.5%)	1.35 (0.70 to 2.62)	P<=0.05																																													
ICV22271872	CARE	Case/Control	F ANF MI	All Possible	WM	6.69	0.0353	9.04	0.0601	144/986 (14.5%)	11/151 (7.3%)	1/8 (12.5%)	0.90 (0.11 to 6.42)	P<=0.05																																													
ICV22271872	CARE	Case/Control	F ANF MI	Cleaner	WM	6.69	0.0353	9.04	0.0601	144/986 (14.5%)	11/151 (7.3%)	1/8 (12.5%)	0.42 (0.22 to 0.83)	P<=0.05																																													

Statistically Significant Associations Between SNP Genotypes and Two CVD Case Definitions: Fatal MI / Sudden Death / Definite Non-fatal MI and Fatal / Non-fatal MI										Placebo Patients									
Overall Chi-Square Test										n(%)									
Marker	Study	Study Design	Case Definition	Stratum	Statistic	p-value	Statistic	p-value	SNP Effect	1 Rare Allele	2 Rare Alleles	1 Rare Allele vs. 0	2 Rare Alleles vs. 0	1 Rare Allele vs. 0	2 Rare Alleles vs. 0	Significance Level			
CDL0A2	hCV22271672	CARE Case/Control	F&NF MI	WM	8.57	0.0356	9.27	0.0546	144/546 (22.3%)	11/55 (11.6%)	1/6 (16.7%)	0.75 (0.09 to 0.82)	0.41 (0.21 to 0.62)	0.41 (0.21 to 0.62)	P<=0.05				
	hCV2603661	CARE Prospective	F&NF MI	Cleaner	WM	8.95	0.0132	8.47	0.0145	97/401 (24.2%)	52/307 (16.9%)	7/80 (11.7%)	0.64 (0.44 to 0.93)	0.64 (0.44 to 0.93)	P<=0.05				
	hCV2603661	CARE Prospective	F&NF MI	Cleaner	WM	8.94	0.0127	12.35	0.0149	97/401 (24.2%)	52/305 (17.0%)	7/80 (11.7%)	0.67 (0.45 to 0.98)	0.67 (0.45 to 0.98)	P<=0.05				
	hCV2811372	CARE Case/Control	F&NF MI	All Possible	WM	7.59	0.0225	7.44	0.0242	47/278 (16.9%)	84/622 (13.5%)	27/295 (9.2%)	0.77 (0.52 to 1.14)	0.77 (0.52 to 1.14)	P<=0.05				
	hCV2811372	CARE Prospective	F&NF MI	Cleaner	WM	7.01	0.0301	6.99	0.0319	47/184 (25.5%)	84/401 (20.9%)	27/186 (14.5%)	0.49 (0.29 to 0.83)	0.77 (0.51 to 1.17)	P<=0.05				
	hCV2811372	CARE Case/Control	F&NF MI	All Possible	WM	8.77	0.0339	12.53	0.0138	47/271 (17.3%)	84/610 (13.8%)	27/200 (9.3%)	0.51 (0.30 to 0.85)	0.77 (0.51 to 1.14)	P<=0.05				
	hCV25595594	CARE Prospective	F&NF MI	Cleaner	WM	4.45	0.0348	4.25	0.0362	147/740 (19.9%)	11/371 (35.5%)	2/200 (0.9%)	2.22 (1.01 to 4.46)	2.22 (1.01 to 4.46)	P<=0.05				
	hCV63397761	CARE Case/Control	F&NF MI	All Possible	WM	6.14	0.0465	5.61	0.0604	113/688 (12.7%)	39/261 (13.5%)	7/23 (30.4%)	3.00 (1.13 to 7.20)	1.07 (0.72 to 1.68)	P<=0.05				
	hCV83397761	CARE Case/Control	F&NF MI	All Possible	WM	7.14	0.0282	10.08	0.0382	113/670 (13.0%)	30/245 (13.8%)	7/22 (18.5%)	1.73 (0.75 to 1.69)	1.73 (0.75 to 1.69)	P<=0.05				
	hCV7800503	CARE Prospective	F&NF MI	All Possible	WM	9.78	0.0075	9.61	0.0082	97/587 (15.5%)	50/507 (9.5%)	1/22 (18.5%)	0.60 (0.41 to 0.86)	0.60 (0.41 to 0.86)	P<=0.05				
CDL0A2	hCV7800503	CARE Prospective	F&NF MI	Cleaner	WM	10.67	0.0048	10.42	0.0055	97/583 (23.2%)	50/520 (15.6%)	17/53 (32.1%)	1.67 (0.82 to 2.18)	0.61 (0.42 to 0.90)	P<=0.05				
	hCV7900503	CARE Case/Control	F&NF MI	All Possible	WM	10.06	0.0065	11.89	0.0021	97/576 (15.8%)	50/497 (10.1%)	17/50 (18.8%)	0.46 (0.25 to 0.80)	0.61 (0.42 to 0.86)	P<=0.05				
	hCV1253650	CARE Prospective	F&NF MI	All Possible	WM	7.22	0.0271	7.03	0.0298	84/408 (15.5%)	75/578 (13.9%)	16/201 (8.0%)	1.42 (0.79 to 2.05)	0.60 (0.35 to 1.14)	P<=0.05				
	hCV1253650	CARE Prospective	F&NF MI	Cleaner	WM	6.32	0.0423	6.18	0.0456	84/268 (23.3%)	75/571 (13.1%)	16/124 (12.9%)	0.47 (0.25 to 0.84)	0.80 (0.55 to 1.18)	P<=0.05				
	hCV1253650	CARE Prospective	F&NF MI	All Possible	WM	9.48	0.0081	19.4	0.0039	94/394 (16.9%)	75/571 (13.1%)	16/197 (8.1%)	0.41 (0.23 to 0.74)	0.77 (0.53 to 1.12)	P<=0.05				
	hCV1253650	CARE Case/Control	F&NF MI	All Possible	WM	7.07	0.0281	12.37	0.0149	84/728 (24.3%)	75/569 (20.3%)	16/121 (13.2%)	0.44 (0.24 to 0.82)	0.78 (0.53 to 1.16)	P<=0.05				
	hCV1253650	CARE Case/Control	F&NF MI	Cleaner	WM	6.3	0.0427	9.26	0.055	197/598 (32.9%)	133/235 (20.3%)	5/12 (4.7%)	1.41 (0.43 to 4.56)	0.59 (0.38 to 0.91)	P<=0.05				
	hCV783184	W Case/Control	F&NF MI	All Possible	WM	5.53	0.0361	6.45	0.0398	84/751 (11.2%)	57/350 (15.8%)	10/52 (19.2%)	1.88 (0.87 to 2.14)	1.49 (1.04 to 2.14)	P<=0.05				
	hCV6921288	CARE Prospective	F&NF MI	Cleaner	WM	6.72	0.0349	6.94	0.0382	84/484 (17.4%)	57/232 (24.6%)	10/55 (26.6%)	1.55 (1.08 to 2.26)	1.63 (1.03 to 2.63)	P<=0.05				
	hCV2276802	CARE Prospective	F&NF MI	Cleaner	WM	5.92	0.0178	5.56	0.0183	51/195 (26.2%)	105/575 (18.3%)	9/3 (0.9%)	0.63 (0.43 to 0.93)	0.63 (0.43 to 0.93)	P<=0.05				
HLA-A																			

[illegible]

TABLE 14, page 7 of 7

Statistically Significant Associations Between SNP Genotypes and Two CVD Case Definitions: Fatal MI / Sudden Death / Definite Non-fatal MI and Fatal / Non-fatal MI															
Placebo Patients															
Overall Chi-Square Test															
SNP Effect															
Ntotal (%)															
1 Rare Allele															
2 Rare Alleles															
2 Rare Alleles vs. 0															
1 Rare Allele vs. 0															
Significance Level															
Public	Marker	Study	Study Design	Case Definition	Stratum	Statistic	p-value	Statistic	p-value	0 Rare Alleles	1 Rare Allele	2 Rare Alleles	2 Rare Alleles vs. 0	1 Rare Allele vs. 0	Significance Level
SPONG2	hCV22375550	CARE	Case/Control	F&NF MI	All Possible	7.02	0.0298	9.5	0.0498	111901 (12.9%)	45248 (18.3%)	2722 (0.1%)	1.00 (0.23 to 4.48)	1.89 (1.14 to 2.46)	P<0.05
TRPCB2	hCV16170882	CARE	Case/Control	F&NF MI	All Possible	7.05	0.0295	10.55	0.0322	128988 (12.9%)	27158 (17.1%)	316 (37.5%)	4.78 (1.11 to 20.80)	1.41 (0.89 to 2.25)	P<0.05
TRPCB2	hCV16171128	CARE	Prospective	F&NF MI	All Possible	6.3	0.043	5.27	0.0717	1301001 (13.0%)	24183 (13.1%)	410 (40.0%)	4.47 (1.13 to 16.84)	1.01 (0.82 to 1.58)	P<0.05
TAP2	hCV16171128	CARE	Case/Control	F&NF MI	All Possible	9.16	0.0103	10.44	0.0336	130987 (13.2%)	24178 (13.6%)	418 (50.0%)	7.07 (1.68 to 30.19)	1.12 (0.69 to 1.80)	P<0.05
TNF	hCV7514878	CARE	Prospective	F&NF MI	Cleaner	6.72	0.0347	5.96	0.0507	103541 (19.0%)	50220 (22.7%)	510 (50.0%)	4.25 (1.18 to 15.55)	1.25 (0.85 to 1.92)	P<0.05
TNF	hCV7514878	CARE	Case/Control	F&NF MI	Cleaner	6.42	0.0404	10.39	0.0349	103532 (18.4%)	50218 (22.8%)	510 (50.0%)	4.12 (1.13 to 15.05)	1.31 (0.89 to 1.94)	P<0.05
TRPCB	hCV288780	CARE	Prospective	F&NF MI	All Possible	7.88	0.0186	7.68	0.0215	104888 (11.7%)	50281 (17.8%)	118 (5.8%)	0.44 (0.02 to 2.18)	1.63 (1.12 to 2.35)	P<0.05
TRPCB	hCV288780	CARE	Case/Control	F&NF MI	Cleaner	6.13	0.0465	8.08	0.0482	104571 (18.2%)	50189 (26.5%)	177 (4.3%)	0.76 (0.04 to 4.45)	1.62 (1.09 to 2.37)	P<0.05
TN	hCV2536595	CARE	Prospective	F&NF MI	All Possible	11.17	0.0037	10.91	0.0043	32361 (8.9%)	93367 (18.4%)	177 (5.9%)	0.83 (0.08 to 4.88)	1.70 (1.16 to 2.48)	P<0.05
TN	hCV2536595	CARE	Case/Control	F&NF MI	Cleaner	9.26	0.0097	9.11	0.0108	32320 (14.5%)	93376 (18.5%)	33288 (12.3%)	1.44 (0.89 to 2.42)	2.02 (1.33 to 3.13)	P<0.005
TN	hCV2536595	CARE	Case/Control	F&NF MI	All Possible	10.93	0.0042	15.92	0.0031	32351 (9.1%)	93556 (16.6%)	33262 (12.8%)	1.36 (0.79 to 2.32)	1.93 (1.25 to 3.04)	P<0.05
TN	hCV2536595	CARE	Case/Control	F&NF MI	Cleaner	8.34	0.0154	12.29	0.0153	32216 (14.6%)	93371 (25.1%)	33714 (19.9%)	1.40 (0.82 to 2.38)	2.03 (1.31 to 3.16)	P<0.005
TN	hCV2536595	CARE	Case/Control	F&NF MI	Cleaner	8.34	0.0154	12.29	0.0153	32216 (14.6%)	93371 (25.1%)	33714 (19.9%)	1.31 (0.75 to 2.28)	1.91 (1.20 to 3.03)	P<0.005

For the CARE prospective study design, results of the Overall Score Test (chi-square test) for the logistic regression model in which the phenotype (case definition) is a function of SNP genotype (based on placebo patients only).

For the case/control study design, results of the Overall Score Test (chi-square test) for the conditional logistic regression model in which the phenotype (case definition) is a function of SNP genotype (based on placebo patients only) and cases and controls were matched on age and current smoking status.

* Results of the chi-square test of the SNP effect based on the logistic regression model in which the phenotype (case definition) is a function of SNP genotype (based on placebo patients only).

Results of the chi-square test of the SNP effect based on the conditional logistic regression model in which the phenotype (case definition) is a function of SNP genotype (based on placebo patients only) and cases and controls were matched on age and current smoking status.

** All Possible Controls include all controls with genotype data. Cleaner controls include controls with genotype data but with no other CVD-related events during the trial.

For case definition, "F&NF MI" = Fatal MI/Sudden Death/Definite Nonfatal MI

For stratum, "WM" = WM

For study, "W" = W

TABLE 15, page 1 of 1

Study ID	Study Title	Study Design	Study Population	Study Definition	Study Outcome	Overall Chi-Square Test	Interaction Effect* Chi-Square Test	0 Rare Alleles n total (%)	1 Rare Allele n total (%)	2 Rare Alleles n total (%)	Prevalence vs. Pseudo Odds Ratio (95% CI)	CARE & WOSCORP	Significance Level
1	Study 1	Prospective	Study 1	Study 1	Study 1	Study 1	Study 1	Study 1	Study 1	Study 1	Study 1	Study 1	Study 1
2	Study 2	Prospective	Study 2	Study 2	Study 2	Study 2	Study 2	Study 2	Study 2	Study 2	Study 2	Study 2	Study 2
3	Study 3	Prospective	Study 3	Study 3	Study 3	Study 3	Study 3	Study 3	Study 3	Study 3	Study 3	Study 3	Study 3
4	Study 4	Prospective	Study 4	Study 4	Study 4	Study 4	Study 4	Study 4	Study 4	Study 4	Study 4	Study 4	Study 4
5	Study 5	Prospective	Study 5	Study 5	Study 5	Study 5	Study 5	Study 5	Study 5	Study 5	Study 5	Study 5	Study 5
6	Study 6	Prospective	Study 6	Study 6	Study 6	Study 6	Study 6	Study 6	Study 6	Study 6	Study 6	Study 6	Study 6
7	Study 7	Prospective	Study 7	Study 7	Study 7	Study 7	Study 7	Study 7	Study 7	Study 7	Study 7	Study 7	Study 7
8	Study 8	Prospective	Study 8	Study 8	Study 8	Study 8	Study 8	Study 8	Study 8	Study 8	Study 8	Study 8	Study 8
9	Study 9	Prospective	Study 9	Study 9	Study 9	Study 9	Study 9	Study 9	Study 9	Study 9	Study 9	Study 9	Study 9
10	Study 10	Prospective	Study 10	Study 10	Study 10	Study 10	Study 10	Study 10	Study 10	Study 10	Study 10	Study 10	Study 10
11	Study 11	Prospective	Study 11	Study 11	Study 11	Study 11	Study 11	Study 11	Study 11	Study 11	Study 11	Study 11	Study 11
12	Study 12	Prospective	Study 12	Study 12	Study 12	Study 12	Study 12	Study 12	Study 12	Study 12	Study 12	Study 12	Study 12
13	Study 13	Prospective	Study 13	Study 13	Study 13	Study 13	Study 13	Study 13	Study 13	Study 13	Study 13	Study 13	Study 13
14	Study 14	Prospective	Study 14	Study 14	Study 14	Study 14	Study 14	Study 14	Study 14	Study 14	Study 14	Study 14	Study 14
15	Study 15	Prospective	Study 15	Study 15	Study 15	Study 15	Study 15	Study 15	Study 15	Study 15	Study 15	Study 15	Study 15
16	Study 16	Prospective	Study 16	Study 16	Study 16	Study 16	Study 16	Study 16	Study 16	Study 16	Study 16	Study 16	Study 16
17	Study 17	Prospective	Study 17	Study 17	Study 17	Study 17	Study 17	Study 17	Study 17	Study 17	Study 17	Study 17	Study 17
18	Study 18	Prospective	Study 18	Study 18	Study 18	Study 18	Study 18	Study 18	Study 18	Study 18	Study 18	Study 18	Study 18
19	Study 19	Prospective	Study 19	Study 19	Study 19	Study 19	Study 19	Study 19	Study 19	Study 19	Study 19	Study 19	Study 19
20	Study 20	Prospective	Study 20	Study 20	Study 20	Study 20	Study 20	Study 20	Study 20	Study 20	Study 20	Study 20	Study 20
21	Study 21	Prospective	Study 21	Study 21	Study 21	Study 21	Study 21	Study 21	Study 21	Study 21	Study 21	Study 21	Study 21
22	Study 22	Prospective	Study 22	Study 22	Study 22	Study 22	Study 22	Study 22	Study 22	Study 22	Study 22	Study 22	Study 22
23	Study 23	Prospective	Study 23	Study 23	Study 23	Study 23	Study 23	Study 23	Study 23	Study 23	Study 23	Study 23	Study 23
24	Study 24	Prospective	Study 24	Study 24	Study 24	Study 24	Study 24	Study 24	Study 24	Study 24	Study 24	Study 24	Study 24
25	Study 25	Prospective	Study 25	Study 25	Study 25	Study 25	Study 25	Study 25	Study 25	Study 25	Study 25	Study 25	Study 25
26	Study 26	Prospective	Study 26	Study 26	Study 26	Study 26	Study 26	Study 26	Study 26	Study 26	Study 26	Study 26	Study 26
27	Study 27	Prospective	Study 27	Study 27	Study 27	Study 27	Study 27	Study 27	Study 27	Study 27	Study 27	Study 27	Study 27
28	Study 28	Prospective	Study 28	Study 28	Study 28	Study 28	Study 28	Study 28	Study 28	Study 28	Study 28	Study 28	Study 28
29	Study 29	Prospective	Study 29	Study 29	Study 29	Study 29	Study 29	Study 29	Study 29	Study 29	Study 29	Study 29	Study 29
30	Study 30	Prospective	Study 30	Study 30	Study 30	Study 30	Study 30	Study 30	Study 30	Study 30	Study 30	Study 30	Study 30
31	Study 31	Prospective	Study 31	Study 31	Study 31	Study 31	Study 31	Study 31	Study 31	Study 31	Study 31	Study 31	Study 31
32	Study 32	Prospective	Study 32	Study 32	Study 32	Study 32	Study 32	Study 32	Study 32	Study 32	Study 32	Study 32	Study 32
33	Study 33	Prospective	Study 33	Study 33	Study 33	Study 33	Study 33	Study 33	Study 33	Study 33	Study 33	Study 33	Study 33
34	Study 34	Prospective	Study 34	Study 34	Study 34	Study 34	Study 34	Study 34	Study 34	Study 34	Study 34	Study 34	Study 34
35	Study 35	Prospective	Study 35	Study 35	Study 35	Study 35	Study 35	Study 35	Study 35	Study 35	Study 35	Study 35	Study 35
36	Study 36	Prospective	Study 36	Study 36	Study 36	Study 36	Study 36	Study 36	Study 36	Study 36	Study 36	Study 36	Study 36
37	Study 37	Prospective	Study 37	Study 37	Study 37	Study 37	Study 37	Study 37	Study 37	Study 37	Study 37	Study 37	Study 37
38	Study 38	Prospective	Study 38	Study 38	Study 38	Study 38	Study 38	Study 38	Study 38	Study 38	Study 38	Study 38	Study 38
39	Study 39	Prospective	Study 39	Study 39	Study 39	Study 39	Study 39	Study 39	Study 39	Study 39	Study 39	Study 39	Study 39
40	Study 40	Prospective	Study 40	Study 40	Study 40	Study 40	Study 40	Study 40	Study 40	Study 40	Study 40	Study 40	Study 40
41	Study 41	Prospective	Study 41	Study 41	Study 41	Study 41	Study 41	Study 41	Study 41	Study 41	Study 41	Study 41	Study 41
42	Study 42	Prospective	Study 42	Study 42	Study 42	Study 42	Study 42	Study 42	Study 42	Study 42	Study 42	Study 42	Study 42
43	Study 43	Prospective	Study 43	Study 43	Study 43	Study 43	Study 43	Study 43	Study 43	Study 43	Study 43	Study 43	Study 43
44	Study 44	Prospective	Study 44	Study 44	Study 44	Study 44	Study 44	Study 44	Study 44	Study 44	Study 44	Study 44	Study 44
45	Study 45	Prospective	Study 45	Study 45	Study 45	Study 45	Study 45	Study 45	Study 45	Study 45	Study 45	Study 45	Study 45
46	Study 46	Prospective	Study 46	Study 46	Study 46	Study 46	Study 46	Study 46	Study 46	Study 46	Study 46	Study 46	Study 46
47	Study 47	Prospective	Study 47	Study 47	Study 47	Study 47	Study 47	Study 47	Study 47	Study 47	Study 47	Study 47	Study 47
48	Study 48	Prospective	Study 48	Study 48	Study 48	Study 48	Study 48	Study 48	Study 48	Study 48	Study 48	Study 48	Study 48
49	Study 49	Prospective	Study 49	Study 49	Study 49	Study 49	Study 49	Study 49	Study 49	Study 49	Study 49	Study 49	Study 49
50	Study 50	Prospective	Study 50	Study 50	Study 50	Study 50	Study 50	Study 50	Study 50	Study 50	Study 50	Study 50	Study 50
51	Study 51	Prospective	Study 51	Study 51	Study 51	Study 51	Study 51	Study 51	Study 51	Study 51	Study 51	Study 51	Study 51
52	Study 52	Prospective	Study 52	Study 52	Study 52	Study 52	Study 52	Study 52	Study 52	Study 52	Study 52	Study 52	Study 52
53	Study 53	Prospective	Study 53	Study 53	Study 53	Study 53	Study 53	Study 53	Study 53	Study 53	Study 53	Study 53	Study 53
54	Study 54	Prospective	Study 54	Study 54	Study 54	Study 54	Study 54	Study 54	Study 54	Study 54	Study 54	Study 54	Study 54
55	Study 55	Prospective	Study 55	Study 55	Study 55	Study 55	Study 55	Study 55	Study 55	Study 55	Study 55	Study 55	Study 55
56	Study 56	Prospective	Study 56	Study 56	Study 56	Study 56	Study 56	Study 56	Study 56	Study 56	Study 56	Study 56	Study 56
57	Study 57	Prospective	Study 57	Study 57	Study 57	Study 57	Study 57	Study 57	Study 57	Study 57	Study 57	Study 57	Study 57
58	Study 58	Prospective	Study 58	Study 58	Study 58	Study 58	Study 58	Study 58	Study 58	Study 58	Study 58	Study 58	Study 58
59	Study 59	Prospective	Study 59	Study 59	Study 59	Study 59	Study 59	Study 59	Study 59	Study 59	Study 59	Study 59	Study 59
60	Study 60	Prospective	Study 60	Study 60	Study 60	Study 60	Study 60	Study 60	Study 60	Study 60	Study 60	Study 60	Study 60
61	Study 61	Prospective	Study 61	Study 61	Study 61	Study 61	Study 61	Study 61	Study 61	Study 61	Study 61	Study 61	Study 61
62	Study 62	Prospective	Study 62	Study 62	Study 62	Study 62	Study 62	Study 62	Study 62	Study 62	Study 62	Study 62	Study 62
63	Study 63	Prospective	Study 63	Study 63	Study 63	Study 63	Study 63	Study 63	Study 63	Study 63	Study 63	Study 63	Study 63
64	Study 64	Prospective	Study 64	Study 64	Study 64	Study 64	Study 64	Study 64	Study 64	Study 64	Study 64	Study 64	Study 64
65	Study 65	Prospective	Study 65	Study 65	Study 65	Study 65	Study 65	Study 65	Study 65	Study 65	Study 65	Study 65	Study 65
66	Study 66	Prospective	Study 66	Study 66	Study 66	Study 66	Study 66	Study 66	Study 66	Study 66	Study 66	Study 66	Study 66
67	Study 67	Prospective	Study 67	Study 67	Study 67	Study 67	Study 67	Study 67	Study 67	Study 67	Study 67	Study 67	Study 67
68	Study 68	Prospective	Study 68	Study 68	Study 68	Study 68	Study 68	Study 68	Study 68	Study 68	Study 68	Study 68	Study 68
69	Study 69	Prospective	Study 69	Study 69	Study 69	Study 69	Study 69	Study 69	Study 69	Study 69	Study 69	Study 69	Study 69
70	Study 70	Prospective	Study 70	Study 70	Study 70	Study 70	Study 70	Study 70	Study 70	Study 70	Study 70	Study 70	Study 70
71	Study 71	Prospective	Study 71	Study 71	Study 71	Study 71	Study 71	Study 71	Study 71	Study 71	Study 71	Study 71	Study 71
72	Study 72	Prospective	Study 72	Study 72	Study 72	Study 72	Study 72	Study 72	Study 72	Study 72	Study 72	Study 72	Study 72
73	Study 73	Prospective	Study 73	Study 73	Study 73	Study 73	Study 73	Study 73	Study 73	Study 73	Study 73	Study 73	Study 73
74	Study 74	Prospective	Study 74	Study 74	Study 74	Study 74	Study 74	Study 74	Study 74	Study 74	Study 74	Study 74	Study 74
75	Study 75	Prospective	Study 75	Study 75	Study 75	Study 75	Study 75	Study 75	Study 75	Study 75	Study 75	Study 75	Study 75
76	Study 76	Prospective	Study 76	Study 76	Study 76	Study 76	Study 76	Study 76	Study 76	Study 76	Study 76	Study 76	Study 76
77	Study 77	Prospective	Study 77	Study 77	Study 77	Study 77	Study 77	Study 77	Study 77	Study 77	Study 77	Study 77	Study 77
78	Study 78	Prospective	Study 78	Study 78	Study 78	Study 78	Study 78	Study 78	Study 78	Study 78	Study 78	Study 78	Study 78
79	Study 79	Prospective	Study 79	Study 79	Study 79	Study 79	Study 79	Study 79	Study 79	Study 79	Study 79	Study 79	Study 79
80	Study 80	Prospective	Study 80	Study 80	Study 80	Study 80	Study 80	Study 80	Study 80	Study 80	Study 80	Study 80	Study 80
81	Study 81	Prospective	Study 81	Study 81	Study 81	Study 81	Study 81	Study 81	Study 81	Study 81	Study 81	Study 81	Study 81
82	Study 82	Prospective	Study 82	Study 82	Study 82	Study 82	Study 82	Study 82	Study 82	Study 82	Study 82	Study 82	Study 82
83	Study 83	Prospective	Study 83	Study 83	Study 83	Study 83	Study 83	Study 83	Study 83	Study 83	Study 83	Study 83	Study 83
84	Study 84	Prospective	Study 84	Study 84	Study 84	Study 84	Study 84	Study 84	Study 84	Study 84	Study 84	Study 84	Study 84
85	Study 85	Prospective	Study 85	Study 85	Study 85	Study 85	Study 85	Study 85	Study 85	Study 85	Study 85	Study 85	Study 85
86	Study 86	Prospective	Study 86	Study 86	Study 86	Study 86	Study 86	Study 86	Study 86	Study 86	Study 86	Study 86	Study 86
87	Study 87	Prospective	Study 87	Study 87	Study 87	Study 87	Study 87	Study 87	Study 87	Study 87	Study 87	Study 87	Study 87
88	Study 88	Prospective	Study 88	Study 88	Study 88	Study 88	Study 88	Study 88	Study 88	Study 88	Study 88	Study 88	Study 88
89	Study 89	Prospective	Study 89	Study 89	Study 89	Study 89	Study 89	Study 89	Study 89	Study 89	Study 89	Study 89	Study 89
90	Study 90	Prospective	Study 90	Study 90	Study 90	Study 90	Study 90	Study 90	Study 90	Study 90	Study 90	Study 90	Study 90
91	Study 91	Prospective	Study 91	Study 91	Study 91	Study 91	Study 91	Study 91	Study 91	Study 91	Study 91	Study 91	Study 91
92	Study 92	Prospective	Study 92	Study 92	Study 92	Study 92	Study 92	Study 92	Study 92	Study 92	Study 92	Study 92	Study 92
93	Study 93	Prospective	Study 93	Study 93	Study 93	Study 93	Study 93	Study 93	Study 93	Study 93	Study 93	Study 93	Study 93
94	Study 94	Prospective	Study 94	Study 94	Study 94	Study 94	Study 94	Study 94	Study 94	Study 94	Study 94	Study 94	Study 94
95	Study 95	Prospective	Study 95	Study 95	Study 95	Study 95	Study 95	Study 95	Study 95	Study 95	Study 95	Study 95	Study 95
96	Study 96	Prospective	Study 96	Study 96	Study 96	Study 96	Study 96	Study 96	Study 96	Study 96	Study 96	Study 96	Study 96
97	Study 97	Prospective	Study 97	Study 97	Study 97	Study 97	Study 97	Study 97	Study 97	Study 97	Study 97	Study 97	Study 97
98	Study 98	Prospective	Study 98	Study 98	Study 98	Study 98	Study 98	Study 98	Study 98	Study 98	Study 98	Study 98	Study 98
99</													

What Is Claimed Is:

1. A method for identifying an individual who has an altered risk for developing a cardiovascular disorder or an altered likelihood of responding to statin treatment, the method comprising detecting a single nucleotide polymorphism (SNP) in any one of the nucleotide sequences of SEQ ID NOS:1-517 and 1035-85,090 in said individual's nucleic acids, wherein the presence of the SNP is correlated with an altered risk for developing a cardiovascular disorder or responding to statin treatment in said individual.
2. The method of claim 1 in which the altered risk is an increased risk of developing a cardiovascular disorder or an increased likelihood of responding to statin treatment.
3. The method of claim 1, wherein the cardiovascular disorder is an acute coronary event selected from the group consisting of myocardial infarction and stroke.
4. The method of claim 3 in which said individual has previously had an acute coronary event.
5. The method of claim 1 in which the altered risk is a decreased risk of developing a cardiovascular disorder or a decreased likelihood of responding to statin treatment.
6. The method of claim 1, wherein the statin treatment comprises treatment with pravastatin.
7. The method of claim 1, wherein the SNP is selected from the group consisting of the SNPs set forth in Tables 6-15.

8. The method of claim 1 in which detection is carried out by a process selected from the group consisting of: allele-specific probe hybridization, allele-specific primer extension, allele-specific amplification, sequencing, 5' nuclease digestion, molecular beacon assay, oligonucleotide ligation assay, size analysis, and single-stranded
5 conformation polymorphism.

9. An isolated nucleic acid molecule comprising at least 8 contiguous nucleotides wherein one of the nucleotides is a single nucleotide polymorphism (SNP) selected from any one of the nucleotide sequences in SEQ ID NOS:1-517 and 1035-
10 85,090, or a complement thereof.

10. The isolated nucleic acid molecule of claim 9, wherein the SNP is selected from the group consisting of the SNPs set forth in Tables 3 and 4.

11. An isolated nucleic acid molecule that encodes any one of the amino acid sequences in SEQ ID NOS:518-1034.

12. An isolated polypeptide comprising an amino acid sequence selected from the group consisting of SEQ ID NOS:518-1034.

20

13. An antibody that specifically binds to a polypeptide of claim 12, or an antigen-binding fragment thereof.

14. The antibody of claim 13 in which the antibody is a monoclonal antibody.

25

15. An amplified polynucleotide containing a single nucleotide polymorphism (SNP) selected from any one of the nucleotide sequences of SEQ ID NOS:1-517 and 1035-85,090, or a complement thereof, wherein the amplified polynucleotide is between about 16 and about 1,000 nucleotides in length.

30

16. The amplified polynucleotide of claim 15 in which the nucleotide sequence comprises any one of the nucleotide sequences of SEQ ID NOS:1-517 and 1035-85,090.

5 17. An isolated polynucleotide which specifically hybridizes to a nucleic acid molecule containing a single nucleotide polymorphism (SNP) in any one of the nucleotide sequences in SEQ ID NOS:1-517 and 1035-85,090.

10 18. The polynucleotide of claim 17 which is 8-70 nucleotides in length.

19. The polynucleotide of claim 17 which is an allele-specific probe.

20. The polynucleotide of claim 17 which is an allele-specific primer.

15 21. The polynucleotide of claim 17, wherein the polynucleotide comprises a nucleotide sequence selected from the group consisting of the primer sequences set forth in Table 5 (SEQ ID NOS:85,091-85,702).

20 22. A kit for detecting a single nucleotide polymorphism (SNP) in a nucleic acid, comprising the polynucleotide of claim 17, a buffer, and an enzyme.

23. A method of detecting a single nucleotide polymorphism (SNP) in a nucleic acid molecule, comprising contacting a test sample with a reagent which specifically hybridizes to a SNP in any one of the nucleotide sequences of SEQ ID
25 NOS:1-517 and 1035-85,090 under stringent hybridization conditions, and detecting the formation of a hybridized duplex.

24. The method of claim 23 in which detection is carried out by a process selected from the group consisting of: allele-specific probe hybridization, allele-specific
30 primer extension, allele-specific amplification, sequencing, 5' nuclease digestion,

molecular beacon assay, oligonucleotide ligation assay, size analysis, and single-stranded conformation polymorphism.

25. A method of detecting a variant polypeptide, comprising contacting a
5 reagent with a variant polypeptide encoded by a single nucleotide polymorphism (SNP) in any one of the nucleotide sequences of SEQ ID NOS:1-517 and 1035-85,090 in a test sample, and detecting the binding of the reagent to the polypeptide.

26. A method for identifying an agent useful in therapeutically or
10 prophylactically treating cardiovasacular disorders, comprising contacting the polypeptide of claim 12 with a candidate agent under conditions suitable to allow formation of a binding complex between the polypeptide and the candidate agent, and
... detecting the formation of the binding complex, wherein the presence of the complex identifies said agent.

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27. A method of treating a cardiovascular disorder in an individual, the method comprising administering to said individual an effective amount of statin based on said
individual's likelihood of responding to statin treatment as predicted by the alleles
present at one or more SNP sites selected from the group consisting of the SNP sites
20 disclosed in Tables 1-15.

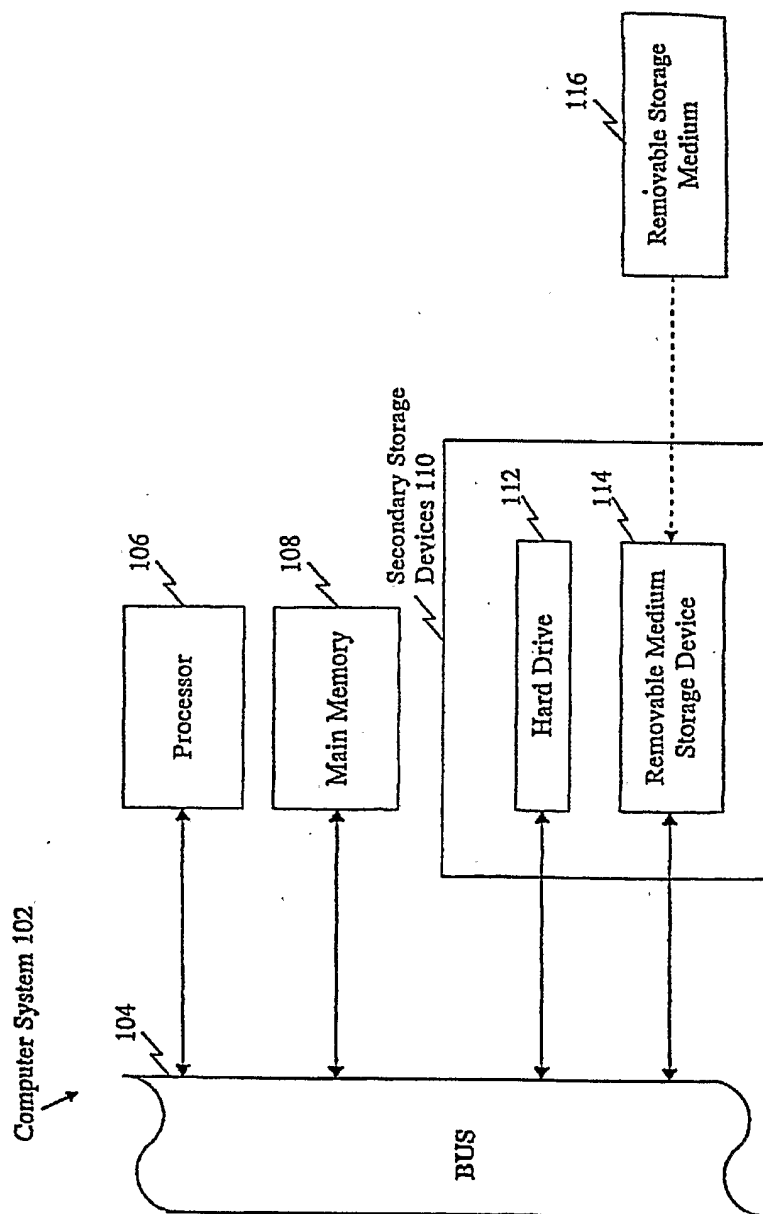


FIGURE 1