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(54) Titre : ACIDES NUCLEIQUES, PROTEINES ET ANTICORPS
 (54) Title: NUCLEIC ACIDS, PROTEINS, AND ANTIBODIES

(57) **Abrégé/Abstract:**

The present invention relates to novel cardiovascular system related polynucleotides and the polypeptides encoded by these polynucleotides herein collectively known as "cardiovascular system antigens", and the use of such cardiovascular system antigens for detecting disorders of the cardiovascular system, particularly the presence of cancer of cardiovascular system tissues and cancer metastases. More specifically, isolated cardiovascular system associated nucleic acid molecules are provided encoding novel cardiovascular system associated polypeptides. Novel cardiovascular system polypeptides and antibodies that bind to these polypeptides are provided. Also provided are vectors, host cells, and recombinant and synthetic methods for producing human cardiovascular system associated polynucleotides and/or polypeptides. The invention further relates to diagnostic and therapeutic methods useful for diagnosing, treating, preventing and/or prognosing disorders related to the cardiovascular system, including cancer of cardiovascular system tissues, and therapeutic methods for treating such disorders. The invention further relates to screening methods for identifying agonists and antagonists of polynucleotides and polypeptides of the invention. The present invention further relates to methods and/or compositions for inhibiting the production and function of the polypeptides of the present invention.

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(54) Title: NUCLEIC ACIDS, PROTEINS, AND ANTIBODIES

(57) Abstract: The present invention relates to novel cardiovascular system related polynucleotides and the polypeptides encoded by these polynucleotides herein collectively known as "cardiovascular system antigens", and the use of such cardiovascular system antigens for detecting disorders of the cardiovascular system, particularly the presence of cancer of cardiovascular system tissues and cancer metastases. More specifically, isolated cardiovascular system associated nucleic acid molecules are provided encoding novel cardiovascular system associated polypeptides. Novel cardiovascular system polypeptides and antibodies that bind to these polypeptides are provided. Also provided are vectors, host cells, and recombinant and synthetic methods for producing human cardiovascular system associated polynucleotides and/or polypeptides. The invention further relates to diagnostic and therapeutic methods useful for diagnosing, treating, preventing and/or prognosing disorders related to the cardiovascular system, including cancer of cardiovascular system tissues, and therapeutic methods for treating such disorders. The invention further relates to screening methods for identifying agonists and antagonists of polynucleotides and polypeptides of the invention. The present invention further relates to methods and/or compositions for inhibiting the production and function of the polypeptides of the present invention.

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60/241,826	20 October 2000 (20.10.2000)	US	20882 (US). BARASH, Steven, C. [US/US]; 111 Watkins		
60/244,617	1 November 2000 (01.11.2000)	US	Pond Blvd. #301, Rockville, MD 20850 (US). RUBEN,		
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60/246,532	8 November 2000 (08.11.2000)	US	MD 20832 (US).		
60/246,476	8 November 2000 (08.11.2000)	US	(74) Agents: HOOVER, Kenley, K. et al.; Human Genome		
60/246,526	8 November 2000 (08.11.2000)	US	Sciences, Inc., 9410 Key West Avenue, Rockville, MD		
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DEMANDE OU BREVET VOLUMINEUX

LA PRÉSENTE PARTIE DE CETTE DEMANDE OU CE BREVET COMPREND PLUS D'UN TOME.

CECI EST LE TOME 1 DE 3
CONTENANT LES PAGES 616 À 291

NOTE : Pour les tomes additionels, veuillez contacter le Bureau canadien des brevets

JUMBO APPLICATIONS/PATENTS

THIS SECTION OF THE APPLICATION/PATENT CONTAINS MORE THAN ONE VOLUME

THIS IS VOLUME 1 OF 3
CONTAINING PAGES 616 TO 291

NOTE: For additional volumes, please contact the Canadian Patent Office

NOM DU FICHER / FILE NAME :

NOTE POUR LE TOME / VOLUME NOTE:

Nucleic Acids, Proteins, and Antibodies

- [001] This application refers to a "Sequence Listing" that is provided only on electronic media in computer readable form pursuant to Administrative Instructions Section 801(a)(i). The Sequence Listing forms a part of this description pursuant to Rule 5.2 and Administrative Instructions Sections 801 to 806, and is hereby incorporated in its entirety.
- [002] The Sequence Listing is provided as an electronic file (PC007PCT_seqList.txt, 4,799,115 bytes in size, created on January 12, 2001) on four identical compact discs (CD-R), labeled "COPY 1," "COPY 2," "COPY 3," and "CRF." The Sequence Listing complies with Annex C of the Administrative Instructions, and may be viewed, for example, on an IBM-PC machine running the MS-Windows operating system by using the V viewer software, version 2000 (see World Wide Web URL: <http://www.fileviewer.com>).

Field of the Invention

- [003] The present invention relates to novel cardiovascular system related polynucleotides, the polypeptides encoded by these polynucleotides herein collectively referred to as "cardiovascular system antigens," and antibodies that immunospecifically bind these polypeptides, and the use of such cardiovascular system polynucleotides, antigens, and antibodies for detecting, treating, preventing and/or prognosing disorders of the cardiovascular system, including, but not limited to, the presence of cancer of the cardiovascular system tissues and cancer metastases. More specifically, isolated cardiovascular system nucleic acid molecules are provided

encoding novel cardiovascular system polypeptides. Novel cardiovascular system polypeptides and antibodies that bind to these polypeptides are provided. Also provided are vectors, host cells, and recombinant and synthetic methods for producing human cardiovascular system polynucleotides, polypeptides, and/or antibodies. The invention further relates to diagnostic and therapeutic methods useful for diagnosing, treating, preventing and/or prognosing disorders related to the cardiovascular system, including of cancer of the cardiovascular system tissues, and therapeutic methods for treating such disorders. The invention further relates to screening methods for identifying agonists and antagonists of polynucleotides and polypeptides of the invention. The invention further relates to methods and/or compositions for inhibiting or promoting the production and/or function of the polypeptides of the invention.

Background of the Invention

[004] The Human Cardiovascular, or circulatory, system is responsible for the delivery of oxygen, nutrient molecules, and hormones, in addition to the removal of carbon dioxide via blood. The system is comprised of the heart and a complex system of arteries, arterioles, capillaries, venules, and veins that innervate and affect the entire body. The circulatory system provides the primary mechanism of transport of materials between the organs and tissues of the body.

[005] The central organ of the circulatory system is the heart, a muscular pump responsible for the propulsion of blood throughout the body. The heart is a two-sided, four chambered structure with muscular walls, contracting and relaxing in a cyclical pattern, or cardiac cycle. The cardiac cycle consists of two parts: systole (e.g., the contraction of the heart muscle) and diastole (e.g., relaxation of the heart muscle). Blood from the body flows through the vena cava into the right atrium (or upper chamber) while oxygenated blood from the lungs flows from the pulmonary vein into the left atrium. Atrial systole occurs as the muscles of both atria contract, forcing blood downward through each atrioventricular (AV) valve into the corresponding ventricle. Diastole occurs as the ventricles are filling with blood. Ventricular systole opens the semilunar, or arterial, valve, forcing the blood out of the ventricles through the pulmonary artery or aorta, depending on the oxygenated state of the blood. The pulmonary artery carries deoxygenated blood to the lungs for gas exchange. The

aorta, the main artery leaving the heart, is responsible for transporting the oxygenated blood from the heart to the network of arteries and capillaries in the body.

[006] Blood vessels that carry blood away from the heart (e.g., arteries) are composed of thick smooth muscle fibers that allows them to expand and contract which enables blood to be carried under high blood pressure. Arterioles are small arteries that connect larger arteries with collections of capillaries (e.g., capillary beds). Capillaries are tiny, extremely thin-walled vessels that act as bridges between arteries and the surrounding tissues. Nutrients, wastes, and hormones are exchanged across the thin walls of capillaries by passing through or between the cells that line the capillary. Some capillaries have small pores between the cells of the capillary walls that allow material exchange as well as the passage of white blood cells.

[007] Blood leaving the capillary beds flows into a progressively larger series of venules that eventually will join to form veins. Because veins carry blood from the capillaries to the heart, most veins carry oxygen-poor blood. The exceptions, pulmonary veins, carry oxygenated blood from the lungs back to the heart via the vena cava. Unlike arteries, pressure in the veins is low; therefore, veins depend on muscular contractions to move the blood through them.

[008] Cardiovascular disease can affect all aspects of the circulatory system, from the heart muscles and valves to the arteries and veins. These diseases can range in severity from mild to severe and acute to chronic. Cardiovascular diseases can be grouped according to the area of the circulatory afflicted, the cause of the affliction, or the result of the affliction.

Disorders and Diseases of the Heart

[009] The most common heart disease is Heart Failure in which the cardiac output of the heart is insufficient to meet the body's normal requirements for oxygen and nutrients. Any disease can lead to heart failure if (a) it increases the heart muscle's workload (e.g., myocarditis, diabetes, coronary artery disease) which eventually weakens the force of contractions, or (b) affects the heart's electrical conduction system (e.g., hyperkalemia) which results in slow, fast, or irregular heartbeats. The body has several mechanisms to initially compensate for heart failure; however, these mechanisms eventually will malfunction and cause edema, making the heart failure worse.

[0010] Several treatment regimens are available for chronic and acute heart failure including dietary adjustments and exercise regimens. Diuretics are used to reduce fluid retention. Other drugs are used to increase the power of a heartbeat and slows a rapid heart rate (e.g., digoxin) and to dilate the blood vessels (e.g., vasodilators, including angiotensin converting enzyme, nitroglycerin, and hydralazine). Heart transplantation may be also recommended if there is no response to any other regimen.

[0011] Cardiomyopathy is group of disorders characterized by an alteration of the structure or an impairment of the function of the muscular wall of the ventricles. The most common form is dilated congestive cardiomyopathy in which the ventricle cavities enlarge, are unable to produce enough cardiac output, and eventually result in congestive heart failure. Viral cardiomyopathy is a form of dilated congestive cardiomyopathy resulting from a viral infection (e.g., coxsackievirus B). Treatments for dilated congestive cardiomyopathy involve managing angina with a nitrate, beta-blocker, or calcium channel blocker. Anticoagulant drugs are also used to prevent embolus. Hypertrophic cardiomyopathy is an inherited genetic defect resulting in thickening of the ventricle walls and possibly blockage of the blood flow into the ventricle. Treatment regimens for hypertrophic cardiomyopathy are aimed primarily at reducing the heart's resistance to filling with blood between heartbeats by the use of beta-blockers and calcium channel blockers. Surgery can also be used to relieve symptoms. Restrictive cardiomyopathy is a rare disorder in which the walls of the ventricles become stiff without thickening and resist normal filling with blood between heartbeats. There are two basic types of restrictive cardiomyopathy: one in which the heart muscle is gradually replaced by scar tissue, and the other in which the heart muscle is infiltrated by abnormal material (e.g., white blood cells, hemochromatosis, amyloidosis, sarcoidosis, or tumor invading the heart tissue). No current therapy for restrictive cardiomyopathy is satisfactory. The therapies for other forms of cardiomyopathy and heart failure worsen this disorder instead of improving it.

[0012] Primary tumors of the heart are generally rare, and their symptoms imitate other heart diseases. Half of all primary heart tumors are myxomas, with most occurring in the left atrium. Myxomas are noncancerous tumors, irregular in shape and jellylike in consistency. The tumor may block or damage the mitral valve or another valve if

pieces of the tumor break off. Symptoms depend on which vessel is blocked. Less common noncancerous heart tumors include fibromas and rhabdomyomas. Single noncancerous primary tumors are generally removed by surgery. Multiple noncancerous and any cancerous heart tumor can not be removed surgically; only their symptoms are treated.

Disorders and Diseases of the Pericardium

[0013] The pericardium is a flexible, two-layered sac that surrounds the heart and is responsible for keeping the heart in position, preventing the heart from overflowing with blood, and protecting the heart from chest infections. Although the pericardium is not essential to the heart's performance, inflammation of the pericardium (e.g., pericarditis), can be painful and result in heart damage. Acute pericarditis occurs when inflammation of the pericardium begins suddenly, resulting in fluid and blood products (e.g., fibrin, red blood cells, and white blood cells) pouring into the pericardial space and compressing the heart. Acute pericarditis has many causes ranging from viral infections to diseases such as AIDS, systemic lupus erythematoses, rheumatoid disease, and kidney failure. Treatment includes analgesics or anti-inflammatory drugs to relieve pain, and in the cases of viral or bacterial infections, antibiotics are also administered.

[0014] Chronic pericarditis is inflammation that results in gradual fluid accumulation and thickening of the pericardium. One form, chronic effusive pericarditis, occurs when fluid slowly accumulates in the pericardium. A rare form, chronic constrictive pericarditis, results when fibrous tissue forms around the heart, compressing the heart, and making the heart smaller. The compression increases the venous pressure resulting in the leaking out and accumulation of fluid in the body. Current protocols for treatment involve diuretics to remove excess fluid or surgery to remove the pericardium.

Disorders and Diseases of the Endocardium and Heart Valves

[0015] Bacterial Endocarditis is an inflammation of the smooth interior lining of the heart (e.g., endocardium) or heart valve occurring most often in people with a heart defect or damaged valves. This disease can appear suddenly and become life-threatening within days (e.g., acute bacterial endocarditis) or can develop gradually over a period

of weeks to several months (e.g., subacute bacterial endocarditis). As a preventive measure, people with heart valve abnormalities, artificial valves, or congenital defects are given antibiotics prior to any dental or surgical procedure. Current treatment for bacterial endocarditis consists of a series of high-dose intravenous antibiotics. Heart surgery may also be required to repair or replace damaged valves and remove accumulations of bacteria and blood clots on the valves (e.g., vegetations).

[0016] Regurgitation describes the leakage back through a valve upon ventricular contraction. The mitral valve opens from the left atrium into the left ventricle. When this valve develops regurgitation, some blood leaks back into the left atrium, increasing the volume and blood pressure, and resulting in lung congestion. The aortic valve opens from the left ventricle into the aorta. Regurgitation of the aortic valve results in a characteristic heart murmur, in mild cases, and enlargement of the ventricle and eventually heart failure in severe cases. The tricuspid valve opens from the right atrium into the right ventricle. Leakage of this valve results in blood pumped forward to the lungs and back into the right atrium and pressure increased in the right atrium and veins, creating resistance to the flow of blood from the body to the heart. Treatment for regurgitation depends on the valve that is leaking. Mitral valve regurgitation is generally treated with surgery, or if atrial fibrillation is also present, with drugs such as beta-blockers, digoxin, and verapamil to slow the heart rate and control the fibrillation. Treatment for aortic valve regurgitation involves reducing the risk for infection of the valve by antibiotics. Currently, there is no treatment for tricuspid valve regurgitation.

[0017] Stenosis is the narrowing of a valve opening that increases resistance to blood flow across the valve. Mitral valve stenosis occurs due to a congenital defect or rheumatic fever and, in the severe cases, results in heart failure and pulmonary edema. Drug therapy (e.g., beta-blockers and digoxin to control fibrillation and diuretics to reduce blood volume and pressure in the lungs) and valve replacement surgery is the current treatment for this stenosis. In addition to the scarring and calcium accumulation in the leaflets of the aortic valve, a congenital defect or rheumatic fever can also cause aortic stenosis. The ventricle wall thickens, requiring an increasing blood supply from the coronary arteries, and resulting in angina, coronary artery disease, and eventually, heart failure. Stenosis can also occur in the tricuspid valve and pulmonary valve; however, it is rarely severe enough to require surgery.

Diseases and Disorders of the Arteries

[0018] Arteriosclerosis is a general term for arterial diseases in which the wall of an artery becomes thicker and less elastic, resulting in an obstruction of the blood flow. Arteriolosclerosis, primarily caused by high blood pressure, is a less common form of arteriosclerosis that affects the inner and middle layer of the walls of arterioles. The most common, atherosclerosis, occurs when fatty material accumulates under the inner lining of the arterial wall. Artherosclerosis can affect the arteries of the brain, heart, kidneys, and other vital organs of the body and results in a severe narrowing of the vessel or a rupture in the vessel, triggering the formation of thrombi. The thrombus may further narrow or occlude the artery, or it may detach and cause an embolism. Treatment for artherosclerosis involves preventing by controlling the risk factors (e.g., high blood pressure, high blood cholesterol levels, cigarette smoking, diabetes) associated with the disease.

[0019] The major cause of cardiovascular disease, coronary artery disease, is arteriosclerosis of the coronary arteries encircling the heart. As coronary artery disease progresses, several major complications can occur, including myocardial ischemia, angina, and myocardial infarction. Ischemia is an inadequate supply of oxygenated blood to the heart that results in heart damage. Angina, or angina pectoris, is the chest pain or pressure sensation that occurs when the heart muscle does not receive enough oxygen. Although ischemia is usually accompanied by an episode of angina, it can occur alone (e.g., silent ischemia).

[0020] Angina pectoris generally occurs upon exertion when the heart's needs increase and the blood flow is no longer enough to meet those needs. However, variant angina, or Prinzmetal's angina, occurs at rest from a spasm of the large coronary arteries on the surface of the heart. Unstable angina occurs when the pattern of symptoms changes, usually reflecting a rapid progression of coronary artery disease. Unstable angina corresponds to a high risk for heart attack and usually translates into a medical emergency. Treatment for both angina pectoris and Prinzmetal's angina is designed to prevent or reduce ischemia and minimize symptoms through drug therapy. Four types of drugs are available: beta-blockers to reduce the resting heart rate and demand for oxygen, nitrates to dilate the blood vessel walls, calcium antagonists to prevent vessel constrictions, and antiplatelet drugs to prevent clot

formation. Unstable angina is currently treated with anticoagulants (e.g., heparin), glycoprotein IIb/IIIa inhibitor (e.g, abciximab) beta-blockers, and intravenous nitroglycerin. If drugs are not effective, coronary arteriography or bypass surgery may be required.

Diseases and Disorders of the Veins

[0021] The main disorders of the veins involve inflammation, clotting, and defects that lead to distention and varicose veins. Varicose veins are enlarged superficial veins most commonly found in the legs. The veins become weak, elongate, and widen, causing the valve cusps to separate, and the veins rapidly fill with blood when the person stands. Varicose veins commonly ache. Although there is no cure, treatment relieves symptoms, improves appearance, and prevents complication. Surgery may also be able to remove the veins.

Disorders Associated with Blood Pressure

[0022] Blood pressure varies naturally over a lifetime. Adjustments in blood pressure are governed by changes in kidney function and in the autonomic nervous system. The most common disorder associated with blood pressure is hypertension or high blood pressure. Hypertension is defined as an average at-rest systolic pressure of 140 mm Hg or more and an average at-rest diastolic pressure of 90 mm Hg or more. Generally, both the systolic and diastolic pressures are elevated. However, in isolated systolic hypertension, only the systolic pressure is elevated. Hypertension probably has more than one cause. Several changes in the heart and blood pressure may combine to elevate blood pressure. Other causes may be kidney disease, hormonal disorders, and drugs. Hypertension increases the risk of developing heart disease, kidney failure, and especially, stroke. Hypertension can not be cured. Treatment involves drug therapy to prevent complications. Current drug regimens include thiazide diuretics to help eliminate salt and water from the kidneys and lower fluid volume, adrenergic blockers (e.g., alpha-blockers, beta-blockers, and alpha-beta blockers) to block the effects of the sympathetic nervous system, angiotensin converting enzyme inhibitors and angiotensin II blockers to dilate arteries, calcium antagonists to dilate blood vessels, and direct vasodialators.

[0023] Low blood pressure can also cause problems. For example, shock results when a low blood volume, an inadequate pumping of the heart, or excessive dilation of the blood vessels causes severe low blood pressure. An inadequate supply of blood reaches the cells, which can be quickly and irreversibly damaged. Low blood volume can occur with excessive loss of body fluids associated with such conditions as pancreatitis, perforation of the intestinal wall, severe diarrhea, excessive use of diuretics, or kidney disease. If untreated, shock is usually fatal. Treatment regimens are aimed at increasing the rate and rhythm of the heartbeat, increasing blood volume, and improve heart muscle contraction.

Disorders Associated with Electrolyte Imbalance

[0024] Changes in the total amount of sodium are closely linked to changes in the volume of water in the blood. Normal kidneys adjust the amount of sodium excreted in the urine so that sodium levels remain relatively constant. Hyponatremia, or low sodium blood level, occurs when the blood sodium concentration falls below 136 milliequivalents (mEq) per liter of blood. A reduction in the blood sodium concentration results in a reduction in blood volume and blood pressure. The heart rate rises and light-headedness and shock can occur. Treatment involves the restriction of fluid intake and a slow increase in the blood sodium levels with intravenous fluids. Hypernatremia, high sodium blood level, occurs when the blood sodium concentration reaches above 145 mEq per liter of blood. This causes an increase in blood volume, resulting in edema. Treatment involves replacing the body's water concentration.

[0025] Changes in potassium concentration can have serious consequences, such as an abnormal heart rhythm or cardiac arrest. Therefore, potassium levels in the blood must be maintained within a narrow range. If the kidneys are not functioning properly or potassium has been lost through the gastrointestinal tract, potassium levels in the blood can drastically drop. Hypokalemia occurs when the blood potassium level falls below 3.8 mEq per liter of blood. Severe hypokalemia can result in muscle weakness, twitches, paralysis, or abnormal heart rhythms. Administration of potassium supplements is generally sufficient to correct this disorder. Hyperkalemia, or high potassium blood level, results when kidneys don't excrete enough potassium or when a rapid influx of potassium is released from the reservoir in cells. Mild

hyperkalemia causes few, if any, symptoms. However, if potassium concentrations rise above 5.5 mEq per liter of blood, the heart's electrical conducting system is affected, resulting in abnormal heart rhythms and, possibly, cardiac arrest. Potassium can be removed from the body by dialysis, by induction of diarrhea, or by administering a potassium-absorbing resin. An intravenous solution of calcium, glucose, or insulin can also be given to protect the heart from the high levels of potassium and to drive the potassium from the blood into the cells, respectively.

[0026] The discovery of new human cardiovascular system associated polynucleotides, the polypeptides encoded by them, and antibodies that immunospecifically bind these polypeptides, satisfies a need in the art by providing new compositions which are useful in the diagnosis, treatment, prevention and/or prognosis of disorders of cardiovascular system, particularly disorders of the cardiovascular system, including, but not limited to, cardiovascular abnormalities (e.g., congenital heart defects, cerebral arteriovenous malformations, and septal defects), heart disease (e.g., heart failure, cardiomyopathy, pericarditis, and endocarditis), arrhythmias, heart valve disease (e.g., stenosis, regurgitation, and prolapse), vascular diseases (e.g., arteriosclerosis, coronary artery disease, angina, varicose veins, hypertension, and shock), electrolyte imbalance disorders (e.g., hypo- and hypernatremia, and hypo- and hyperkalemia), and/or as described under "Cardiovascular Disorders" below.

Summary of the Invention

[0027] The present invention relates to novel cardiovascular system related polynucleotides, the polypeptides encoded by these polynucleotides herein collectively referred to as "cardiovascular system antigens," and antibodies that immunospecifically bind these polypeptides, and the use of such cardiovascular system polynucleotides, antigens, and antibodies for detecting, treating, preventing and/or prognosing disorders of the cardiovascular system, including, but not limited to, the presence of cancer and cancer metastases. More specifically, isolated cardiovascular system nucleic acid molecules are provided encoding novel cardiovascular system polypeptides. Novel cardiovascular system polypeptides and antibodies that bind to these polypeptides are provided. Also provided are vectors, host cells, and recombinant and synthetic methods for producing human cardiovascular system polynucleotides, polypeptides, and/or antibodies. The

invention further relates to diagnostic and therapeutic methods useful for diagnosing, treating, preventing and/or prognosing disorders related to the cardiovascular system, including of cancer of the cardiovascular system tissues, and therapeutic methods for treating such disorders. The invention further relates to screening methods for identifying agonists and antagonists of polynucleotides and polypeptides of the invention. The invention further relates to methods and/or compositions for inhibiting or promoting the production and/or function of the polypeptides of the invention.

Detailed Description

Tables

[0028] Table 1A summarizes some of the polynucleotides encompassed by the invention (including cDNA clones related to the sequences (Clone ID NO:Z), contig sequences (contig identifier (Contig ID:) and contig nucleotide sequence identifier (SEQ ID NO:X)) and further summarizes certain characteristics of these polynucleotides and the polypeptides encoded thereby. The first column provides a unique clone identifier, "Clone ID NO:Z", for a cDNA plasmid related to each cardiovascular system associated contig sequence disclosed in Table 1A. The second column provides a unique contig identifier, "Contig ID:" for each of the contig sequences disclosed in Table 1A. The third column provides the sequence identifier, "SEQ ID NO:X", for each of the contig polynucleotide sequences disclosed in Table 1A. The fourth column, "ORF (From-To)", provides the location (i.e., nucleotide position numbers) within the polynucleotide sequence of SEQ ID NO:X that delineate the preferred open reading frame (ORF) shown in the sequence listing and referenced in Table 1A as SEQ ID NO:Y (column 5). Column 6 lists residues comprising predicted epitopes contained in the polypeptides encoded by each of the preferred ORFs (SEQ ID NO:Y). Identification of potential immunogenic regions was performed according to the method of Jameson and Wolf (CABIOS, 4:181-186 (1988)); specifically, the Genetics Computer Group (GCG) implementation of this algorithm, embodied in the program PEPTIDESTRUCTURE (Wisconsin Package v10.0, Genetics Computer Group (GCG), Madison, Wisc.). This method returns a measure of the probability that a given residue is found on the surface of the protein. Regions where the antigenic index score is greater than 0.9 over at least 6 amino acids are indicated in Table 1A as "Predicted Epitopes." In particular embodiments, cardiovascular system associated

polypeptides of the invention comprise, or alternatively consist of, one, two, three, four, five or more of the predicted epitopes described in Table 1A. It will be appreciated that depending on the analytical criteria used to predict antigenic determinants, the exact address of the determinant may vary slightly. Column 7, "Tissue Distribution" shows the expression profile of tissue, cells, and/or cell line libraries which express the polynucleotides of the invention. The first number in column 7 (preceding the colon), represents the tissue/cell source identifier code corresponding to the code and description provided in Table 4. Expression of these polynucleotides was not observed in the other tissues and/or cell libraries tested. For those identifier codes in which the first two letters are not "AR", the second number in column 7 (following the colon), represents the number of times a sequence corresponding to the reference polynucleotide sequence (e.g., SEQ ID NO:X) was identified in the tissue/cell source. Those tissue/cell source identifier codes in which the first two letters are "AR" designate information generated using DNA array technology. Utilizing this technology, cDNAs were amplified by PCR and then transferred, in duplicate, onto the array. Gene expression was assayed through hybridization of first strand cDNA probes to the DNA array. cDNA probes were generated from total RNA extracted from a variety of different tissues and cell lines. Probe synthesis was performed in the presence of ³³P dCTP, using oligo(dT) to prime reverse transcription. After hybridization, high stringency washing conditions were employed to remove non-specific hybrids from the array. The remaining signal, emanating from each gene target, was measured using a Phosphorimager. Gene expression was reported as Phosphor Stimulating Luminescence (PSL) which reflects the level of phosphor signal generated from the probe hybridized to each of the gene targets represented on the array. A local background signal subtraction was performed before the total signal generated from each array was used to normalize gene expression between the different hybridizations. The value presented after "[array code]:" represents the mean of the duplicate values, following background subtraction and probe normalization. One of skill in the art could routinely use this information to identify normal and/or diseased tissue(s) which show a predominant expression pattern of the corresponding polynucleotide of the invention or to identify polynucleotides which show predominant and/or specific tissue and/or cell expression. Column 8, "Cytologic Band," provides the chromosomal location of

polynucleotides corresponding to SEQ ID NO:X. Chromosomal location was determined by finding exact matches to EST and cDNA sequences contained in the NCBI (National Center for Biotechnology Information) UniGene database. Given a presumptive chromosomal location, disease locus association was determined by comparison with the Morbid Map, derived from Online Mendelian Inheritance in Man (Online Mendelian Inheritance in Man, OMIM™. McKusick-Nathans Institute for Genetic Medicine, Johns Hopkins University (Baltimore, MD) and National Center for Biotechnology Information, National Library of Medicine (Bethesda, MD) 2000. World Wide Web URL: <http://www.ncbi.nlm.nih.gov/omim/>). If the putative chromosomal location of the Query overlapped with the chromosomal location of a Morbid Map entry, an OMIM identification number is provided in Table 1A, column 9 labeled "OMIM Disease Reference(s)". A key to the OMIM reference identification numbers is provided in Table 5.

[0029] Table 1B summarizes additional polynucleotides encompassed by the invention (including cDNA clones related to the sequences (Clone ID NO:Z), contig sequences (contig identifier (Contig ID:) contig nucleotide sequence identifiers (SEQ ID NO:X)), and genomic sequences (SEQ ID NO:B). The first column provides a unique clone identifier, "Clone ID NO:Z", for a cDNA clone related to each contig sequence. The second column provides the sequence identifier, "SEQ ID NO:X", for each contig sequence. The third column provides a unique contig identifier, "Contig ID:" for each contig sequence. The fourth column, provides a BAC identifier "BAC ID NO:A" for the BAC clone referenced in the corresponding row of the table. The fifth column provides the nucleotide sequence identifier, "SEQ ID NO:B" for a fragment of the BAC clone identified in column four of the corresponding row of the table. The sixth column, "Exon From-To", provides the location (i.e., nucleotide position numbers) within the polynucleotide sequence of SEQ ID NO:B which delineate certain polynucleotides of the invention that are also exemplary members of polynucleotide sequences that encode polypeptides of the invention (e.g., polypeptides containing amino acid sequences encoded by the polynucleotide sequences delineated in column six, and fragments and variants thereof).

[0030] Table 2 summarizes homology and features of some of the polypeptides of the invention. The first column provides a unique clone identifier, "Clone ID NO:Z", corresponding to a cDNA disclosed in Table 1A. The second column provides the

unique contig identifier, "Contig ID:" corresponding to contigs in Table 1A and allowing for correlation with the information in Table 1A. The third column provides the sequence identifier, "SEQ ID NO:X", for the contig polynucleotide sequences. The fourth column provides the analysis method by which the homology/identity disclosed in the row was determined. Comparisons were made between polypeptides encoded by the polynucleotides of the invention and either a non-redundant protein database (herein referred to as "NR"), or a database of protein families (herein referred to as "PFAM") as further described below. The fifth column provides a description of PFAM/NR hits having significant matches to a polypeptide of the invention. Column six provides the accession number of the PFAM/NR hit disclosed in the fifth column. Column seven, "Score/Percent Identity", provides a quality score or the percent identity, of the hit disclosed in column five. Columns 8 and 9, "NT From" and "NT To" respectively, delineate the polynucleotides in "SEQ ID NO:X" that encode a polypeptide having a significant match to the PFAM/NR database as disclosed in the fifth column. In specific embodiments, polypeptides of the invention comprise, or alternatively consist of, an amino acid sequence encoded by the polynucleotides in SEQ ID NO:X as delineated in columns 8 and 9, or fragments or variants thereof.

[0031] Table 3 provides polynucleotide sequences that may be disclaimed according to certain embodiments of the invention. The first column provides a unique clone identifier, "Clone ID NO:Z", for a cDNA clone related to cardiovascular system associated contig sequences disclosed in Table 1A. The second column provides the sequence identifier, "SEQ ID NO:X", for contig polynucleotide sequences disclosed in Table 1A. The third column provides the unique contig identifier, "Contig ID", for contigs disclosed in Table 1A. The fourth column provides a unique integer 'a' where 'a' is any integer between 1 and the final nucleotide minus 15 of SEQ ID NO:X, represented as "Range of a", and the fifth column provides a unique integer 'b' where 'b' is any integer between 15 and the final nucleotide of SEQ ID NO:X, represented as "Range of b", where both a and b correspond to the positions of nucleotide residues shown in SEQ ID NO:X, and where b is greater than or equal to a + 14. For each of the polynucleotides shown as SEQ ID NO:X, the uniquely defined integers can be substituted into the general formula of a-b, and used to describe polynucleotides which may be preferably excluded from the invention. In certain embodiments,

preferably excluded from the polynucleotides of the invention (including polynucleotide fragments and variants as described herein and diagnostic and/or therapeutic uses based on these polynucleotides) are at least one, two, three, four, five, ten, or more of the polynucleotide sequence(s) having the accession number(s) disclosed in the sixth column of this Table (including for example, published sequence in connection with a particular BAC clone). In further embodiments, preferably excluded from the invention are the specific polynucleotide sequence(s) contained in the clones corresponding to at least one, two, three, four, five, ten, or more of the available material having the accession numbers identified in the sixth column of this Table (including for example, the actual sequence contained in an identified BAC clone).

[0032] Table 4 provides a key to the tissue/cell source identifier code disclosed in Table 1A, column 7. Column 1 provides the key to the tissue/cell source identifier code disclosed in Table 1A, Column 7. Columns 2-5 provide a description of the tissue or cell source. Codes corresponding to diseased tissues are indicated in column 6 with the word "disease". The use of the word "disease" in column 6 is non-limiting. The tissue or cell source may be specific (e.g. a neoplasm), or may be disease-associated (e.g., a tissue sample from a normal portion of a diseased organ). Furthermore, tissues and/or cells lacking the "disease" designation may still be derived from sources directly or indirectly involved in a disease state or disorder, and therefore may have a further utility in that disease state or disorder. In numerous cases where the tissue/cell source is a library, column 7 identifies the vector used to generate the library.

[0033] Table 5 provides a key to the OMIM™ reference identification numbers disclosed in Table 1A, column 9. OMIM reference identification numbers (Column 1) were derived from Online Mendelian Inheritance in Man (Online Mendelian Inheritance in Man, OMIM™. McKusick-Nathans Institute for Genetic Medicine, Johns Hopkins University (Baltimore, MD) and National Center for Biotechnology Information, National Library of Medicine, (Bethesda, MD) 2000. World Wide Web URL: <http://www.ncbi.nlm.nih.gov/omim/>). Column 2 provides diseases associated with the cytologic band disclosed in Table 1A, column 8, as determined from the Morbid Map database.

- [0034] Table 6 summarizes ATCC Deposits, Deposit dates, and ATCC designation numbers of deposits made with the ATCC in connection with the present application.
- [0035] Table 7 shows the cDNA libraries sequenced, tissue source description, vector information and ATCC designation numbers relating to these cDNA libraries.
- [0036] Table 8 provides a physical characterization of clones encompassed by the invention. The first column provides the unique clone identifier, "Clone ID NO:Z", for certain cDNA clones of the invention, as described in Table 1A. The second column provides the size of the cDNA insert contained in the corresponding cDNA clone.

Definitions

- [0037] The following definitions are provided to facilitate understanding of certain terms used throughout this specification.
- [0038] In the present invention, "isolated" refers to material removed from its original environment (e.g., the natural environment if it is naturally occurring), and thus is altered "by the hand of man" from its natural state. For example, an isolated polynucleotide could be part of a vector or a composition of matter, or could be contained within a cell, and still be "isolated" because that vector, composition of matter, or particular cell is not the original environment of the polynucleotide. The term "isolated" does not refer to genomic or cDNA libraries, whole cell total or mRNA preparations, genomic DNA preparations (including those separated by electrophoresis and transferred onto blots), sheared whole cell genomic DNA preparations or other compositions where the art demonstrates no distinguishing features of the polynucleotide sequences of the present invention.
- [0039] As used herein, a "polynucleotide" refers to a molecule having a nucleic acid sequence encoding SEQ ID NO:Y or a fragment or variant thereof, a nucleic acid sequence contained in SEQ ID NO:X (as described in column 3 of Table 1A) or the complement thereof, a cDNA sequence contained in Clone ID NO:Z (as described in column 1 of Table 1A and contained within a library deposited with the ATCC); a nucleotide sequence encoding the polypeptide encoded by a nucleotide sequence in SEQ ID NO:B as defined in column 6 of Table 1B or a fragment or variant thereof; or a nucleotide coding sequence in SEQ ID NO:B as defined in column 6 of Table 1B or the complement thereof. For example, the polynucleotide can contain the nucleotide

sequence of the full length cDNA sequence, including the 5' and 3' untranslated sequences, the coding region, as well as fragments, epitopes, domains, and variants of the nucleic acid sequence. Moreover, as used herein, a "polypeptide" refers to a molecule having an amino acid sequence encoded by a polynucleotide of the invention as broadly defined (obviously excluding poly-Phenylalanine or poly-Lysine peptide sequences which result from translation of a polyA tail of a sequence corresponding to a cDNA).

[0040] As used herein, a "cardiovascular system antigen" refers collectively to any polynucleotide disclosed herein (e.g., a nucleic acid sequence contained in SEQ ID NO:X or the complement thereof, or cDNA sequence contained in Clone ID NO:Z, or a nucleotide sequence encoding the polypeptide encoded by a nucleotide sequence in SEQ ID NO:B as defined in column 6 of Table 1B, or a nucleotide coding sequence in SEQ ID NO:B as defined in column 6 of Table 1B or the complement thereof and fragments or variants thereof as described herein) or any polypeptide disclosed herein (e.g., an amino acid sequence contained in SEQ ID NO:Y, an amino acid sequence encoded by SEQ ID NO:X, or the complement thereof, an amino acid sequence encoded by the cDNA sequence contained in Clone ID NO:Z, an amino acid sequence encoded by SEQ ID NO:B, or the complement thereof, and fragments or variants thereof as described herein). These cardiovascular system antigens have been determined to be predominantly expressed in cardiovascular system tissues, including normal or diseased tissues (as shown in Table 1A column 7 and Table 4).

[0041] In the present invention, "SEQ ID NO:X" was often generated by overlapping sequences contained in multiple clones (contig analysis). A representative clone containing all or most of the sequence for SEQ ID NO:X is deposited at Human Genome Sciences, Inc. (HGS) in a catalogued and archived library. As shown, for example, in column 1 of Table 1A, each clone is identified by a cDNA Clone ID (identifier generally referred to herein as Clone ID NO:Z). Each Clone ID is unique to an individual clone and the Clone ID is all the information needed to retrieve a given clone from the HGS library. Furthermore, certain clones disclosed in this application have been deposited with the ATCC on October 5, 2000, having the ATCC designation numbers PTA 2574 and PTA 2575; and on January 5, 2001, having the depositor reference numbers TS-1, TS-2, AC-1, and AC-2. In addition to the individual cDNA clone deposits, most of the cDNA libraries from which the clones

were derived were deposited at the American Type Culture Collection (hereinafter "ATCC"). Table 7 provides a list of the deposited cDNA libraries. One can use the Clone ID NO:Z to determine the library source by reference to Tables 6 and 7. Table 7 lists the deposited cDNA libraries by name and links each library to an ATCC Deposit. Library names contain four characters, for example, "HTWE." The name of a cDNA clone (Clone ID NO:Z) isolated from that library begins with the same four characters, for example "HTWEP07". As mentioned below, Table 1A correlates the Clone ID NO:Z names with SEQ ID NO:X. Thus, starting with an SEQ ID NO:X, one can use Tables 1A, 6 and 7 to determine the corresponding Clone ID NO:Z, which library it came from and which ATCC deposit the library is contained in. Furthermore, it is possible to retrieve a given cDNA clone from the source library by techniques known in the art and described elsewhere herein. The ATCC is located at 10801 University Boulevard, Manassas, Virginia 20110-2209, USA. The ATCC deposits were made pursuant to the terms of the Budapest Treaty on the international recognition of the deposit of microorganisms for the purposes of patent procedure.

[0042] In specific embodiments, the polynucleotides of the invention are at least 15, at least 30, at least 50, at least 100, at least 125, at least 500, or at least 1000 continuous nucleotides but are less than or equal to 300 kb, 200 kb, 100 kb, 50 kb, 15 kb, 10 kb, 7.5 kb, 5 kb, 2.5 kb, 2.0 kb, or 1 kb, in length. In a further embodiment, polynucleotides of the invention comprise a portion of the coding sequences, as disclosed herein, but do not comprise all or a portion of any intron. In another embodiment, the polynucleotides comprising coding sequences do not contain coding sequences of a genomic flanking gene (i.e., 5' or 3' to the gene of interest in the genome). In other embodiments, the polynucleotides of the invention do not contain the coding sequence of more than 1000, 500, 250, 100, 50, 25, 20, 15, 10, 5, 4, 3, 2, or 1 genomic flanking gene(s).

[0043] A "polynucleotide" of the present invention also includes those polynucleotides capable of hybridizing, under stringent hybridization conditions, to sequences contained in SEQ ID NO:X, or the complement thereof (e.g., the complement of any one, two, three, four, or more of the polynucleotide fragments described herein), the polynucleotide sequence delineated in columns 8 and 9 of Table 2 or the complement thereof, and/or cDNA sequences contained in Clone ID NO:Z (e.g., the complement of any one, two, three, four, or more of the polynucleotide fragments, or the cDNA

clone within the pool of cDNA clones deposited with the ATCC, described herein) and/or the polynucleotide sequence delineated in column 6 of Table 1B or the complement thereof. "Stringent hybridization conditions" refers to an overnight incubation at 42 degree C in a solution comprising 50% formamide, 5x SSC (750 mM NaCl, 75 mM trisodium citrate), 50 mM sodium phosphate (pH 7.6), 5x Denhardt's solution, 10% dextran sulfate, and 20 µg/ml denatured, sheared salmon sperm DNA, followed by washing the filters in 0.1x SSC at about 65 degree C.

[0044] Also contemplated are nucleic acid molecules that hybridize to the polynucleotides of the present invention at lower stringency hybridization conditions. Changes in the stringency of hybridization and signal detection are primarily accomplished through the manipulation of formamide concentration (lower percentages of formamide result in lowered stringency), salt conditions, or temperature. For example, lower stringency conditions include an overnight incubation at 37 degree C in a solution comprising 6X SSPE (20X SSPE = 3M NaCl; 0.2M NaH₂PO₄; 0.02M EDTA, pH 7.4), 0.5% SDS, 30% formamide, 100 ug/ml salmon sperm blocking DNA; followed by washes at 50 degree C with 1XSSPE, 0.1% SDS. In addition, to achieve even lower stringency, washes performed following stringent hybridization can be done at higher salt concentrations (e.g. 5X SSC).

[0045] Note that variations in the above conditions may be accomplished through the inclusion and/or substitution of alternate blocking reagents used to suppress background in hybridization experiments. Typical blocking reagents include Denhardt's reagent, BLOTTO, heparin, denatured salmon sperm DNA, and commercially available proprietary formulations. The inclusion of specific blocking reagents may require modification of the hybridization conditions described above, due to problems with compatibility.

[0046] Of course, a polynucleotide which hybridizes only to polyA⁺ sequences (such as any 3' terminal polyA⁺ tract of a cDNA shown in the sequence listing), or to a complementary stretch of T (or U) residues, would not be included in the definition of "polynucleotide," since such a polynucleotide would hybridize to any nucleic acid molecule containing a poly (A) stretch or the complement thereof (e.g., practically any double-stranded cDNA clone generated using oligo dT as a primer).

[0047] The polynucleotide of the present invention can be composed of any polyribonucleotide or polydeoxribonucleotide, which may be unmodified RNA or DNA or modified RNA or DNA. For example, polynucleotides can be composed of single- and double-stranded DNA, DNA that is a mixture of single- and double-stranded regions, single- and double-stranded RNA, and RNA that is mixture of single- and double-stranded regions, hybrid molecules comprising DNA and RNA that may be single-stranded or, more typically, double-stranded or a mixture of single- and double-stranded regions. In addition, the polynucleotide can be composed of triple-stranded regions comprising RNA or DNA or both RNA and DNA. A polynucleotide may also contain one or more modified bases or DNA or RNA backbones modified for stability or for other reasons. "Modified" bases include, for example, tritylated bases and unusual bases such as inosine. A variety of modifications can be made to DNA and RNA; thus, "polynucleotide" embraces chemically, enzymatically, or metabolically modified forms.

[0048] The polypeptide of the present invention can be composed of amino acids joined to each other by peptide bonds or modified peptide bonds, i.e., peptide isosteres, and may contain amino acids other than the 20 gene-encoded amino acids. The polypeptides may be modified by either natural processes, such as posttranslational processing, or by chemical modification techniques which are well known in the art. Such modifications are well described in basic texts and in more detailed monographs, as well as in a voluminous research literature. Modifications can occur anywhere in a polypeptide, including the peptide backbone, the amino acid side-chains and the amino or carboxyl termini. It will be appreciated that the same type of modification may be present in the same or varying degrees at several sites in a given polypeptide. Also, a given polypeptide may contain many types of modifications. Polypeptides may be branched, for example, as a result of ubiquitination, and they may be cyclic, with or without branching. Cyclic, branched, and branched cyclic polypeptides may result from posttranslation natural processes or may be made by synthetic methods. Modifications include 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 cross-

links, formation of cysteine, formation of pyroglutamate, formylation, gamma-carboxylation, glycosylation, GPI anchor formation, hydroxylation, iodination, methylation, myristoylation, oxidation, pegylation, proteolytic processing, phosphorylation, prenylation, racemization, selenoylation, sulfation, transfer-RNA mediated addition of amino acids to proteins such as arginylation, and ubiquitination. (See, for instance, PROTEINS - STRUCTURE AND MOLECULAR PROPERTIES, 2nd Ed., T. E. Creighton, W. H. Freeman and Company, New York (1993); POSTTRANSLATIONAL COVALENT MODIFICATION OF PROTEINS, B. C. Johnson, Ed., Academic Press, New York, pgs. 1-12 (1983); Seifter et al., Meth. Enzymol. 182:626-646 (1990); Rattan et al., Ann. N.Y. Acad. Sci. 663:48-62 (1992).)

[0049] "SEQ ID NO:X" refers to a polynucleotide sequence described, for example, in Tables 1A or 2, while "SEQ ID NO:Y" refers to a polypeptide sequence described in column 5 of Table 1A. SEQ ID NO:X is identified by an integer specified in column 3 of Table 1A. The polypeptide sequence SEQ ID NO:Y is a translated open reading frame (ORF) encoded by polynucleotide SEQ ID NO:X. "Clone ID NO:Z" refers to a cDNA clone described in column 1 of Table 1A.

[0050] "A polypeptide having biological activity" refers to a polypeptide exhibiting activity similar to, but not necessarily identical to, an activity of a polypeptide of the present invention, including mature forms, as measured in a particular biological assay, with or without dose dependency. In the case where dose dependency does exist, it need not be identical to that of the polypeptide, but rather substantially similar to the dose-dependence in a given activity as compared to the polypeptide of the present invention (i.e., the candidate polypeptide will exhibit greater activity or not more than about 25-fold less and, preferably, not more than about tenfold less activity, and most preferably, not more than about three-fold less activity relative to the polypeptide of the present invention).

[0051] Table 1A summarizes some of the polynucleotides encompassed by the invention (including contig sequences (SEQ ID NO:X) and clones (Clone ID NO:Z) and further summarizes certain characteristics of these polynucleotides and the polypeptides encoded thereby.

Polynucleotides and Polypeptides

TABLE 1A

Clone ID NO: Z	Contig ID:	SEQ ID NO: X	ORF (From-To)	AA SEQ ID NO: Y	Predicted Epitopes	Tissue Distribution Library code: count (see Table IV for Library Codes)	Cytologic Band	OMIM Disease Reference(s):
HAHCL07	952661	11	489 - 136	626	Phe-16 to Cys-24, Thr-49 to Asp-60.	L0471: 3, L0759: 2, L0459: 1, L0622: 1, H0599: 1, H0196: 1, L0662: 1, L0747: 1 and L0604: 1.		
HAHCP26	681258	12	2 - 403	627	Val-18 to Glu-26, Val-43 to Gln-48, Pro-56 to Asp-63.	H0599: 2		
HAHCP41	712086	13	81 - 239	628	Gly-13 to Glu-18.	H0599: 2		
HAHCP49	722659	14	1 - 234	629	Tyr-24 to His-32, Asp-43 to Thr-48, Ala-54 to Lys-59.	H0599: 2		
HAHCP55	865095	15	62 - 250	630		H0599: 2		
HAHCP67	756916	16	2 - 262	631		H0599: 2	3p21.1	150250, 164500, 168468, 182280, 238310, 600163, 601226, 601916

HAHCP91	789998	17	163 - 288	632	Ser-29 to Ala-38.	H0599: 2		
HAHCR57	865096	18	1 - 387	633	Ala-6 to Ser-17, Ser-19 to Trp-24.	H0599: 2		
HAHEE04	922257	19	2 - 346	634		H0599: 2		
HAHEE05	928673	20	3 - 422	635	Asp-1 to Pro-10, Thr-13 to Asn-20, His-28 to Gln-45, Phe-56 to Ser-61, Glu-63 to Pro-70, Ser-98 to Ser-110, Thr-115 to Ser-122, Arg-130 to Gln-140.	H0599: 2 and L0777: 1.		
HAHEO46	718772	21	85 - 222	636	Arg-9 to Phe-14, Val-28 to Gln-35.	H0599: 3		
HAHES10	961594	22	2 - 241	637	Gly-1 to Asn-14, Val-20 to Ser-25, Thr-46 to Gly-54.	H0599: 2		
HAHFX20	925753	23	53 - 139	638	Glu-1 to Ala-7.	H0599: 2		
HAHHE12	969107	24	88 - 804	639		H0373: 5, L0604: 4, H0599: 2 and L0485: 1.		
HAHHO04	925814	25	41 - 313	640	Asp-18 to Asp-24, Pro-47 to Ser-53.	H0599: 2		
HAHHS01	913863	26	44 - 181	641	Ser-18 to Leu-28.	H0599: 2		
HAHIK10	961425	27	1 - 171	642	Glu-31 to Leu-47.	H0599: 2		
HAHIW08	955803	28	16 - 312	643	Tyr-4 to His-14,	H0599: 2		

HAHSC42	695111	29	3 - 440	644	Thr-32 to Ala-38, Pro-46 to Pro-51.	H0097: 1 and H0373: 1.	
HCMBA95	508774	30	138 - 293	645	Ile-1 to Ala-12.	H0173: 1 and H0196: 1.	
HCMSC52	522615	31	32 - 88	646	Glu-12 to Lys-17.	H0196: 2	
HCMSE09	530511	32	119 - 358	647	Phe-10 to His-18.	H0196: 2	
HCMSEQ77	862373	33	1 - 216	648	Arg-1 to Pro-7.	H0196: 2	
HCMSS72	526183	34	1 - 174	649		H0196: 2	
HCMSU37	706337	35	1 - 312	650	Ser-1 to Leu-6, Lys-16 to Arg-23, Gln-26 to Asn-42, Ser-54 to Pro-66.	H0599: 1, H0196: 1 and L0485: 1.	
HCMSEX59	522598	36	3 - 173	651		H0230: 1 and H0196: 1.	
HELAF85	507230	37	63 - 266	652	Cys-1 to Gly-7.	S0045: 2	
HELAI26	920922	38	79 - 216	653		S0045: 2	
HELAL34	527994	39	1 - 210	654	Asn-3 to Gly-29.	S0045: 2	
HELAV61	507205	40	87 - 305	655	Phe-2 to Thr-12, His-49 to Arg-62.	S0045: 2	
HELBDO8	960106	41	69 - 203	656		S0045: 2	
HELBDO70	527677	42	5 - 166	657	Pro-4 to Cys-10.	S0045: 2	
HELBK27	527669	43	35 - 163	658		S0045: 2	
HELBNA45	527666	44	1 - 195	659	Tyr-7 to Tyr-12,	S0045: 2	

								Asp-55 to Glu-61.				
HELBP62	527533	45	168 - 335	660			660	Ser-1 to Cys-12.		S0045: 2		
HELDFG77	750478	46	2 - 112	661			661	Pro-6 to Ser-12.		S0045: 2		
HELK12	766209	47	99 - 233	662			662			S0045: 2		
HELDO56	531576	48	110 - 229	663			663	Tyr-24 to Ile-30.		S0045: 2		
HELEA45	954371	49	3 - 143	664			664			S0045: 1 and H0196: 1.		
HELEE09	531415	50	180 - 290	665			665	Met-6 to Tyr-11.		S0045: 2		
HELEF52	506677	51	68 - 268	666			666			S0045: 2		
HELEQ47	577187	52	31 - 246	667			667			S0045: 2		
HELER30	574038	53	38 - 289	668			668	Arg-22 to Leu-28.		S0045: 2		
HELEU12	574023	54	130 - 387	669			669			S0045: 2, L0748: 1 and L0749: 1.		
HELEU37	522407	55	38 - 145	670			670			S0045: 2		
HELEU73	574016	56	235 - 378	671			671			S0045: 2		
HELEU91	851160	57	101 - 337	672			672	Leu-2 to Ser-8, Asn-34 to Phe-39, Pro-41 to Tyr-46.		S0045: 2		
HELEW62	574025	58	200 - 304	673			673			S0045: 2		
HELFF40	574058	59	66 - 152	674			674			S0045: 2		
HELFFH33	576530	60	3 - 224	675			675			S0045: 1 and S0046: 1.		
HELFFJ03	921943	61	42 - 320	676			676	Tyr-6 to Gln-14, Pro-17 to Ala-24.		S0045: 2		
HELFFQ54	728888	62	3 - 440	677			677	Gly-17 to Lys-32, Gly-38 to Tyr-43, Pro-77 to His-82.		S0045: 2		

HELFAQ79	577248	63	126 - 371	678	Asp-22 to Gly-27, Ala-36 to Leu-43, Phe-58 to Trp-73.	S0045: 3		
HELGA54	576374	64	12 - 440	679	Pro-7 to Trp-15, Leu-17 to Cys-32.	S0045: 2		
HELGC24	576377	65	56 - 247	680	Arg-15 to Arg-24, Ser-39 to Val-47.	S0045: 2		
HELGC32	699375	66	2 - 238	681	Pro-10 to Ser-17, Ala-21 to Thr-26, Pro-60 to Leu-72.	L0455: 2, S0045: 1 and H0050: 1.		
HELGC77	577317	67	72 - 242	682	Ser-2 to Asp-14.	S0045: 2		
HELGG77	825795	68	312 - 527	683	Lys-27 to Asn-45, Pro-62 to His-68.	S0045: 1 and H0413: 1.		
HELGH89	545009	69	338 - 3	684	Arg-41 to Tyr-46, Ile-92 to Asn-97.	AR050: 1, AR054: 1, AR051: 0 S0045: 2		
	553652	606	338 - 3	1221	Arg-41 to Tyr-46, Ile-92 to Asn-97.			
HELGN53	963160	70	180 - 368	685	Arg-1 to Gly-6.	S0045: 1 and H0619: 1.		
HELGP50	576339	71	27 - 197	686	Arg-1 to Gly-7.	S0045: 2		
HELGQ48	851178	72	97 - 222	687		S0045: 2		
HELGT48	879483	73	312 - 647	688	Arg-41 to Tyr-46, Ile-92 to Asn-97.	S0045: 2		
HELGZ48	721742	74	1 - 348	689	Pro-20 to Thr-26, Gln-62 to Thr-68,	S0045: 1 and S0046: 1.		

							Val-75 to Gln-83.						
HELHB12	970863	75	86 - 184	690					S0045: 1 and S0046: 1.				
HELHC49	576292	76	40 - 228	691					S0045: 2				
HELHD46	719129	77	1 - 279	692					S0045: 1 and S0046: 1.				
HELHF07	949067	78	65 - 340	693			Thr-16 to Pro-21.		AR061: 5, AR089: 4 S0045: 2				
HELHM29	883505	79	1 - 303	694					S0045: 2				
HEMBC56	577797	80	148 - 381	695			Gly-33 to Ser-38.		S0046: 2				
HEMBI16	507220	81	23 - 169	696					S0046: 2				
HEMBZ84	527989	82	33 - 125	697					S0046: 2				
HEMCA89	527985	83	9 - 131	698					S0046: 2				
HEMCM25	948738	84	84 - 212	699					AR051: 22, AR054: 20, AR050: 17 S0046: 4				
HEMDG56	715834	85	1 - 120	700					S0046: 2				
HEMDG83	576508	86	231 - 452	701					S0046: 4 and L0754: 1.				
HEMDK92	574278	87	124 - 303	702					S0046: 2, L0748: 1 and L0755: 1.				
HEMDM56	577251	88	94 - 252	703					S0045: 1 and S0046: 1.				
HEMDO24	577297	89	101 - 391	704			Asp-10 to Gln-20, Trp-27 to Ser-38, Glu-54 to Lys-69.		S0046: 2				
HEMEA72	527804	90	2 - 184	705			Lys-16 to Phe-21.		S0046: 1 and H0268: 1.				
HEMEH76	574345	91	2 - 211	706			Pro-6 to Ser-16, Ala-33 to Ser-38.		S0046: 2				

HEMEK19	574209	92	78 - 263	707	Phe-48 to Gly-57.	AR089: 9, AR061: 3 S0046: 2		
HEMEN63	578717	93	1 - 321	708	Gly-1 to Lys-6, Arg-16 to Gly-27, Pro-47 to Gly-67.	S0046: 3		
HEMEU54	947801	94	3 - 371	709	Ala-10 to Arg-17, Pro-74 to Val-79, Gly-85 to Tyr-92, Pro-94 to Lys-100.	AR054: 126, AR050: 108, AR051: 103 S0046: 1 and H0619: 1.		
HEMFL58	576505	95	3 - 221	710	Gln-25 to Leu-30.	S0046: 2		
HEMFN33	702564	96	2 - 169	711	Ala-4 to Ser-10.	S0046: 2		
HEMFX20	840164	97	41 - 160	712	Glu-1 to Lys-7.	S0045: 1 and S0046: 1.		
HEMGL57	971118	98	3 - 182	713	Pro-13 to Arg-19.	S0046: 2		
HEMGL58	578091	99	1 - 195	714		S0046: 1, H0050: 1 and 3 L0743: 1.		
HHBBA47	720472	100	30 - 179	715	Arg-9 to Arg-22.	H0373: 2		
HHBBI11	959756	101	1 - 201	716	Cys-11 to Thr-20, Ala-22 to Thr-30.	H0373: 2		
HHBBK65	588062	102	242 - 343	717		H0373: 2		
HHBBL40	588066	103	98 - 274	718	Asn-43 to Gly-51.	H0373: 2		
HHBBL53	588067	104	2 - 199	719	Pro-1 to Leu-15, Lys-18 to Ala-25, Glu-32 to Asp-49, Ser-55 to Thr-66.	H0373: 2		
HHBEA32	927399	105	1 - 159	720	Pro-8 to Gly-17.	H0373: 2		

HHBEE70	697541	106	269 - 424	721			H0373: 2	
HHBEM70	756949	107	45 - 242	722			AR089: 3, AR061: 1 H0373: 3	
HHBEN34	703745	108	278 - 382	723	Ser-11 to Lys-21.		H0373: 2	
HHBFL31	800035	109	41 - 223	724			AR050: 51, AR054: 43, AR051: 35 H0373: 2	
HHBFW44	716283	110	49 - 117	725			H0373: 2	
HHBFW75	958692	111	100 - 423	726	Thr-24 to Lys-30, Gln-33 to Glu-41.		H0373: 2	
HHBGN42	698774	112	124 - 2	727	Arg-12 to Asn-19.		H0373: 2	
HHBGN52	726391	113	2 - 229	728	Pro-1 to Lys-6.		H0373: 3	
HHBGN68	752745	114	3 - 53	729	Glu-10 to Gly-17.		H0373: 2	
HHBGR37	708457	115	139 - 306	730			H0373: 2	
HHBGT39	940578	116	2 - 67	731	Lys-11 to Gly-18.		H0373: 2	
HHBGY59	792027	117	3 - 452	732			H0373: 2	
HHBHE83	780875	118	2 - 76	733	Ala-3 to Arg-8.		H0373: 3	
HHBHK08	958649	119	146 - 301	734	Gly-16 to Pro-24.		H0373: 2	
HHBHK84	858431	120	3 - 350	735	Leu-16 to Gly-26, Pro-67 to Arg-78.		H0373: 3	
HHBHO63	906947	121	179 - 310	736			H0373: 2	
HHBHP27	676601	122	79 - 414	737	Ile-12 to Gln-30, Tyr-57 to Ser-64.		H0373: 2	10p12
HHFBD39	826307	123	1 - 231	738	Cys-51 to Arg-60.		H0050: 2	
HHFBD50	724763	124	301 - 146	739	Asp-36 to Pro-48.		H0619: 1, H0050: 1,	

									L0748: 1 and L0759: 1.		
	858082	607	209 - 3	1222					Gln-1 to Thr-35.		
HHF32	502872	125	69 - 179	740					Glu-1 to Glu-8.	H0619: 1, H0050: 1 and H0105: 1.	
HHFBH26	502843	126	46 - 213	741					Cys-34 to Ser-48.	H0050: 3	
HHFBI05	932961	127	3 - 188	742					Gly-2 to Ser-9.	H0050: 3	
HHFBJ81	502954	128	56 - 196	743						H0050: 2	
HHFBL16	509237	129	147 - 362	744					Gln-30 to Gly-49, Pro-52 to Arg-63.	H0050: 2	
HHFBL30	509238	130	1 - 222	745					Arg-18 to Pro-37.	H0050: 2	
HHFBL32	509233	131	82 - 228	746					Ser-1 to Phe-12, Gly-37 to Lys-49.	H0050: 2	
HHFBL36	707930	132	169 - 249	747						H0050: 3	
HHFBL39	509637	133	3 - 185	748					Cys-1 to Arg-8, Pro-13 to Tyr-22.	H0050: 2	
HHFBL60	739670	134	115 - 270	749						H0050: 2	
HHFBP60	503453	135	1 - 183	750					Phe-31 to Tyr-51.	H0050: 2	
HHFBX77	959805	136	1 - 369	751					Thr-19 to His-25, Glu-58 to Lys-66, Ala-74 to Glu-84, Asn-116 to Glu-123.	H0050: 4 and H0619: 1.	
HHFCA64	720849	137	287 - 207	752						H0050: 3 and H0619: 1.	
	926760	608	69 - 260	1223							
HHFCF70	518435	138	2 - 379	753					Glu-4 to Ser-16,	H0050: 2	

HHFCH59	526389	139	174 - 350	754	Pro-41 to Gln-48, Lys-55 to Ser-63, Lys-109 to Leu-115.	H0050: 2		
HHFCI73	518427	140	150 - 1	755	Lys-6 to Leu-12, Arg-24 to Gly-29, Pro-32 to Cys-38, Thr-42 to Asn-50.	H0050: 2		
HHFCK71	781725	141	98 - 214	756		H0050: 2		
HHFCL91	509628	142	3 - 221	757	Asn-32 to Val-41, Pro-52 to Ala-65.	H0050: 2		
HHFCP67	536062	143	110 - 295	758		H0050: 2		
HHFCZ01	509163	144	165 - 287	759		H0050: 2		
HHFDA67	509387	145	16 - 294	760		H0050: 2 and H0645: 1.		
HHFDG32	502957	146	118 - 300	761	Ser-4 to Ser-9, Phe-13 to Tyr-19.	H0050: 2		
HHFDH02	921297	147	1 - 168	762	Asn-1 to Asn-15.	H0050: 2		
HHFDH38	536551	148	3 - 293	763	Thr-3 to Glu-9.	H0050: 2		
HHFDI07	954404	149	47 - 214	764	Pro-24 to Asn-29.	H0050: 2		
HHFDI42	500877	150	3 - 152	765	Arg-11 to Gly-16.	H0050: 2		
HHFDI62	745569	151	169 - 309	766		H0050: 2		
HHFDI66	573283	152	210 - 401	767		H0050: 2		
HHFDJ27	534909	153	166 - 378	768		H0242: 4 and H0050: 1.		

HHFDJ87	575105	154	60 - 293	769	Val-13 to Arg-25, Ile-51 to Pro-56.	H0050: 2		
HHFDM05	932863	155	218 - 427	770	Thr-10 to Glu-27.	H0050: 2		
HHFEJ18	525616	156	30 - 134	771	Gly-29 to Glu-35.	H0619: 1, H0050: 1 and H0242: 1.		
HHFEO24	525611	157	132 - 308	772	Asn-10 to Ser-16.	H0050: 2		
HHFES51	525609	158	1 - 180	773	Asn-1 to Gly-7, Lys-15 to Ser-20.	H0050: 2		
HHFFG41	575009	159	2 - 121	774		H0050: 2		
HHFFO64	523769	160	191 - 316	775		H0050: 2		
HHFFO66	500910	161	77 - 217	776	Ser-31 to Gly-41.	H0050: 3		
HHFFO96	894076	162	186 - 76	777	Ser-1 to Ile-12.	H0619: 1 and H0050: 1.		
HHFFT69	662462	163	230 - 511	778	Ser-72 to Val-81.	L0779: 2, L0731: 2, H0002: 1, H0050: 1, L0769: 1, L0637: 1, L0809: 1 and L0745: 1.		
HHFFX20	525617	164	45 - 116	779		H0050: 2		
HHFFX75	507394	165	115 - 261	780	Gln-28 to Gln-34.	H0050: 1 and H0242: 1.		
HHFFY80	732614	166	124 - 399	781	Asn-1 to Asn-9.	H0050: 2		
HHFFZ04	927869	167	269 - 514	782	Asp-1 to Glu-6.	L0777: 3, H0050: 2 and H0619: 1.	107970, 115650, 123270, 182600,	14q24-q32

												245200, 251600, 270100, 276900, 602091
HHFFZ19	509630	168	320 - 466	783	Thr-25 to Gln-31.	H0050: 2 and H0266: 1.						
HHFGA21	573584	169	114 - 299	784		H0050: 2						
HHFGC14	741650	170	38 - 370	785	Gln-1 to Asn-10.	AR089: 9, AR061: 5 H0050: 2						
HHFGC69	573491	171	81 - 275	786		H0050: 2						
HHFGC93	576487	172	90 - 311	787		H0050: 2						
HHFGC95	795968	173	24 - 389	788	Asn-34 to Glu-39.	H0050: 2						
HHFGE01	917137	174	2 - 406	789		H0050: 1 and H0105: 1.						
HHFGJ85	524890	175	183 - 293	790		H0050: 2						
HHFGM50	506635	176	111 - 311	791	Gln-10 to Val-15, Arg-21 to Gly-29.	H0050: 2						
HHFGN31	908508	177	93 - 230	792		AR089: 43, AR061: 5 H0619: 1 and H0050: 1.						
HHFGN67	573509	178	68 - 184	793		H0050: 2						
HHFGP71	573860	179	120 - 263	794	Val-18 to Glu-25.	H0050: 3 and H0619: 1.						
HHFGR35	573510	180	125 - 229	795		H0050: 2 and H0619:						

							1.							
HHFGS09	526331	181	3 - 257			796	Leu-43 to Leu-53.		H0050: 2					
HHFGS40	888332	182	35 - 313			797	Val-1 to His-9, Gly-43 to Leu-49.		AR051: 2, AR054: 2, AR050: 2 H0050: 3					
HHFGS92	871899	183	54 - 332			798			H0050: 2					
HHFGT10	968109	184	172 - 411			799			H0619: 1, H0645: 1 and H0050: 1.					
HHFGY13	573473	185	1 - 234			800	Gly-1 to Gly-9, Gly-24 to Arg-33, Thr-42 to Asp-47, Asn-63 to Lys-68.		H0050: 2					
HHFGY37	711364	186	133 - 414			801	Gly-3 to Trp-25.		H0050: 2					
HHFGY75	573483	187	196 - 450			802			H0050: 2					
HHFGZ54	573477	188	33 - 143.			803	Pro-1 to Gly-9.		H0050: 2					
HHFGZ63	661248	189	132 - 281			804	Glu-27 to Lys-38.		H0050: 2					
	744984	609	470 - 228			1224								
HHFGZ69	918322	190	226 - 417			805	Gly-7 to Pro-12.		H0619: 2 and H0050: 1.					
HHFHA44	573498	191	138 - 275			806	Pro-31 to Lys-40.		H0050: 2					
HHFHC02	920510	192	1 - 216			807			H0050: 2					
HHFHC44	716763	193	3 - 227			808			H0050: 2 and L0748: 1.					
HHFHC57	573506	194	3 - 161			809			H0050: 2					
HHFHC72	766128	195	152 - 265			810	Arg-8 to Gly-25.		H0050: 2					

HHFHE28	506630	196	139 - 327	811			H0050: 2		
HHFHE58	526391	197	316 - 525	812			H0050: 2 and L0748: 1.		
HHFHE76	506578	198	281 - 436	813			H0050: 2 and H0619: 1.		
HHFHF91	526396	199	1 - 366	814	Gly-13 to Lys-32, Lys-47 to Glu-54, Thr-90 to Arg-98.		H0050: 2		
HHFHJ46	576949	200	1 - 513	815			S0045: 1, H0050: 1 and L0749: 1.		
HHFHJ72	575030	201	1 - 78	816			H0050: 1 and H0242: 1.		
HHFHM77	934027	202	2 - 187	817			H0619: 1 and H0050: 1.		
HHFHN54	506624	203	1 - 225	818	Ser-12 to Leu-17.		H0050: 2		
HHFHQ86	572923	204	231 - 353	819			H0050: 2		
HHFHU63	572871	205	52 - 300	820	Ser-40 to Lys-45.		H0050: 2		
HHFHX11	967321	206	3 - 83	821			H0050: 2		
HHFHY47	720473	207	151 - 351	822			H0050: 2 and H0242: 1.		
HHFHY66	573294	208	155 - 319	823			H0050: 2		
HHFJC02	918318	209	78 - 296	824	Arg-1 to Gly-10, Pro-44 to Trp-49, Ser-58 to Val-64.		H0619: 2		
HHFJI11	883731	210	2 - 298	825	Leu-2 to Gln-11.		H0619: 2		

HHFJL11	965931	211	56 - 202	826			H0619: 3	
HHFJM56	857990	212	26 - 268	827			H0619: 2	
HHFJN01	913798	213	1 - 312	828	Asn-28 to Gln-33.		H0619: 1 and H0050: 1.	
HHFJN02	918358	214	23 - 226	829			H0619: 1 and H0050: 1.	
HHFJO06	934168	215	271 - 453	830			H0619: 2 and H0050: 1.	
HHFJO12	969624	216	46 - 162	831			H0619: 1 and H0645: 1.	
HHFJR06	934093	217	25 - 243	832	Gly-66 to Asp-73.		H0619: 2	
HHFJX18	907658	218	154 - 342	833	Pro-5 to Lys-15.		H0619: 2	
HHFKB03	922803	219	58 - 318	834	Gly-66 to Gly-71, Ser-79 to Pro-87.		H0619: 2	
HHFKC28	857948	220	44 - 271	835			H0619: 1 and H0050: 1.	
HHFKC43	906903	221	171 - 404	836	Cys-26 to Thr-31.		H0619: 3, L0749: 3 and L0748: 1.	
HHFKE05	920550	222	335 - 472	837	Gln-4 to Trp-12.		H0619: 1 and H0050: 1.	
HHFKH82	857810	223	91 - 336	838			H0619: 1 and H0645: 1.	
HHFKI02	918288	224	83 - 268	839			H0619: 3	
HHFKJ68	934045	225	22 - 321	840	Pro-3 to Thr-9, Cys-34 to Leu-41,		H0619: 3	

HHFKK95	952082	226	340 - 510	841	Pro-49 to Arg-56.	H0619: 3		
HHFKM10	963184	227	55 - 324	842	Ser-15 to Arg-20, Gly-31 to Ala-47, Arg-69 to Gly-77.	H0619: 3		
HHFKU12	887244	228	2 - 229	843	Arg-16 to Gly-21, Gly-33 to Met-39, Glu-71 to His-76.	L0748: 3 and H0619: 2.		
HHFKU44	857923	229	239 - 529	844	Glu-15 to Gly-24.	H0619: 3		
HHFKX11	965874	230	155 - 331	845	Thr-53 to Phe-58.	H0619: 2		
HHFKY11	965876	231	121 - 315	846	Ser-10 to Trp-18, Arg-20 to Cys-27.	H0619: 2		
HHFLA69	933869	232	47 - 211	847		H0619: 1 and H0645: 1.		
HHFLH34	857907	233	2 - 334	848	Glu-45 to Gln-52, Asp-78 to Leu-85.	H0619: 1 and H0645: 1.		
HHFLM06	933868	234	147 - 359	849	Asn-37 to Gln-46, Asp-50 to Gly-65.	H0619: 1 and H0645: 1.		
HHFLP28	857888	235	1 - 204	850	His-8 to Ser-19.	H0619: 2		
HHFLU04	870085	236	127 - 366	851	Asn-1 to Glu-7, Glu-13 to Cys-18.	H0619: 2 and H0050: 1.		
HHFMA58	853959	237	2 - 202	852		H0619: 2		
HHFMB01	914951	238	3 - 179	853	Asp-1 to Glu-7, Leu-32 to Trp-37.	H0619: 2		
HHFME70	926497	239	128 - 265	854	Gln-6 to Arg-22.	H0619: 2		

HHFMH85	872838	240	2 - 256	855	Pro-5 to Pro-12.	H0619: 2		
HHFMI58	857856	241	1 - 372	856	Thr-1 to Gly-14, Pro-40 to His-48, Thr-50 to Gly-72, His-74 to Glu-87.	H0619: 2 and L0534: 1.		
HHFMO03	922708	242	319 - 426	857	Arg-29 to Lys-36.	H0619: 3, L0766: 3, H0645: 1, H0050: 1 and L0439: 1.		
HHFMO94	957955	243	52 - 204	858	Leu-11 to Cys-17.	H0645: 3 and H0619: 1.		
HHFMQ70	840039	244	97 - 177	859	Asn-16 to Pro-27.	H0619: 2		
HHFMZ40	974299	245	269 - 475	860	Gln-44 to Pro-49, Asn-51 to Ser-57.	H0619: 2		
HHFNA49	914838	246	120 - 263	861		H0619: 2		
HHFND10	963140	247	188 - 451	862	Leu-16 to Leu-32.	H0619: 2		
HHFNF41	857825	248	1 - 357	863		H0619: 2		
HHFNI49	857850	249	1 - 192	864	Ser-17 to Ser-24.	H0619: 2 and H0050: 1.		
HHFOC27	857816	250	216 - 404	865		H0645: 1 and H0050: 1.		
HHFOC66	857955	251	1 - 240	866	Pro-19 to His-27, Pro-41 to Gln-54.	H0619: 1 and H0645: 1.	11q13	102200, 106100, 131100, 131100, 131100,

									133780, 147050, 153700, 161015, 164009, 168461, 168461, 168461, 180721, 180840, 191181, 193235, 209901, 232600, 259700, 259770, 600045, 600319, 600528, 601884
HHFOF07	952062	252	83 - 160	867				H0645: 1 and H0050: 1.	
HHFOF40	930839	253	106 - 327	868				H0645: 3	
HHFOJ05	930856	254	93 - 239	869	Cys-5 to Val-11.			H0645: 1 and H0050: 1.	

HHFON08	957974	255	2 - 154	870				H0645: 2	
HHFON15	857792	256	68 - 259	871				H0645: 2	
HHFON19	910891	257	250 - 825	872	Thr-136 to Cys-141.			AR089: 19, AR061: 17 H0645: 2 and H0050: 1.	
HHFON32	858034	258	111 - 398	873	Lys-39 to Ser-49.			H0645: 3, H0050: 1 and H0105: 1.	
HHFON87	857783	259	1 - 273	874	Pro-8 to Arg-15.			H0645: 2 and L0529: 1.	
HHFOW08	857772	260	351 - 202	875				H0645: 1 and H0050: 1.	
HHFSB02	921364	261	3 - 191	876	Pro-43 to Tyr-49.			H0050: 2 and H0105: 1.	
HHFTC88	500903	262	357 - 190	877				H0050: 1 and H0233: 1.	
HHFUB15	534520	263	81 - 314	878	Ala-32 to Asp-39.			H0242: 4	
HHFUB23	928063	264	101 - 250	879	Leu-3 to Phe-11.			H0242: 2	
HHFUB77	772691	265	76 - 195	880				H0242: 2	
HHFUC24	524840	266	81 - 317	881				H0242: 2	
HHFUC26	960331	267	136 - 381	882	Lys-48 to Ser-53.			H0242: 2 and H0645: 1.	
HHFUC42	525603	268	221 - 325	883				H0242: 2, L0789: 2, L0805: 1, L0776: 1 and L0530: 1.	
HHFUC45	525600	269	1 - 162	884	Thr-1 to Gly-9.			H0242: 2	

HHFUC47	525599	270	194 - 75	885			H0242: 2	
HHFUC83	507459	271	1 - 174	886	Arg-13 to Cys-20.		H0242: 2	
HHFUC92	507018	272	48 - 245	887			H0242: 2 and H0050: 1.	
HHFUK58	525604	273	43 - 168	888	Gly-2 to Cys-8, Pro-17 to Lys-27.		H0242: 2	
HHFUL75	675569	274	1 - 237	889	Thr-4 to Ala-9, His-40 to Ala-51, Glu-53 to Leu-58.		H0050: 1, H0242: 1 and H0373: 1.	
HHFUN56	530953	275	1 - 222	890			H0050: 1 and H0242: 1.	
HMEBA75	530303	276	1 - 159	891	Arg-1 to Gln-10.		S0045: 1 and H0267: 1.	
HMEBY61	947868	277	29 - 193	892			T0049: 1 and H0267: 1.	
HMEDF58	738427	278	284 - 493	893			S0045: 1 and H0266: 1. H0266: 2	
HMEDR48	529173	279	3 - 134	894			S0045: 1 and H0266: 1.	
HMEEF64	918746	280	2 - 229	895	Ser-8 to Arg-13, Gln-19 to Gln-30.		S0045: 1 and H0266: 1.	
HMEEX61	742085	281	44 - 361	896	Lys-61 to Leu-68.		H0050: 1, H0266: 1 and L0362: 1.	
HMEFR17	664438	282	3 - 473	897	Asp-11 to Thr-35.		H0266: 2 and L0742: 2.	
HMEFX12	661951	283	16 - 186	898	Pro-1 to Pro-11, Ala-15 to Pro-21, Pro-29 to Asp-34.		H0266: 2	

HMEGB93	573814	284	3 - 365	899	His-1 to Asn-10, Ile-25 to Asn-38, Gly-60 to Ile-66.	H0266: 2	1p35-p34	118210, 120550, 120570, 120575, 121800, 130500, 133200, 138140, 138971, 168360, 171760, 171760, 172411, 176100, 176100, 178300, 185470, 230000, 230350, 255800, 602771
HMEGF48	573821	285	74 - 256	900		H0266: 2		
HMEGG44	796421	286	15 - 176	901	Cys-12 to Trp-18.	H0266: 2 and L0740: 1.		
HMEGH46	887791	287	1 - 315	902	Asp-13 to Asp-19,	AR054: 29, AR051:		

						Lys-76 to Asn-83.		12, AR061: 6, AR089: 3, AR050: 2 H0196: 1 and H0266: 1.		
HMEGI07	953815	288	9 - 272	903				H0266: 2, S0046: 1, L0776: 1 and L0754: 1.		
HMEIG42	931114	289	35 - 406	904		Ala-8 to Arg-17, Val-43 to Gln-56, Ser-73 to Met-89.		H0266: 2		
HMEIM40	523589	290	61 - 219	905		Lys-5 to Ser-14.		H0266: 2		
HMEIU49	722988	291	99 - 284	906				H0266: 2		
HMEIW23	682863	292	1 - 276	907		Gly-36 to Ser-45, Pro-87 to Ser-92.		H0266: 2		
HMEJD13	657231	293	2 - 271	908		Ala-1 to Pro-11.		S0046: 1 and H0266: 1.		
HMEJJ84	781983	294	8 - 136	909		Ile-1 to Gly-13, Asn-18 to Ser-29.		H0266: 2		
HMEJU60	740392	295	33 - 191	910		Glu-21 to Leu-29.		H0266: 2		
HMEKA53	711664	296	76 - 183	911				H0266: 3		
HMEKJ43	715893	297	136 - 381	912		Leu-1 to Leu-13, Gln-55 to Pro-60.		H0266: 2 and L0744: 1.		
HMEKS76	767517	298	3 - 221	913		His-1 to Arg-9, Arg-23 to Ser-32, Gln-39 to Lys-46, Gly-53 to Gly-58, Glu-64 to Asn-73.		H0266: 2		

HMEKX51	727154	299	198 - 314	914			H0266: 2	
HMEKX89	786055	300	1 - 75	915	Ala-7 to Arg-15.		S0045: 1 and H0266: 1.	
HMELC56	745773	301	2 - 319	916	Ala-1 to Lys-6, Lys-75 to His-84.		H0266: 2	
HMELQ62	719681	302	40 - 372	917			H0266: 2	
HMELR10	964629	303	208 - 336	918			H0266: 2	
HMELS59	720341	304	135 - 305	919			H0266: 2	
HMELV19	668665	305	13 - 279	920	Ser-1 to Gly-8, Asn-39 to Ala-45.		H0266: 2	
HULAF89	791261	306	1 - 99	921			H0530: 2	
HULAI37	708923	307	72 - 173	922	Leu-9 to Lys-34.		AR061: 0, AR089: 0 H0530: 6	
HULAX31	868930	308	1 - 219	923			H0530: 2	
HULBU59	636253	309	1 - 234	924			H0530: 2	
HULBY15	659557	310	211 - 387	925	Glu-4 to Gly-10, Leu-47 to Lys-54.		H0530: 3	
HULDF69	754381	311	123 - 257	926	Lys-14 to Lys-20, Lys-25 to Gly-42.		H0530: 2	
HULFA03	918691	312	92 - 379	927	Leu-36 to Phe-55, Lys-61 to Phe-68.		H0530: 2	
HULFB76	767873	313	37 - 150	928			AR089: 1, AR061: 1 H0530: 3	
HUMBE61	838469	314	1 - 414	929			H0531: 2 and H0530: 2.	
HUSAY26	527909	315	263 - 373	930			H0268: 2 and L0666:	

							1.						
HUSCA57	527800	316	142 - 264	931			H0268: 2						
HUSCD26	527799	317	127 - 255	932			H0268: 2						
HUSCH45	507197	318	121 - 273	933			H0268: 2						
HUSCH77	527801	319	1 - 129	934			H0268: 2						
HUSGH88	871776	320	41 - 298	935		Asn-30 to Trp-36, Ser-63 to Ser-69.	L0740: 3, H0413: 2, L0777: 2, T0048: 1, H0412: 1 and L0757: 1.						
HUSGK23	675951	321	102 - 239	936			S0045: 1, H0268: 1 and H0412: 1.	15q15				177070, 177070, 182500, 218000, 227220, 243500, 600839, 601800	
HUSGL13	575798	322	2 - 169	937			H0412: 2						
HUSHH64	576459	323	1 - 126	938		Ala-3 to Ser-10, Arg-24 to Trp-33.	H0437: 3						
HUSHJ55	576381	324	2 - 337	939		Trp-25 to Trp-42.	H0437: 2	1p36				118210, 120550, 120570, 120575, 121800, 130500,	

												133200, 155600, 171760, 171760, 185470, 211420, 230350, 255800, 601990, 602023, 602771
HUSHL83	868883	325	181 - 348	940	Glu-42 to Val-47.	H0437: 1 and H0268: 1.						
HUSIA38	709472	326	79 - 282	941	Ala-49 to Gln-56.	H0412: 2						
HUSIA43	575768	327	28 - 249	942	Asn-28 to Asp-33.	H0412: 2						
HUSIF23	862494	328	169 - 447	943	Lys-1 to Thr-10, Ala-20 to Val-25.	S0005: 1 and H0412: 1.22q13.2- q13.31						188826, 250100, 250800, 250800
HUSIS60	727153	329	2 - 235	944	Ala-47 to Trp-54.	H0266: 1 and H0412: 1.						
HUSIW10	963324	330	59 - 322	945		H0412: 2						
HUSJW78	772956	331	3 - 188	946	Asn-6 to Arg-14.	H0412: 2						
HUSKI76	914084	332	3 - 230	947	Pro-65 to Gly-73.	H0412: 2						
HUSXK92	848959	333	221 - 487	948	Trp-1 to Asp-13,	H0413: 2, L0754: 1,						

								Ser-23 to Arg-28, Pro-44 to Arg-60, Leu-79 to Lys-89.	L0747: 1 and L0588: 1.		
HUSXO30	973266	334	203 - 463	949		Met-9 to Ser-16, Pro-24 to Asn-29.			H0412: 1, H0413: 1 and L0749: 1.		
HUSYA63	928021	335	158 - 442	950					H0412: 1 and H0413: 1.		
HUSYB16	868843	336	3 - 308	951		Ser-24 to Thr-29, Asn-58 to Arg-63.			H0413: 2		
HUSYD15	699195	337	106 - 279	952		Trp-16 to Leu-21.			H0266: 1 and H0413: 1.		
HUSYO46	868827	338	190 - 447	953		Lys-1 to Leu-10, Pro-43 to Gln-48, Thr-63 to Gly-69, Asn-76 to Arg-86.			H0413: 2		
HUSYP67	575787	339	2 - 118	954		Arg-1 to Ser-7, Glu-32 to Glu-37.			H0413: 2		
HUSZV72	851170	340	142 - 399	955					S0045: 1, H0413: 1, L0756: 1 and L0588: 1.		
HUSZH03	922852	341	13 - 714	956					L0754: 3 and H0413: 1.		
HUSYX03	922840	342	272 - 397	957		Leu-16 to Gln-21.			H0413: 1, L0438: 1 and L0439: 1.		
HUSYO86	784691	343	189 - 362	958		Glu-50 to Pro-58.			H0413: 1 and L0747: 1.		

HUSYN33	651293	344	189 - 371	959	Cys-34 to Gly-41.	H0413: 1 and L0439: 1.		
HUSYN11	943237	345	133 - 360	960	Pro-21 to Lys-63.	AR089: 11, AR061: 9 H0413: 1		
HUSYM49	723015	346	1 - 159	961		H0413: 1		
HUSYM37	464221	347	2 - 211	962		H0413: 1		
HUSYI13	657288	348	524 - 670	963		L0439: 7, L0759: 4, L0803: 2, L0438: 2, L0740: 2, L0751: 2, L0758: 2, H0413: 1, L0776: 1, L0367: 1, L0790: 1, L0666: 1, L0747: 1 and L0777: 1.		
HUSYG24	677258	349	53 - 277	964		L0439: 2, L0756: 2 and H0413: 1.		
HUSYF74	554723	350	92 - 328	965		L0439: 2, L0752: 2 and H0413: 1.		
HUSYA27	934423	351	459 - 638	966	Lys-47 to Lys-58.	L0717: 1, H0413: 1, L0748: 1, L0749: 1, L0779: 1, L0759: 1, L0608: 1, L0593: 1 and L0595: 1.		
HUSXW61	741856	352	386 - 559	967		L0740: 2 and H0413: 1.		
HUSXM28	703326	353	1 - 372	968	Pro-9 to Gln-22.	L0748: 2 and H0413:		

									1.					
HUSXI71	760415	354	3 - 83	969					H0413: 1 and L0748: 1.					
HUSXH57	859907	355	3 - 347	970					H0413: 1 and L0747: 1.					
HUSKA86	784887	356	2 - 229	971					L0748: 2 and H0412: 1.	8q22.3-q23.1	216550			
HUSKA65	868860	357	3 - 329	972			Gly-53 to Ile-59.		H0412: 1 and L0367: 1.					
HUSJW03	923035	358	121 - 270	973			Gly-20 to Gly-25.		L0748: 2, L0749: 2 and H0412: 1.					
HUSJN66	886987	359	3 - 455	974			Arg-22 to Pro-31, Pro-39 to Arg-50, Asp-86 to Gly-91, Phe-96 to Ser-105, Gly-114 to Gly-120, Asp-132 to Ser-139.		AR050: 86, AR054: 82, AR051: 63, AR089: 14, AR061: 11 H0412: 1 and L0759: 1.					
HUSIT75	679416	360	227 - 466	975			Arg-45 to Trp-50.		H0412: 1 and L0747: 1.					
HUSIS59	739327	361	1 - 231	976			Pro-10 to Gly-22, Gly-29 to Lys-47.		H0412: 1					
HUSIS54	730734	362	60 - 158	977			Val-22 to Leu-30.		H0412: 1					
HUSIS08	959536	363	93 - 425	978					H0412: 1 and L0593: 1.					
HUSIR04	709228	364	178 - 330	979			Ser-31 to Val-39.		L0748: 2 and H0412: 1.					

HUSIN12	970759	365	1 - 474	980	Leu-1 to Glu-10.	1. H0412: 1 and L0665: 1.		
HUSIE95	967176	366	2 - 445	981		H0412: 1 and L0747: 1.		
HUSIE18	666523	367	104 - 280	982	Gly-1 to Lys-7, Arg-11 to Asn-23.	H0412: 1 and L0742: 1.		
HUSIE08	908574	368	335 - 661	983	Arg-19 to Ser-26.	L0157: 2, L0758: 2, H0412: 1, L0803: 1, L0744: 1, L0777: 1 and L0753: 1.		
HUSHL86	960355	369	779 - 1003	984	Ser-12 to Gly-17.	L0662: 2, H0437: 1 and L0731: 1.		
HUSHE34	703409	370	276 - 425	985		H0437: 1 and L0777: 1.		
HUSHB71	766060	371	1 - 267	986	Gly-1 to Arg-11, Asn-29 to Arg-35, Phe-37 to Tyr-48, His-74 to Cys-81.	H0437: 1 and L0748: 1.		
HUSHB60	746560	372	2 - 421	987	Glu-10 to Met-17, Thr-23 to Asp-32, Pro-37 to Gln-43, Val-67 to Asp-75.	H0437: 1 and L0596: 1.		
HUSGW06	935574	373	296 - 574	988	Gln-17 to Ser-29.	H0412: 1, L0754: 1 and L0752: 1.		

HUSGV84	813557	374	3 - 113	989	Asp-1 to Ser-8, Ser-22 to Asn-30.	H0412: 1 and L0598: 1.	13q12-q14	109543, 121011, 121011, 129500, 253700, 600631, 601499, 601885, 602221
HUSGU08	959540	375	105 - 281	990	Trp-25 to Ile-30.	H0412: 1 and L0657: 1.		
HUSGT01	916620	376	3 - 215	991	Glu-61 to Ile-67.	H0412: 1 and L0532: 1.		
HUSGS35	707777	377	97 - 507	992	Thr-11 to Gly-17.	L0777: 3, L0766: 2, L0776: 2, L0759: 2, H0412: 1, L0638: 1, L0646: 1, L0764: 1, L0662: 1, L0659: 1, L0666: 1, L0663: 1, L0740: 1, L0749: 1 and L0588: 1.	19p13.2	108725, 120700, 133171, 143890, 147670, 147670, 147670, 151440, 164953, 231670, 600276, 600957,

HUSGQ62	745727	378	253 - 450	993	His-6 to Val-22.	H0412: 1 and L0748: 1.		601843
HUSGM24	425180	379	395 - 751	994		H0412: 1 and L0754: 1.		
HUSGJ68	753059	380	41 - 232	995	Lys-8 to Cys-14.	H0412: 1		
HUSGH09	625647	381	324 - 689	996	Arg-1 to Arg-8.	H0412: 1 and L0748: 1.		
HUSGF79	775309	382	269 - 403	997	Ser-23 to Tyr-31, Gln-34 to Thr-41.	L0766: 2, H0412: 1 and L0754: 1.		
HUSGF59	576784	383	1 - 282	998	Gly-41 to Cys-59, Arg-72 to Lys-77.	H0412: 1		
HUSGF10	964844	384	97 - 291	999	Ser-34 to Asp-39.	H0412: 1		
HUSGE22	888829	385	199 - 444	1000	Lys-1 to Lys-16, Lys-70 to Gly-79.	AR054: 4 H0412: 1		
HUSGB36	572924	386	78 - 245	1001	Ser-17 to Ala-22, Pro-37 to Tyr-46.	H0412: 1 and L0754: 1.		
HUSGB01	916804	387	2 - 169	1002	Leu-16 to Lys-21.	H0412: 1		
HUSFH89	786970	388	98 - 262	1003		L0748: 2 and H0433: 1.		
HUSFF03	924616	389	2 - 589	1004	Pro-12 to Glu-28, Arg-34 to Cys-43, Pro-45 to Ser-57, Ser-65 to Tyr-70, Ser-83 to Asn-88.	L0766: 2, H0433: 1 and L0779: 1.	9q31-q33	109400, 132800, 132800, 146150, 186855,

						Asp-128 to Asp-134, Val-157 to Glu-168, Ser-182 to Lys-192.						223900, 253800, 253800, 268900, 278700, 602088
HUSFE05	932106	390	57 - 263	1005					H0433: 1, L0766: 1 and L0595: 1.			
HUSDA09	461656	391	260 - 487	1006		Gly-10 to Phe-16.			H0403: 1 and L0589: 1.			
HUSAY21	920403	392	255 - 503	1007		Val-27 to Asp-39, Thr-41 to Gly-46, Ser-54 to Thr-63, Asp-77 to Pro-83.			H0268: 1 and L0754: 1.			
HUSAO27	955287	393	160 - 270	1008					H0268: 1			
HUSAM87	529783	394	3 - 137	1009		Arg-1 to Lys-6, Gly-14 to Cys-20.			H0268: 1			
HUSAM35	558191	395	187 - 2	1010					H0268: 1			
HUSAM22	523674	396	3 - 95	1011		Glu-20 to Lys-29.			H0268: 1			
HUSAL04	927719	397	190 - 330	1012					H0268: 1			
HUSAJ57	678932	398	127 - 351	1013		Leu-1 to Thr-6.			H0268: 1			
HUSAJ15	522056	399	105 - 203	1014		Leu-18 to Gln-30.			H0268: 1			
HULAG30	788577	400	2 - 277	1015		Gly-8 to Arg-26.			L0731: 2 and H0530: 1.			
HMELV25	678120	401	201 - 311	1016					L0777: 2, H0266: 1,			

									L0766: 1, L0803: 1 and L0748: 1.		
HMELV14	876087	402	86 - 223	1017		Ser-38 to Thr-46.			H0266: 1, L0746: 1 and L0779: 1.		
HMELR45	717696	403	192 - 52	1018		Lys-14 to Arg-20, Gly-27 to Thr-40.			H0266: 1		
	717797	610	186 - 389	1225		Arg-29 to Leu-37.					
HMELM86	784702	404	23 - 133	1019		Phe-32 to Glu-37.			H0266: 1		
HMELM85	783536	405	72 - 224	1020					H0266: 1		
HMELM03	924168	406	119 - 316	1021					H0266: 1		
HMELI57	734769	407	2 - 292	1022		Met-1 to Gln-15, Ser-22 to Ala-31, Glu-45 to Val-51, Met-58 to Ser-63, Thr-74 to Asn-84, Met-90 to Pro-97.			H0266: 1 and L0591: 1.		
HMELH60	422844	408	338 - 3	1023					H0266: 1		
	878666	611	2 - 166	1226							
HMEKZ06	935467	409	43 - 297	1024		Asp-13 to Asn-25, Ile-41 to Pro-52.			H0266: 1 and L0780: 4		
HMEKW07	953369	410	354 - 623	1025					H0266: 1 and L0776: 1.		
	668659	411	289 - 585	1026					H0266: 1, L0748: 1 and L0759: 1.		
HMEKO03	924172	412	159 - 338	1027					L0766: 2, H0266: 1		

													and L0779: 1.							
HMEKJ40	711187	413	119 - 340	1028		Ile-13 to Cys-20, Ile-36 to Ser-41.							H0266: 1 and L0748: 1.							
HMEKH73	923893	414	65 - 541	1029		Asp-14 to Leu-49, Pro-52 to Pro-73.							H0266: 1 and L0759: 1.							
HMEKC72	760637	415	199 - 393	1030		Cys-1 to Asp-8.							H0266: 1 and L0743: 1.							
HMEJW50	724396	416	61 - 237	1031									H0266: 1 and L0748: 1.							
HMEJJ81	777945	417	73 - 309	1032		Arg-1 to Asp-9, Arg-22 to His-33, Ala-37 to Glu-47.							H0266: 1 and L0749: 1.							
HMEJF25	678131	418	99 - 425	1033		Val-30 to Thr-40, Lys-75 to Trp-88, Lys-90 to Ser-95.							H0266: 1 and L0731: 1.							
HMEIV22	674611	419	408 - 503	1034									H0266: 1 and L0748: 1.							
HMEIS07	922703	420	1 - 387	1035		Gly-1 to Arg-7, Pro-13 to Pro-37.							H0266: 1, L0745: 1 and L0603: 1.							
HMEIA06	935966	421	19 - 168	1036		Pro-6 to Gly-11.							H0266: 1							
HMEGK14	796443	422	11 - 334	1037		Gln-18 to Lys-29, Arg-43 to Leu-55, Pro-57 to Pro-67, Pro-81 to Gly-86.							L0749: 2 and H0266: 1.							
HMEGH92	790629	423	18 - 494	1038		Asp-21 to Arg-31.							H0266: 1 and L0766: 1.							

HMEFD72	766185	424	1 - 234	1039	Leu-6 to Thr-11, His-13 to Gly-21, Gln-52 to Arg-62.	1. H0266: 1 and L0766: 1.		
HMEEL38	733649	425	3 - 200	1040		H0266: 1, L0748: 1, L0756: 1 and L0599: 1.	6p12 180297, 230450, 263200, 601690	
HMEDR76	529897	426	18 - 173	1041		H0266: 1		
HMECQ10	968500	427	2 - 148	1042	Trp-8 to Ser-14, Arg-30 to Arg-39.	H0266: 1 and L0766: 1.		
HMECH43	715568	428	2 - 133	1043		H0266: 1 and L0766: 1.		
HMEBY95	796058	429	172 - 327	1044		H0267: 1 and L0766: 1.		
HMEBG01	921763	430	94 - 240	1045		H0267: 1 and L0744: 1.		
HMEAN12	655220	431	59 - 259	1046		H0266: 1 and L0754: 1.		
HMEAI38	709207	432	325 - 504	1047	Pro-2 to Gly-7, Asp-13 to Ser-20.	H0266: 1 and L0748: 1.		
HMEAH31	698403	433	68 - 190	1048	Gly-32 to Asp-39.	L0581: 2, L0471: 1, H0266: 1 and L0364: 1.		
HMEAE24	880925	434	2 - 169	1049		H0266: 1		
HMEAE01	916744	435	2 - 118	1050		H0266: 1		

HMEAD86	785802	436	3 - 299	1051	Phe-32 to Arg-37, Cys-40 to Thr-45, Glu-63 to Gly-70.	H0266: 1 and L0766: 1.		
HMEAD47	720638	437	2 - 346	1052	Arg-41 to Ser-46, Pro-52 to Gly-57.	H0266: 1 and L0748: 1.		
HMEAA17	921765	438	105 - 332	1053		H0266: 1 and L0439: 1.		
HHFUB83	800580	439	2 - 235	1054	Gly-1 to Ala-7.	H0242: 1		
HHFOU02	918070	440	142 - 432	1055	Ser-7 to Ser-14.	L0803: 2, H0645: 1 and L0747: 1.		
HHFOL43	974002	441	16 - 324	1056	His-1 to His-10, Pro-14 to Asn-19, Leu-48 to Arg-56, Lys-65 to Ile-76, Lys-93 to Arg-103.	H0645: 1		
HHFOK10	961346	442	22 - 279	1057	Ser-2 to Ser-8, Lys-14 to Arg-19.	H0645: 1 and L0766: 1.		
HHFNJ05	930899	443	3 - 320	1058	Pro-13 to Gly-22, Arg-31 to Gly-42, Ser-86 to Cys-92, Pro-94 to Pro-101.	L0774: 2, H0619: 1 and L0769: 1.		
HHFMX34	945385	444	3 - 461	1059	Ala-7 to Gly-13, Ile-71 to Gln-77, Phe-79 to Ala-85, Gly-142 to Pro-148.	AR089: 11, AR061: 8 H0619: 1		

HHFLU06	857884	445	2 - 328	1060		AR061: 5, AR089: 2 H0619: 1		
HHFLT84	857890	446	407 - 225	1061		H0619: 1 and L0745: 1.		
HHFLLO8	958103	447	67 - 354	1062	Asn-6 to Asn-27, Ser-44 to Tyr-52.	H0619: 1 and L0599: 1.		
HHFLJ51	857898	448	186 - 443	1063	Phe-12 to His-17, Gly-53 to Tyr-60.	L0617: 1 and H0619: 1.		
HHFLI10	963162	449	64 - 471	1064	Thr-11 to Lys-19, Ser-44 to Asn-49, Cys-102 to Ala-111, Pro-114 to Thr-120.	H0619: 1		
HHFLI07	952081	450	404 - 589	1065	Ser-1 to Cys-24.	H0619: 1		
HHFLH62	857908	451	46 - 240	1066	Thr-26 to Tyr-31, Ile-52 to Cys-65.	H0619: 1 and L0759: 1.		
HHFLE12	969531	452	2 - 205	1067		H0619: 1 and L0758: 1.		
HHFKX28	971102	453	454 - 176	1068	Tyr-41 to Gly-52, Leu-66 to Trp-71, Ser-73 to Cys-85.	L0766: 2 and H0619: 1.		
HHFKB24	887025	454	3 - 173	1069	Asp-1 to Ser-14.	AR054: 27, AR050: 20, AR051: 19 H0619: 1		
HHFJM64	958384	455	170 - 1030	1070	Val-4 to Asn-11, Cys-24 to Tyr-31.	H0619: 1 and L0805: 1.		

HHFLA58	858011	456	99 - 284	1071	Glu-31 to Ala-40.	H0050: 1 and L0070: 1.		
HHFLA13	657405	457	108 - 308	1072	Val-19 to Trp-24, Ser-59 to Trp-67.	L0745: 2 and H0050: 1.		
HHFHY95	795053	458	13 - 243	1073		H0050: 1 and L0599: 1.		
HHFHR63	745215	459	164 - 391	1074	Pro-36 to Asn-45.	H0050: 1, L0748: 1 and L0439: 1.		
HHFHP68	753144	460	232 - 432	1075		H0050: 1 and L0666: 1.		
HHFHN74	765758	461	602 - 799	1076		L0439: 7 and H0050: 1.		
HHFHM22	674841	462	18 - 287	1077	Leu-6 to Gln-13.	H0050: 1 and L0439: 1.		
HHFHJ90	675218	463	200 - 364	1078	Gln-32 to Phe-37.	H0050: 1 and L0748: 1.		
HHFHD38	709082	464	33 - 149	1079		H0050: 1 and L0748: 1.		
HHFGX13	656806	465	566 - 414	1080	Pro-8 to Leu-22, Leu-42 to Glu-49.	H0050: 1		
	657080	612	30 - 131	1227	Pro-1 to Gln-6.			
HHFGX03	924753	466	3 - 338	1081	Trp-5 to Asp-16, Asp-25 to Asp-30, Arg-49 to Pro-54.	H0050: 1 and L0766: 1.		
HHFGR31	953204	467	109 - 405	1082	Leu-22 to Gly-31.	H0050: 1 and L0750: 1.		

								1.				
HHFGR30	692887	468	1 - 141	1083		Thr-25 to Thr-30, Gly-32 to Asp-37.		H0050: 1 and L0589: 1.				
HHFGP91	800328	469	52 - 579	1084				H0050: 1 and L0794: 1.				
HHFGP69	918393	470	712 - 485	1085		Asn-1 to Gly-9.		AR051: 57, AR050: 56, AR054: 46 H0050: 1				
	918394	613	281 - 126	1228		Phe-4 to Gln-24, Thr-29 to Leu-38, Ser-46 to Arg-52.						
HHFGL77	490379	471	322 - 119	1086		Val-3 to Ser-29, Phe-47 to Gly-52.		H0050: 1				
	570229	614	120 - 275	1229								
HHFGH81	778193	472	46 - 267	1087		Asp-14 to Gln-22, Gln-35 to Phe-41.		H0050: 1 and L0439: 1.				
HHFGH43	573495	473	2 - 202	1088				L0744: 3, H0050: 1, L0743: 1 and L0748: 1.	2p14-p13.4	203800		
HHFFZ50	513773	474	263 - 436	1089				H0050: 1				
	858039	615	103 - 309	1230								
HHFFT05	932675	475	3 - 137	1090		Thr-2 to Ser-19, Glu-21 to Trp-30.		H0050: 1				
HHFFT01	880757	476	179 - 400	1091		Arg-37 to Phe-45.		AR051: 33, AR054: 28, AR050: 14 H0050: 1				

HHFFR95	796677	477	1 - 213	1092		L0439: 2 and H0050: 1.		
HHFFR75	766630	478	483 - 250	1093	Pro-1 to Ala-8.	H0050: 1		
	858041	616	207 - 335	1231				
HHFFR32	699723	479	92 - 313	1094	Pro-6 to Gly-12.	H0050: 1 and L0777: 1.		
	880667	480	215 - 409	1095		H0050: 1 and L0803: 1.		
HHFFO46	530501	481	32 - 286	1096	Ser-1 to Cys-6, Ala-28 to His-34.	H0050: 1		
HHFFM05	932738	482	324 - 470	1097		H0050: 1 and L0748: 1.		
HHFFL66	530503	483	1 - 150	1098	Ile-1 to Ala-6.	H0050: 1		
HHFFK30	858051	484	2 - 193	1099	Ile-8 to Gly-13.	H0050: 1 and L0378: 1.		
	739587	485	74 - 280	1100	Gln-22 to Ser-29.	H0050: 1 and L0748: 1.		
HHFFI08	960254	486	49 - 342	1101	Thr-13 to Ala-18, Ala-39 to Ser-46, Cys-51 to Thr-58, Pro-70 to Tyr-75, Glu-83 to Gln-95.	L0748: 2, L0002: 1 and H0050: 1.		
	767623	487	265 - 546	1102	Ala-1 to Asn-6.	H0050: 1 and L0750: 1.	2q32.1	600258, 602087
HHFFG82	530662	488	3 - 281	1103	Ala-21 to Asn-27.	H0050: 1		

HHFFF92	790572	489	52 - 345	1104		L0745: 3, L0750: 2 and H0050: 1.		
HHFFF07	954258	490	409 - 576	1105		H0050: 1 and L0749: 1.		
HHFEB86	785653	491	161 - 367	1106		H0050: 1 and L0748: 1.		
HHFDN80	781634	492	93 - 287	1107	Ile-7 to Asn-26, Gly-35 to Gly-42, Ala-44 to Gly-49.	H0050: 1 and L0591: 1.	6p22	248611
HHFDI82	499010	493	370 - 492	1108	Ile-18 to Asp-28, Ile-32 to Asn-37.	H0050: 1		
	511062	617	518 - 306	1232				
HHFDH26	685188	494	1 - 441	1109	Ser-36 to Lys-53, Pro-63 to Pro-79, Val-82 to Gly-104.	H0050: 1 and L0754: 1.		
HHFDC10	968647	495	2 - 136	1110	Ser-34 to Leu-40.	L0748: 2, H0050: 1 and L0599: 1.		
HHFDA13	667804	496	221 - 337	1111	Met-6 to Ile-18.	H0050: 1 and L0748: 1.		
HHFCT63	572784	497	184 - 32	1112		H0050: 1 and L0748: 1.		
HHFCP39	429442	498	81 - 194	1113	Asn-24 to Asn-36.	H0050: 1 and L0748: 1.		
HHFCO13	500899	499	322 - 221	1114		H0050: 1 and L0754: 1.		

HHFCN59	739657	500	386 - 138	1115	His-39 to Pro-45.	H0050: 1 and L0750: 1.		
HHFCN13	667805	501	221 - 6	1116	Phe-38 to Lys-44.	L0749: 3 and H0050: 1.		
HHFCM51	509631	502	23 - 151	1117	Asn-28 to Leu-33.	H0050: 1		
HHFCH52	911570	503	307 - 50	1118		H0050: 1		
HHFCF58	575183	504	166 - 333	1119	Ser-2 to Gly-12.	L0748: 3, H0050: 1 and L0750: 1.		
	575184	618	500 - 159	1233				
HHFCE73	764763	505	5 - 214	1120		L0748: 3 and H0050: 1.		
HHFCE40	712866	506	71 - 199	1121		H0050: 1 and L0439: 1.		
HHFCD43	714353	507	52 - 150	1122		H0050: 1, L0803: 1 and L0596: 1.		
HHFCC60	739669	508	197 - 436	1123		H0050: 1 and L0439: 1.		
HHFCC45	858066	509	23 - 217	1124		H0050: 1 and L0746: 1.		
HHFCC20	600231	510	605 - 411	1125		H0050: 1		
	825658	619	3 - 344	1234	Gln-41 to Gly-53, Pro-55 to Glu-64, Arg-108 to Gly-113.			

HHFBW92	575156	511	393 - 551	1126		H0050: 1 and L0748: 1.		
HHFBU63	745661	512	212 - 382	1127	Lys-3 to Arg-21, Pro-40 to Lys-47.	H0050: 1 and L0748: 1.		
HHFBU07	954478	513	172 - 405	1128		H0050: 1 and L0804: 1.		
HHFBT24	508067	514	2 - 418	1129		H0050: 1		
HHFBQ94	796838	515	108 - 278	1130		L0750: 2, H0050: 1 and L0604: 1.		
HHFBP29	710894	516	1 - 279	1131	Val-17 to Thr-23, Ser-57 to Arg-64.	L0748: 5, H0050: 1, L0805: 1 and L0749: 1.		
HHFBN17	589798	517	180 - 1	1132	Ser-30 to Tyr-35, Leu-52 to Glu-60.	H0050: 1		
	858072	620	358 - 528	1235				
HHFBM11	968002	518	224 - 3	1133	Val-36 to Ser-54.	L0758: 4, H0050: 1, L0769: 1 and L0438: 1.		
HHFBD83	781525	519	602 - 411	1134		L0748: 2, H0050: 1 and L0745: 1.		
HHFBD42	712899	520	463 - 77	1135		L0754: 3, L0749: 2, H0050: 1, L0662: 1 and L0596: 1.		
HHFBB14	522375	521	3 - 191	1136	Arg-26 to Glu-37.	H0050: 1 and L0605: 1.		

HHFBA11	967991	522	181 - 321	1137	Asp-1 to Thr-9.	H0050: 1		
HHFAB62	824590	523	608 - 255	1138	Arg-4 to Asp-9.	L0439: 4 and H0019: 1.		
HHBGN74	765214	524	145 - 471	1139	Phe-12 to Pro-22, Glu-29 to Asn-38, Glu-45 to Tyr-55.	H0373: 1 and L0604: 1.		
HHBGJ53	909912	525	1 - 282	1140	Ser-1 to Ser-7, Ser-25 to Arg-31.	AR089: 8, AR061: 5 L0740: 2 and H0373: 1.		
HHBGG10	963849	526	215 - 400	1141	Lys-1 to Thr-7, Gln-12 to Glu-25.	H0373: 1 and L0752: 1.		
HHBGC75	767042	527	16 - 219	1142	Lys-48 to Lys-63.	L0777: 3 and H0373: 1.		
HHBFT06	934826	528	358 - 489	1143	Asp-6 to Ile-12, Met-21 to Ala-26.	H0373: 1 and L0142: 1.		
HHBFM77	771816	529	186 - 266	1144		H0373: 1 and L0753: 1.		
HHBEV93	792041	530	2 - 139	1145		L0742: 3 and H0373: 1.		
HHBES89	786667	531	216 - 398	1146	His-12 to Ser-17.	L0439: 4 and H0373: 1.		
HHBEM49	722337	532	288 - 455	1147	Lys-1 to Phe-6.	H0373: 1, L0749: 1 and L0601: 1.		

HHBEG80	951688	533	284 - 442	1148	Ser-11 to Cys-26, Lys-30 to Lys-53.	AR089: 21, AR061: 7 H0373: 1 and L0731: 1.		
HHBEG72	761150	534	157 - 402	1149	Arg-29 to Ser-34.	H0373: 1 and L0748: 1.		
HEMHA53	728297	535	450 - 605	1150		S0046: 1 and L0749: 1.		
HEMGX57	872083	536	382 - 606	1151		S0046: 1 and L0766: 1.		
HEMGT27	851065	537	123 - 293	1152	Cys-36 to Trp-42.	S0046: 1 and L0592: 1.		
HEMGL56	767669	538	3 - 332	1153	Gly-89 to Ala-95.	AR089: 25, AR061: 7 S0046: 1	150250, 164500, 277730, 600971, 601226	
HEMFN30	692818	539	344 - 805	1154	Gln-1 to Asn-8, Lys-17 to Arg-24, Ser-89 to Arg-103.	L0598: 2, L0731: 2 and S0046: 1.		
HEMFF16	576539	540	3 - 140	1155	Asn-1 to Pro-11.	S0046: 1		
HEMEF34	596812	541	477 - 695	1156	Gly-37 to Val-43.	S0046: 1		
	851083	621	3 - 182	1236	Gly-24 to Val-30.			
HEMEA03	921922	542	124 - 258	1157		S0046: 1 and L0749: 1.		
HEMDX96	935963	543	650 - 255	1158		L0751: 2 and S0046: 1.		
HEMCV44	574321	544	235 - 345	1159	Tyr-6 to Ser-11.	S0046: 1		

HEMCK53	728424	545	69 - 251	1160	Gly-11 to Asp-24, Ser-41 to Ile-46.	L0748: 2 and S0046: 1.		
HEMCI59	739551	546	1 - 354	1161	His-1 to Met-11, Asp-40 to Glu-48, Tyr-72 to Arg-77, Asn-111 to His-117.	AR089: 4, AR061: 3 S0046: 1 and L0740: 1.		
HEMCI41	712614	547	300 - 578	1162		L0805: 2, L0608: 2, S0046: 1, L0775: 1, L0375: 1, L0651: 1, L0756: 1, L0759: 1 and L0592: 1.		
HEMCC38	707453	548	201 - 341	1163		S0046: 1 and L0748: 1.		
HEMBU26	684928	549	1 - 81	1164	Thr-11 to Lys-17.	S0046: 1 and L0754: 1.		
HEMBT61	939957	550	1 - 351	1165		AR061: 8, AR089: 4 L0547: 2, S0046: 1, L0471: 1, L0772: 1, L0529: 1 and L0780: 1.		
HEMAL61	851106	551	130 - 270	1166	Pro-4 to Lys-13, Leu-21 to Pro-26, Lys-32 to Gly-41.	S0046: 1		
HEMAA63	745498	552	3 - 149	1167		S0046: 1 and L0748: 1.		

HELHJ74	765696	553	181 - 513	1168	Arg-4 to Lys-26, Thr-31 to Gly-36, Glu-83 to Lys-88.	L0745: 3 and S0045: 1.	
HELHD20	668881	554	222 - 434	1169	Lys-1 to Trp-10, Thr-18 to Val-27.	S0045: 1	
HELHC59	769404	555	285 - 518	1170		S0045: 1 and L0740: 1.	
HELGY42	713019	556	47 - 220	1171		L0742: 2 and S0045: 1.	
HELGY02	948302	557	3 - 410	1172	His-1 to Gly-8, Leu-20 to Pro-30, Lys-44 to Glu-58, Pro-60 to Gln-67.	AR089: 0, AR061: 0 S0045: 1	
HELGW31	610003	558	576 - 1337	1173	Asp-56 to Ser-62, Gly-195 to Ser-202.	AR061: 335, AR089: 290, AR051: 10, AR050: 2, AR054: 2 S0045: 1	
	957568	622	1035 - 394	1237			
	964303	623	21 - 449	1238			
HELGV36	597120	559	233 - 373	1174	Arg-4 to Ala-10.	S0045: 1, L0748: 1 and L0754: 1.	
HELGQ55	732223	560	1 - 315	1175		S0045: 1 and L0750: 1.	
HELGK56	925698	561	129 - 788	1176		AR061: 3, AR089: 1 S0045: 1	
HELGG21	671071	562	2 - 253	1177		S0045: 1 and L0748: 1.	

HELGD47	851143	563	304 - 453	1178	Arg-1 to Cys-6, Pro-43 to Met-50.	S0045: 1 and L0717: 1.		
HELFAQ55	732224	564	116 - 265	1179	Thr-28 to Gln-34, His-38 to Thr-44.	S0045: 1 and L0439: 1.		
HELFN75	658681	565	264 - 635	1180		AR051: 6, AR054: 4, AR050: 1, AR089: 1, AR061: 0 S0045: 1		
HELFI35	506277	566	133 - 321	1181	Gln-6 to Lys-15.	S0045: 1		
HELFA38	851146	567	85 - 318	1182	Trp-55 to Gly-60.	S0045: 1		
	954009	624	482 - 210	1239				
HELEZ81	571340	568	3 - 329	1183	Pro-82 to Gln-87.	S0045: 1		
HELET68	800029	569	17 - 208	1184	Thr-1 to Glu-9.	S0045: 1 and L0748: 1.		
HELEO42	579016	570	3 - 467	1185	His-1 to Ser-20, Leu-35 to Glu-43, Ser-73 to Glu-79.	AR051: 19, AR054: 11, AR050: 9 S0045: 1		
HELEH76	506674	571	1 - 411	1186		S0045: 1, L0766: 1 and 1p13 L0754: 1.	102770, 188540, 600234, 601414, 601691, 601691, 601691, 601691,	

												601718, 602094
HELEE83	577206	572	1 - 123	1187		Gly-1 to Ala-7.		S0045: 1				
HELDT63	744864	573	635 - 516	1188		Arg-12 to Lys-19, Gly-35 to Gly-40.		AR051: 21, AR050: 18, AR054: 3 S0045: 1				
	898960	625	3 - 107	1240		Leu-28 to Ser-35.						
HELDL15	660557	574	170 - 406	1189		Lys-40 to Pro-48, Cys-66 to Cys-74.		L0750: 2, S0045: 1, L0803: 1 and L0783: 1.				
HELDL08	959919	575	267 - 377	1190				S0045: 1 and L0589: 1.				
HELDK22	567310	576	1 - 309	1191				S0045: 1				
HELDH71	740198	577	239 - 634	1192		Leu-6 to Asn-14, Thr-22 to Lys-47.		S0045: 1 and L0748: 1.				
HELDG91	790371	578	555 - 704	1193		Ala-24 to Pro-37.		S0045: 1, L0743: 1 and L0740: 1.				
HEL CW51	531073	579	110 - 262	1194		Asn-12 to Lys-20.		S0045: 1				
HEL CI30	691024	580	12 - 200	1195				S0045: 1 and L0439: 1.				
HEL CG36	655045	581	96 - 218	1196				S0045: 1, L0754: 1 and L0731: 1.				
HEL BU11	967661	582	10 - 204	1197				L0748: 2, S0045: 1 and L0608: 1.				
HEL BC83	781412	583	132 - 425	1198				L0439: 2 and S0045: 1.				

HELAZ48	864515	584	2 - 226	1199			L0439: 2, L0740: 2, S0045: 1, L0750: 1 and L0752: 1.		
HELAW26	684925	585	279 - 542	1200			L0748: 3 and S0045: 1.		
HELAQ36	707420	586	69 - 176	1201			S0045: 1 and L0748: 1.		
HELAM32	699661	587	1 - 228	1202			S0045: 1 and L0748: 1.		
HELAH32	699665	588	1 - 249	1203			L0757: 2 and S0045: 1.		
HCMSY80	526182	589	1 - 153	1204			H0196: 1		
HCMSQ63	745584	590	142 - 303	1205		Pro-1 to Pro-7, Pro-10 to Asn-15.	H0196: 1 and L0777: 1.		
HCMSK41	940260	591	109 - 402	1206		Ser-1 to Trp-6, Leu-24 to Ser-29.	AR061: 3, AR089: 1 H0196: 1		
HAHSB27	501010	592	196 - 417	1207		Trp-5 to His-16, Gln-45 to Phe-50.	H0097: 1		
HAHFS80	954432	593	202 - 510	1208		Pro-12 to Thr-19.	L0623: 1, H0599: 1, L0471: 1 and L0485: 1.		
HAHFE11	965293	594	88 - 282	1209			H0599: 1 and L0758: 1.		
HAHEP68	738501	595	84 - 431	1210		Ser-1 to Val-14, Ser-26 to Glu-39, Ala-48 to Pro-53, Trp-62 to Thr-68, Lys-74 to Asn-84, Thr-89 to Pro-95,	H0599: 1, L0439: 1 and L0747: 1.		

HAHCU22	848831	596	35 - 211	1211	Val-99 to Thr-108. Thr-18 to Gly-26.	H0599: 1 and L0471: 1.			
HAHCR15	810326	597	3 - 455	1212		H0599: 1, L0471: 1 and L0602: 1.			
HAHCL94	794044	598	2 - 316	1213	Ala-1 to Ala-6, Ser-10 to Gly-17.	H0599: 1 and L0748: 1.	5p13.1-5cen	108962, 600837	
HAHBC03	923542	599	232 - 519	1214	Gln-48 to Trp-71, His-87 to Lys-94.	H0002: 1 and L0758: 1.	1p36-p34	118210, 120550, 120570, 120575, 121800, 130500, 133200, 138140, 155600, 168360, 171760, 171760, 176100, 176100, 178300, 185470, 211420, 230000,	

																				230350, 255800, 601990, 602023, 602771	
HAHAD95	865104	600	106 - 279	1215	Gly-7 to Gly-14.																
HAFBG30	693363	601	284 - 472	1216																	
HAFAY37	928705	602	332 - 529	1217																	
HAFAJ63	845452	603	273 - 497	1218																	
HAECA04	932993	604	40 - 195	1219	Glu-1 to Arg-9, Leu-17 to Ala-25.																
HAEM82	781539	605	272 - 571	1220	Tyr-13 to Met-23, Ser-40 to Pro-49.																

- [0052] The first column in Table 1A provides a unique "Clone ID NO:Z" for a cDNA clone related to each contig sequence disclosed in Table 1A. This clone ID references the cDNA clone which contains at least the 5' most sequence of the assembled contig, and at least a portion of SEQ ID NO:X was determined by directly sequencing the referenced clone. The reference clone may have more sequence than described in the sequence listing or the clone may have less. In the vast majority of cases, however, the clone is believed to encode a full-length polypeptide. In the case where a clone is not full-length, a full-length cDNA can be obtained by methods known in the art and/or as described elsewhere herein.
- [0053] The second column in Table 1A provides a unique "Contig ID" identification for each contig sequence. The third column provides the "SEQ ID NO:X" identifier for each of the cardiovascular system associated contig polynucleotide sequences disclosed in Table 1A. The fourth column, "ORF (From-To)", provides the location (i.e., nucleotide position numbers) within the polynucleotide sequence "SEQ ID NO:X" that delineate the preferred open reading frame (ORF) shown in the sequence listing and referenced in Table 1A, column 5, as SEQ ID NO:Y. Where the nucleotide position number "To" is lower than the nucleotide position number "From", the preferred ORF is the reverse complement of the referenced polynucleotide sequence.
- [0054] The fifth column in Table 1A provides the corresponding SEQ ID NO:Y for the polypeptide sequence encoded by the preferred ORF delineated in column 4. In one embodiment, the invention provides an amino acid sequence comprising, or alternatively consisting of, a polypeptide encoded by the portion of SEQ ID NO:X delineated by "ORF (From-To)". Also provided are polynucleotides encoding such amino acid sequences and the complementary strand thereto.
- [0055] Column 6 in Table 1A lists residues comprising epitopes contained in the polypeptides encoded by the preferred ORF (SEQ ID NO:Y), as predicted using the algorithm of Jameson and Wolf, (1988) *Comp. Appl. Biosci.* 4:181-186. The Jameson-Wolf antigenic analysis was performed using the computer program PROTEAN (Version 3.11 for the Power MacIntosh, DNASTAR, Inc., 1228 South Park Street Madison, WI). In specific embodiments, polypeptides of the invention comprise, or alternatively consist of, at least one, two, three, four, five or more of the

predicted epitopes as described in Table 1A. It will be appreciated that depending on the analytical criteria used to predict antigenic determinants, the exact address of the determinant may vary slightly.

[0056] Column 7 in Table 1A provides an expression profile and library code: count for each of the contig sequences (SEQ ID NO:X) disclosed in Table 1A, which can routinely be combined with the information provided in Table 4 and used to determine the normal or diseased tissues, cells, and/or cell line libraries which predominantly express the polynucleotides of the invention. The first number in column 7 (preceding the colon), represents the tissue/cell source identifier code corresponding to the code and description provided in Table 4. For those identifier codes in which the first two letters are not "AR", the second number in column 7 (following the colon) represents the number of times a sequence corresponding to the reference polynucleotide sequence was identified in the tissue/cell source. Those tissue/cell source identifier codes in which the first two letters are "AR" designate information generated using DNA array technology. Utilizing this technology, cDNAs were amplified by PCR and then transferred, in duplicate, onto the array. Gene expression was assayed through hybridization of first strand cDNA probes to the DNA array. cDNA probes were generated from total RNA extracted from a variety of different tissues and cell lines. Probe synthesis was performed in the presence of ³³P dCTP, using oligo(dT) to prime reverse transcription. After hybridization, high stringency washing conditions were employed to remove non-specific hybrids from the array. The remaining signal, emanating from each gene target, was measured using a Phosphorimager. Gene expression was reported as Phosphor Stimulating Luminescence (PSL) which reflects the level of phosphor signal generated from the probe hybridized to each of the gene targets represented on the array. A local background signal subtraction was performed before the total signal generated from each array was used to normalize gene expression between the different hybridizations. The value presented after "[array code]:" represents the mean of the duplicate values, following background subtraction and probe normalization. One of skill in the art could routinely use this information to identify normal and/or diseased tissue(s) which show a predominant expression pattern of the corresponding polynucleotide of the invention or to identify polynucleotides which show predominant and/or specific tissue and/or cell expression. The sequences disclosed

herein have been determined to be predominantly expressed in cardiovascular system tissues, including normal and diseased cardiovascular system tissues (See Table 1A, column 7 and Table 4).

[0057] Column 8 in Table 1A provides a chromosomal map location for certain polynucleotides of the invention. Chromosomal location was determined by finding exact matches to EST and cDNA sequences contained in the NCBI (National Center for Biotechnology Information) UniGene database. Each sequence in the UniGene database is assigned to a "cluster"; all of the ESTs, cDNAs, and STSs in a cluster are believed to be derived from a single gene. Chromosomal mapping data is often available for one or more sequence(s) in a UniGene cluster; this data (if consistent) is then applied to the cluster as a whole. Thus, it is possible to infer the chromosomal location of a new polynucleotide sequence by determining its identity with a mapped UniGene cluster.

[0058] A modified version of the computer program BLASTN (Altschul et al., J. Mol. Biol. 215:403-410 (1990), and Gish et al., Nat. Genet. 3:266-272 (1993)) was used to search the UniGene database for EST or cDNA sequences that contain exact or near-exact matches to a polynucleotide sequence of the invention (the 'Query'). A sequence from the UniGene database (the 'Subject') was said to be an exact match if it contained a segment of 50 nucleotides in length such that 48 of those nucleotides were in the same order as found in the Query sequence. If all of the matches that met this criteria were in the same UniGene cluster, and mapping data was available for this cluster, it is indicated in Table 1A under the heading "Cytologic Band". Where a cluster had been further localized to a distinct cytologic band, that band is disclosed; where no banding information was available, but the gene had been localized to a single chromosome, the chromosome is disclosed.

[0059] Once a presumptive chromosomal location was determined for a polynucleotide of the invention, an associated disease locus was identified by comparison with a database of diseases, which have been experimentally associated with genetic loci. The database used was the Morbid Map, derived from OMIM™ (*supra*). If the putative chromosomal location of a polynucleotide of the invention (Query sequence) was associated with a disease in the Morbid Map database, an OMIM reference identification number was noted in column 9, Table 1A, labeled "OMIM Disease

Reference(s)". Table 5 is a key to the OMIM reference identification numbers (column 1), and provides a description of the associated disease in Column 2.

TABLE 1B

Clone ID NO:Z	SEQ ID NO:X	CONTIG ID:	BAC ID: A	SEQ ID NO:B	EXON From-To
HAHCL07	11	952661	AC022706	1241	1-1814
HAHCL07	11	952661	AC022916	1242	1-1814
HAHCL07	11	952661	AC022706	1243	1-107
HAHCL07	11	952661	AC022916	1244	1-107
HAHCP41	13	712086	AP002755	1245	1-326
HAHCP41	13	712086	AP000774	1246	1-326
HAHCP41	13	712086	AC020742	1247	1-326
HAHCP41	13	712086	AC001234	1248	1-326
HAHCP41	13	712086	AP002755	1249	1-538
HAHCP41	13	712086	AP000774	1250	1-538
HAHCP41	13	712086	AC020742	1251	1-538
HAHCP41	13	712086	AC001234	1252	1-538
HAHCP49	14	722659	AC046164	1253	1-244
HAHCP55	15	865095	AC011610	1254	1-125 1640-1708 1938-2132 3921-4067 4332-4975 6267-6343 6434-6748 6940-7010 9423-9456 9548-9900 12131-12199 13540-13627 13844-13921 14168-14201 14997-15076 15386-16024 16177-16523 16776-16849 17304-17711 17901-18042 18921-19274
HAHCP55	15	865095	AC066599	1255	1-69 524-931 1121-1262 2140-2493

HAHCP55	15	865095	AC022382	1256	1-69 524-931 1121-1262 2142-2495
HAHCP55	15	865095	AC024163	1257	1-69 524-931 1121-1262 2140-2493
HAHCP55	15	865095	AC007850	1258	1-125 1640-1708 1938-2132 3921-4067 4332-4975 6267-6343 6434-6748 6940-7010 9423-9456 9548-9900 12130-12198 13539-13626 13843-13920 14167-14200 14996-15075 15385-16023 16176-16522 16774-16847 17302-17709 17899-18040 18918-19206
HAHCP55	15	865095	AC008034	1259	1-125 1640-1708 1938-2132 3921-4067 4332-4975 6267-6343 6434-6748 6940-7010 9637-9816 12130-12198 13539-13626 13843-13920

					14167-14200 14996-15075 15385-16023 16176-16522 16774-16847 17302-17709 17899-18040 18918-19271 20211-20888 21472-21834 22101-22510 24271-24974 25056-25409 25860-26636 26691-26822 27128-28128 30303-30454 30745-31348
HAHCP55	15	865095	AC066599	1260	1-347
HAHCP55	15	865095	AC022382	1261	1-347
HAHCP55	15	865095	AC011610	1262	1-564
HAHCP55	15	865095	AC066599	1263	1-678
HAHCP55	15	865095	AC022382	1264	1-678
HAHCP55	15	865095	AC024163	1265	1-347
HAHCP55	15	865095	AC007850	1266	1-564
HAHCP55	15	865095	AC008034	1267	1-564
HAHCP55	15	865095	AC024163	1268	1-678
HAHCP67	16	756916	AC044892	1269	1-160 1117-1442 1844-2103 2869-3022 3971-4116 5198-5472 6138-6590 7022-7205 7607-7703 7910-8685 9075-9227 9362-9724 9937-10537
HAHCP67	16	756916	AC006252	1270	1-160

					1116-1441 1843-2102 2868-3021 3978-4123 5226-5479 6145-6597 7029-7211 7613-7709 7916-8691 9081-9233 9368-9730 9943-10543
HAHCP67	16	756916	AC044892	1271	1-995 1441-1664
HAHCP67	16	756916	AC006252	1272	1-995 1441-1664
HAHCP91	17	789998	AC005833	1273	1-288
HAHCP91	17	789998	AC005833	1274	1-216
HAHCP91	17	789998	AC005833	1275	1-328 378-1059 1980-2100
HAHCR57	18	865096	AC073487	1276	1-587 2146-3842 3989-4201 5499-5529 6178-6728 7177-7679 8088-9978 10716-10977 10981-11359 11459-11652 11709-12255 12352-12457 12485-12662 12775-12853 12946-13797 13854-13972 14616-14764 15230-15403 15550-15610 15784-15879

					16027-16157 16273-16359 16716-16906 17040-17252 18205-18727 18898-19487 20516-20784 21205-21286 21386-21515 25809-26225
HAHCR57	18	865096	AC073487	1277	1-259
HAHEE04	19	922257	AL158169	1278	1-217 532-704 791-908 1623-1788 1831-1985 2107-2447 4415-4873 5085-5172 5281-5360 5579-5646 5738-5988 6535-8317
HAHEE04	19	922257	AL356104	1279	1-459 671-758 867-946
HAHEE04	19	922257	AL158169	1280	1-84
HAHEE04	19	922257	AL356104	1281	1-68 160-410 957-2739
HAHEO46	21	718772	AC008640	1282	1-988
HAHEO46	21	718772	AC011376	1283	1-988
HAHEO46	21	718772	AC008640	1284	1-308
HAHEO46	21	718772	AC011376	1285	1-308
HAHES10	22	961594	AC007618	1286	1-417
HAHES10	22	961594	AC007618	1287	1-545
HAHES10	22	961594	AC007618	1288	1-557
HAHFX20	23	925753	AC022965	1289	1-265
HAHFX20	23	925753	AL390725	1290	1-265
HAHFX20	23	925753	AC022965	1291	1-489
HAHFX20	23	925753	AL390725	1292	1-489

HAHFX20	23	925753	AC022965	1293	1-518
HAHFX20	23	925753	AL390725	1294	1-518
HAHHO04	25	925814	AC009417	1295	1-166 344-432 941-1480
HAHHO04	25	925814	AC073650	1296	1-31 529-793 1012-1296 1451-1539 2048-2587
HAHHO04	25	925814	AC009417	1297	1-289
HAHHO04	25	925814	AC073650	1298	1-289
HAHHS01	26	913863	AC011189	1299	1-290
HAHHS01	26	913863	AC027040	1300	1-290
HAHHS01	26	913863	AC002993	1301	1-290
HAHHS01	26	913863	AC011189	1302	1-562
HAHIK10	27	961425	AL354822	1303	1-172
HAHIK10	27	961425	AL159982	1304	1-168
HAHIK10	27	961425	AC025100	1305	1-170
HAHIK10	27	961425	AC023572	1306	1-173
HAHIK10	27	961425	AL354817	1307	1-173
HAHIK10	27	961425	AL354697	1308	1-173
HAHIK10	27	961425	AC000382	1309	1-170
HAHIK10	27	961425	AC025100	1310	1-293
HAHIK10	27	961425	AC023572	1311	1-293
HAHIK10	27	961425	AL354822	1312	1-293
HAHIK10	27	961425	AL354817	1313	1-455
HAHIK10	27	961425	AL354697	1314	1-455
HAHIK10	27	961425	AL159982	1315	1-292
HAHIW08	28	955803	AC002413	1316	1-647
HAHIW08	28	955803	AL139396	1317	1-647
HAHIW08	28	955803	AC002413	1318	1-352
HAHSC42	29	695111	AC073389	1319	1-119 1375-1607 2148-2689 2792-3076 3843-4509 4904-5519
HAHSC42	29	695111	AC073389	1320	1-457
HAHSC42	29	695111	AC073389	1321	1-327

HCMSC52	31	522615	AC026228	1322	1-111
HCMSQ77	33	862373	AC006463	1323	1-303
HCMSX59	36	522598	AC012134	1324	1-362
HCMSX59	36	522598	AC073904	1325	1-361
HCMSX59	36	522598	AP001811	1326	1-361
HCMSX59	36	522598	AP001811	1327	1-558
HCMSX59	36	522598	AC012134	1328	1-558
HCMSX59	36	522598	AC073904	1329	1-558
HELAF85	37	507230	AC020988	1330	1-320
HELAF85	37	507230	AC020988	1331	1-886 900-3110
HELAI26	38	920922	AL157829	1332	1-327 383-585 5577-5852 7628-7977 15024-15185 23099-23432
HELAI26	38	920922	AC015464	1333	1-276
HELAI26	38	920922	AL133284	1334	1-276
HELAI26	38	920922	AC015464	1335	1-350
HELAV61	40	507205	AL390880	1336	1-349
HELAV61	40	507205	AL390880	1337	1-264
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HELEO42	570	579016	AC010674	2355	1-1038 2072-2350 2444-2783 3079-3144 4658-5350 6459-6639 7394-7624 10010-10103 10404-10463 10557-10641 10928-11380 11817-11998

					12307-12468 14217-14314 15654-15714
HELEH76	571	506674	AL360298	2356	1-944
HELEH76	571	506674	AL358072	2357	1-972
HELEH76	571	506674	AC053494	2358	1-972
HELEH76	571	506674	AC022671	2359	1-972
HELEH76	571	506674	AC053494	2360	1-470 766-1174
HELDL08	575	959919	AC073595	2361	1-453 819-1737
HELDL08	575	959919	AC027288	2362	1-454 820-1738
HELDL08	575	959919	AC027288	2363	1-584
HEL DG91	578	790371	AC026562	2364	1-774
HEL DG91	578	790371	AC069256	2365	1-774
HEL DG91	578	790371	AC026562	2366	1-255
HEL DG91	578	790371	AC069256	2367	1-255
HEL DG91	578	790371	AC026562	2368	1-544
HEL DG91	578	790371	AC069256	2369	1-544
HEL CW51	579	531073	AC078913	2370	1-165
HEL CI30	580	691024	AC016697	2371	1-510
HEL CI30	580	691024	AC012362	2372	1-140 2160-2746 2944-3409 3461-3941
HEL CI30	580	691024	AC016697	2373	1-126
HEL CI30	580	691024	AC012362	2374	1-484
HEL CI30	580	691024	AC012362	2375	1-108
HEL CG36	581	655045	AL133377	2376	1-1464
HEL CG36	581	655045	AL136164	2377	1-1563
HEL CG36	581	655045	AL136164	2378	1-277
HEL CG36	581	655045	AL133377	2379	1-277
HEL CG36	581	655045	AL136164	2380	1-1285
HEL BU11	582	967661	AC010209	2381	1-697
HEL BU11	582	967661	AC010209	2382	1-396
HEL BU11	582	967661	AC010209	2383	1-284
HEL BC83	583	781412	AL139328	2384	1-515 1506-1971
HEL BC83	583	781412	AC018379	2385	1-515

					1506-1971
HELBC83	583	781412	AL136527	2386	1-515 1506-1971
HELBC83	583	781412	AL139328	2387	1-413
HELBC83	583	781412	AC018379	2388	1-631 637-1252
HELBC83	583	781412	AL139328	2389	1-631 637-1252
HELBC83	583	781412	AL136527	2390	1-631 637-1252
HELBC83	583	781412	AL136527	2391	1-413
HELAZ48	584	864515	AL162734	2392	1-2089
HELAZ48	584	864515	AL162734	2393	1-1074
HELAZ48	584	864515	AL162734	2394	1-310
HELAM32	587	699661	AC008079	2395	1-295 428-875 892-945 1563-1700 2084-2191 5109-5504 6802-7282 9658-9809 9818-10338 10350-11130 11158-15251 15262-15836 15909-16774
HELAM32	587	699661	AC008101	2396	1-295 428-875 892-945 1563-1700 2032-2191 5109-5504 6801-7281 9657-9808 9817-10337 10349-11129 11157-15257 15269-15843
HELAM32	587	699661	AC016830	2397	1-145 433-1745

HELAM32	587	699661	AC016027	2398	1-295 428-875 892-945 1563-1700 2084-2191 5109-5504 6028-6128 6802-7282 9658-9809 9818-10338 10350-11130 11158-15836 15909-16774
HELAM32	587	699661	AC008079	2399	1-287
HELAM32	587	699661	AC008079	2400	1-297
HELAM32	587	699661	AC008101	2401	1-287
HELAM32	587	699661	AC008101	2402	1-802
HELAM32	587	699661	AC016830	2403	1-687
HELAM32	587	699661	AC016830	2404	1-284 574-1700 2012-2132
HELAM32	587	699661	AC016027	2405	1-287
HELAM32	587	699661	AC016027	2406	1-304
HCMSY80	589	526182	AC069028	2407	1-255
HCMSQ63	590	745584	AC025975	2408	1-52 752-1355
HCMSQ63	590	745584	AC008681	2409	1-52 757-1360
HCMSQ63	590	745584	AC025975	2410	1-530 837-919 1945-3561
HCMSQ63	590	745584	AC008681	2411	1-530 837-919 1944-3560
HAHFE11	594	965293	AL008718	2412	1-466 554-874 2846-2933 4193-4484 4853-5225 5311-5727 6015-9575

HAHFE11	594	965293	AC062010	2413	1-373 459-875 1166-2221
HAHFE11	594	965293	AL008718	2414	1-440
HAHCU22	596	848831	AC021054	2415	1-62 909-1442 1984-4152
HAHCU22	596	848831	AC006205	2416	1-54 796-950 1203-1275 1695-1850 2485-2616 3454-3987 4529-6698
HAHCU22	596	848831	AC021054	2417	1-395 928-1113 1661-1885
HAHCU22	596	848831	AC006205	2418	1-130
HAHCU22	596	848831	AC006205	2419	1-395 928-1113 1661-1885
HAHAD95	600	865104	AC026149	2420	1-338
HAHAD95	600	865104	AC026149	2421	1-154
HAHAD95	600	865104	AC026149	2422	1-1125
HAFBG30	601	693363	AC010264	2423	1-577
HAFBG30	601	693363	AC005740	2424	1-2469 2938-3229 5273-5782 6611-6709 7387-7969 8404-8801 9433-9896 12391-13237
HAFBG30	601	693363	AC010264	2425	1-477 743-1093 1601-1973 2653-3336 3487-6292 6493-6735
HAFBG30	601	693363	AC010264	2426	1-257
HAFBG30	601	693363	AC005740	2427	1-477

					743-1093 1601-1973 2653-3336 3487-6735 6910-7038 7213-7317 7329-8051 9152-10208 10293-11443 11593-12545 12811-13152 13422-13481 13601-14334 14418-14524 14625-14713 14958-15119 15309-15446 16402-16558 19172-19292 19680-19767 20000-20121 20728-20869
HAFAY37	602	928705	AC073264	2428	1-338 804-3157
HAFAY37	602	928705	AC024155	2429	1-340 808-1235 1241-3169
HAFAY37	602	928705	AC073264	2430	1-488 1407-2258 2342-3262
HAFAY37	602	928705	AC073264	2431	1-534
HAFAY37	602	928705	AC024155	2432	1-535
HAFAY37	602	928705	AC024155	2433	1-488 1407-2258 2342-3262
HAECA04	604	932993	AC012419	2434	1-401 1140-1492 1588-2434
HAECA04	604	932993	AC068288	2435	1-401 1140-1492 1588-2433

HAECA04	604	932993	AC015971	2436	1-401 1140-1492 1588-2433
HAECA04	604	932993	AC012419	2437	1-803
HAECA04	604	932993	AC068288	2438	1-465
HAECA04	604	932993	AC068288	2439	1-781 1537-2119
HAECA04	604	932993	AC015971	2440	1-362 408-802 1558-2142
HAECA04	604	932993	AC015971	2441	1-465
HAEAM82	605	781539	AC009790	2442	1-1057 1129-1711

[0060] Table 1B summarizes additional polynucleotides encompassed by the invention (including cDNA clones related to the sequences (Clone ID NO:Z), contig sequences (contig identifier (Contig ID:) contig nucleotide sequence identifiers (SEQ ID NO:X)), and genomic sequences (SEQ ID NO:B). The first column provides a unique clone identifier, "Clone ID NO:Z", for a cDNA clone related to each contig sequence. The second column provides the sequence identifier, "SEQ ID NO:X", for each contig sequence. The third column provides a unique contig identifier, "Contig ID:" for each contig sequence. The fourth column, provides a BAC identifier "BAC ID NO:A" for the BAC clone referenced in the corresponding row of the table. The fifth column provides the nucleotide sequence identifier, "SEQ ID NO:B" for a fragment of the BAC clone identified in column four of the corresponding row of the table. The sixth column, "Exon From-To", provides the location (i.e., nucleotide position numbers) within the polynucleotide sequence of SEQ ID NO:B which delineate certain polynucleotides of the invention that are also exemplary members of polynucleotide sequences that encode polypeptides of the invention (e.g., polypeptides containing amino acid sequences encoded by the polynucleotide sequences delineated in column six, and fragments and variants thereof).

TABLE 2

Clone ID NO:Z	Contig ID:	SEQ ID NO:X	Analysis Method	PFam/NR Description	PFam/NR Accession Number	Score/ Percent Identity	NT From	NT To
HAHEE05	928673	20	blastx.2	(AC005531) similar to mouse homeodomain- interacting protein 1	gb AAD04728.1	100%	39	422
HAHHE12	969107	24	blastx.14	N-RAP [Mus musculus]	gj 2351568 gb AAC5 3323.1	76%	307	621
						67%	139	333
						54%	460	612
						78%	667	762
						35%	514	708
						75%	673	759
						59%	481	576
						32%	526	708
						37%	598	717
						34%	541	705
						40%	601	705
						34%	547	675
						27%	457	621
						27%	514	708
						85%	762	803
						26%	619	756
						31%	541	693
						55%	703	762
						29%	544	675
						30%	460	585
						38%	619	696
						34%	598	693
						38%	619	696

HELEA45	954371	49	blastx.14	exopolyphosphatase [Escherichia coli]	gi 147343 gb AAA24 415.1	47%	526	588
HELHF07	949067	78	HMMER 1.8	PFAM: Aminotransferases class- III pyridoxal-phosphate	PF00202	89%	86	169
			blastx.14	4-aminobutyrate aminotransferase (EC 2.6.1.19) 1 1 aminotransferase).	gi 1742132 dbj BAA1 4871.1	100%	66	98
						38.85	95	295
						85%	83	295
						92%	21	98
						45%	246	311
						100%	1	18
						30%	415	483
						29%	720	800
						26%	526	594
						27%	592	702
						28%	711	794
						50%	762	797
						50%	762	797
						56%	526	573
						39%	723	791
						57%	532	573
						37%	637	708
						37%	637	708
						23%	460	585
						36%	649	705
						33%	616	696
						40%	526	585
						75%	627	662
						47%	526	576
						66%	457	492
						29%	607	717
						29%	598	690
						47%	526	588

HEMEK19	574209	92	HMMER 2.1.1	[Escherichia coli] PFAM: TonB dependent receptor C-terminal region	PF00593	46.8	81	233
HEMEU54	947801	94	blastx.14	samaphorin G [Mus musculus]	gi 1418942 emb CAA 66398.1	96% 50% 42% 51% 54% 35% 33% 42% 30% 41% 44% 55% 62% 45% 62%	11 122 128 122 14 68 134 29 122 343 248 302 305 296 305	325 280 298 238 112 235 328 112 238 429 301 328 328 328
HHBEM70	756949	107	HMMER 1.8	PFAM: Core histones H2A, H2B, H3 and H4	PF00125	13.08	144	215
HHBHO63	906947	121	HMMER 1.8	PFAM: Phorbol esters / diacylglycerol binding domain	PF00130	2.21	188	217
HHFBX77	959805	136	blastx.14	(AB012308) B2HC [Anthocidaris crassispina]	gi 4033608 dbj BAA3 5136.1	83%	13	366
HHFCA64	720849	137	HMMER 1.8	PFAM: Zinc-binding metalloprotease domain	PF00099	3.2	287	267
HHFGN31	908508	177	HMMER 2.1.1	PFAM: KRAB box	PF01352	64.1	93	215
HHFHC02	920510	192	HMMER	PFAM: Eukaryotic protein	PF00069	13.11	118	183

				1.8 blastx.14	kinase domain (AB023658) Ca/calmodulin-dependent protein kinase 1	gi 4512334 dbj BAA7 5246.1	94%	70	183
HHFJN02	918358	214		blastx.14	retrovirus-related reverse transcriptase pseudogene - slow loris	pir B25313 GNLRL1	53% 54%	297 390	208 286
HHFON19	910891	257		HMMER 2.1.1	PFAM: Dual specificity phosphatase, catalytic domain	PF00782	154.8	316	732
HHFUC26	960331	267		blastx.14	(AF143321) unknown [Homo sapiens]	gi 4929222 gb AAD3 3910.1 AF143321_1	68%	298	825
HMEGH46	887791	287		HMMER 1.8	PFAM: Src homology domain 3	PF00018	3.21	343	375
HULAI37	708923	307		HMMER 1.8	PFAM: C2 domain	PF00168	12.81	10	78
HULFB76	767873	313		HMMER 2.1.1	PFAM: Core histones H2A, H2B, H3 and H4	PF00125	13.48	99	173
HUSIW10	963324	330		HMMER 2.1.1	PFAM: HIT family	PF01230	24.6	67	147
HUSYA63	928021	335		blastx.14	(AF098499) No definition line found [Caenorhabditis elegans]	gi 3786408 gb AAC6 7396.1	48% 41%	234 149	320 241
HUSZH03	922852	341		blastx.14	(AF116865) hedgehog- interacting protein [Mus musculus]	gi 4868122 gb AAD3 1172.1 AF116865_1	88%	251	439
HUSYN11	943237	345		HMMER 1.8	C06A6.3 gene product [Caenorhabditis elegans]	gi 1086626 gb AAA8 2295.1	34% 61%	367 259	633 297
					PFAM: Core histones H2A, H2B, H3 and H4	PF00125	13.67	238	315

HUSIE95	967176	366	blastx.2	(AL137556) hypothetical protein [Homo sapiens]	emb CAB70810.1	67%	137	319
			blastx.14	GS2NA [Homo sapiens]	gi 805095 gb AAB81551.1	56%	229	5
						53%	496	413
						37%	121	11
						31%	388	332
						33%	484	431
HUSIE08	908574	368	blastx.14	(AB024005) KRAB-containing zinc-finger protein KRAZ2 [Mus musculus]	gi 4514561 dbj BAA75468.1	70%	38	229
HUSHL86	960355	369	blastx.14	(AF151805) CGI-47 protein [Homo sapiens]	gi 4929563 gb AAD34042.1 AF151805.1	96%	1142	882
						100%	1413	1330
HUSFF03	924616	389	blastx.14	(AF033276) A kinase anchor protein [Mus musculus]	gi 2852701 gb AAC02208.1	83%	266	535
						47%	541	591
HHFLU06	857884	445	HMMER 2.1.1	PFAM: Adenylate and Guanylate cyclase catalytic domain	PF00211	108.8	17	268
HHFKX28	971102	453	blastx.14	Similarity to Yeast LPG22P protein (TR:G1151240); 1 1 cDNA EST EMBL:C10626 comes from this gene; cDNA EST EMBL:C10848	gi 3881836 emb CAB01454.1	76%	858	619
						65%	495	409
						91%	617	546
HHFJM64	958384	455	blastx.2	(AF026504) SPA-1 like protein p1294 [Rattus norvegicus]	gb AAB81526.1	83%	3	287
						43%	323	664
						29%	799	1266

HHFCH52	911570	503	blastx.14	INSERTIN=TENSIN HOMOLOG.	sp G256713 G256713	28%	847	1344
HHBGJ53	909912	525	HMMER 2.1.1	PFAM: PH domain	PF00169	38.3	160	267
HHBGG10	963849	526	blastx.14	(AB011527) MEGF1 [Rattus norvegicus]	gi 3449286 dbj BAA3 2458.1	90%	98	3
HHBEG80	951688	533	HMMER 1.8	PFAM: Core histones H2A, H2B, H3 and H4	PF00125	75%	210	112
HEMGL56	767669	538	HMMER 2.1.1	PFAM: Filamin/ABP280 repeat.	PF00630	45%	210	151
HEMDX96	935963	543	blastx.14	(AF111170) unknown [Homo sapiens]	gi 4314286 gb AAD1 5563.1	41%	219	184
HEMBT61	939957	550	HMMER 2.1.1	PFAM: Eukaryotic protein kinase domain	PF00069	12.4	371	436
HELGY02	948302	557	blastx.2	(AD000092) hypothetical human serine-threonine protein kinase R31240_1 [Homo sapiens]	gb AAB51171.1	84.1	45	209
HELGW31	610003	558	HMMER 2.1.1	Similar to sulfatase [Caenorhabditis elegans]	gb AAA83618.1	79%	491	255
HELGW31	957568	622	HMMER 2.1.1	PFAM: Cytochrome C assembly protein	PF01578	76.6	16	285
			blastx.2	(AE000309) heme exporter protein C, [Escherichia coli]	gb AAC75259.1	71%	13	441
				PFAM: Cytochrome C assembly protein	PF01578	59%	383	523
						216.5	672	1286
						100%	603	1337
						200.9	990	421

HELGW31	964303	623	blastx.2	(AE000309) heme exporter protein C [Escherichia coli]	gb AAC75259.1	99% 100%	5 621	619 713
HELK56	925698	561	HMMER 2.1.1	yeyV [Escherichia coli]	gb AAA16392.1	93% 60%	39 1	449 75
HELFN75	658681	565	blastx.14	PFAM: Pyruvate kinase	PF00224	406.9	147	731
HAHFS80	954432	593	blastx.2	pyruvate kinase type II [Escherichia coli]	gi 147459 gb AAA24473.1	98% 65%	147 21	731 107
HAECA04	932993	604	blastx.14	Molybdenum transport system permease protein ModB. [Escherichia coli]	dbj BAA35428.1	100%	288	635
			blastx.14	(AJ010306) human smoothelin, large isoform [Homo sapiens]	gi 4128006 emb CAA09077.1	73%	3	275
			blastx.14	(AF097473) ORF1 [Mus musculus]	gi 4204569 gb AADI0771.1	37% 53% 35% 61% 57%	106 239 40 178 94	216 322 99 216 135

[0061] Table 2 further characterizes certain encoded polypeptides of the invention, by providing the results of comparisons to protein and protein family databases. The first column provides a unique clone identifier, "Clone ID NO:", corresponding to a cDNA clone disclosed in Table 1A. The second column provides the unique contig identifier, "Contig ID:" which allows correlation with the information in Table 1A. The third column provides the sequence identifier, "SEQ ID NO:X", for the contig polynucleotide sequences. The fourth column provides the analysis method by which the homology/identity disclosed in the row was determined. The fifth column provides a description of PFam/NR hits having significant matches identified by each analysis. Column six provides the accession number of the PFam/NR hit disclosed in the fifth column. Column seven, "Score/Percent Identity", provides a quality score or the percent identity, of the hit disclosed in column five. Comparisons were made between polypeptides encoded by polynucleotides of the invention and a non-redundant protein database (herein referred to as "NR"), or a database of protein families (herein referred to as "PFam"), as described below.

[0062] The NR database, which comprises the NBRF PIR database, the NCBI GenPept database, and the SIB SwissProt and TrEMBL databases, was made non-redundant using the computer program nrdb2 (Warren Gish, Washington University in Saint Louis). Each of the polynucleotides shown in Table 1A, column 3 (e.g., SEQ ID NO:X or the 'Query' sequence) was used to search against the NR database. The computer program BLASTX was used to compare a 6-frame translation of the Query sequence to the NR database (for information about the BLASTX algorithm please see Altschul et al., J. Mol. Biol. 215:403-410 (1990), and Gish et al., Nat. Genet. 3:266-272 (1993)). A description of the sequence that is most similar to the Query sequence (the highest scoring 'Subject') is shown in column five of Table 2 and the database accession number for that sequence is provided in column six. The highest scoring 'Subject' is reported in Table 2 if (a) the estimated probability that the match occurred by chance alone is less than $1.0e-07$, and (b) the match was not to a known repetitive element. BLASTX returns alignments of short polypeptide segments of the Query and Subject sequences which share a high degree of similarity; these segments are known as High-Scoring Segment Pairs or HSPs. Table 2 reports the degree of

similarity between the Query and the Subject for each HSP as a percent identity in Column 7. The percent identity is determined by dividing the number of exact matches between the two aligned sequences in the HSP, dividing by the number of Query amino acids in the HSP and multiplying by 100. The polynucleotides of SEQ ID NO:X which encode the polypeptide sequence that generates an HSP are delineated by columns 8 and 9 of Table 2.

[0063] The PFam database, PFam version 5.2, (Sonnhammer et al., Nucl. Acids Res., 26:320-322, (1998)) consists of a series of multiple sequence alignments; one alignment for each protein family. Each multiple sequence alignment is converted into a probability model called a Hidden Markov Model, or HMM, that represents the position-specific variation among the sequences that make up the multiple sequence alignment (see, e.g., R. Durbin et al., *Biological sequence analysis: probabilistic models of proteins and nucleic acids*, Cambridge University Press, 1998 for the theory of HMMs). The program HMMER version 1.8 (Sean Eddy, Washington University in Saint Louis) was used to compare the predicted protein sequence for each Query sequence (SEQ ID NO:Y in Table 1A) to each of the HMMs derived from PFam version 5.2. A HMM derived from PFam version 5.2 was said to be a significant match to a polypeptide of the invention if the score returned by HMMER 1.8 was greater than 0.8 times the HMMER 1.8 score obtained with the most distantly related known member of that protein family. The description of the PFam family which shares a significant match with a polypeptide of the invention is listed in column 5 of Table 2, and the database accession number of the PFam hit is provided in column 6. Column 7 provides the score returned by HMMER version 1.8 for the alignment. Columns 8 and 9 delineate the polynucleotides of SEQ ID NO:X which encode the polypeptide sequence which shows a significant match to a PFam protein family.

[0064] As mentioned, columns 8 and 9 in Table 2, "NT From" and "NT To", delineate the polynucleotides of "SEQ ID NO:X" that encode a polypeptide having a significant match to the PFam/NR database as disclosed in the fifth column of Table 2. In one embodiment, the invention provides a protein comprising, or alternatively consisting of, a polypeptide encoded by the polynucleotides of SEQ ID NO:X delineated in columns 8 and 9 of Table 2. Also

provided are polynucleotides encoding such proteins, and the complementary strand thereto.

[0065] The nucleotide sequence SEQ ID NO:X and the translated SEQ ID NO:Y are sufficiently accurate and otherwise suitable for a variety of uses well known in the art and described further below. For instance, the nucleotide sequences of SEQ ID NO:X are useful for designing nucleic acid hybridization probes that will detect nucleic acid sequences contained in SEQ ID NO:X or the cDNA contained in Clone ID NO:Z. These probes will also hybridize to nucleic acid molecules in biological samples, thereby enabling immediate applications in chromosome mapping, linkage analysis, tissue identification and/or typing, and a variety of forensic and diagnostic methods of the invention. Similarly, polypeptides identified from SEQ ID NO:Y may be used to generate antibodies which bind specifically to these polypeptides, or fragments thereof, and/or to the polypeptides encoded by the cDNA clones identified in, for example, Table 1A.

[0066] Nevertheless, DNA sequences generated by sequencing reactions can contain sequencing errors. The errors exist as misidentified nucleotides, or as insertions or deletions of nucleotides in the generated DNA sequence. The erroneously inserted or deleted nucleotides cause frame shifts in the reading frames of the predicted amino acid sequence. In these cases, the predicted amino acid sequence diverges from the actual amino acid sequence, even though the generated DNA sequence may be greater than 99.9% identical to the actual DNA sequence (for example, one base insertion or deletion in an open reading frame of over 1000 bases).

[0067] Accordingly, for those applications requiring precision in the nucleotide sequence or the amino acid sequence, the present invention provides not only the generated nucleotide sequence identified as SEQ ID NO:X, and a predicted translated amino acid sequence identified as SEQ ID NO:Y, but also a sample of plasmid DNA containing cDNA Clone ID NO:Z (deposited with the ATCC on October 5, 2000, and receiving ATCC designation numbers PTA 2574 and PTA 2575; deposited with the ATCC on January 5, 2001, having the depositor reference numbers TS-1, TS-2, AC-1, and AC-2; and/or as set forth, for example, in Table 1A, 6 and 7). The nucleotide sequence of each deposited clone can readily be determined by sequencing the deposited clone in accordance with

known methods. Further, techniques known in the art can be used to verify the nucleotide sequences of SEQ ID NO:X.

[0068] The predicted amino acid sequence can then be verified from such deposits. Moreover, the amino acid sequence of the protein encoded by a particular clone can also be directly determined by peptide sequencing or by expressing the protein in a suitable host cell containing the deposited human cDNA, collecting the protein, and determining its sequence.

RACE Protocol For Recovery of Full-Length Genes

[0069] Partial cDNA clones can be made full-length by utilizing the rapid amplification of cDNA ends (RACE) procedure described in Frohman, M.A., et al., Proc. Nat'l. Acad. Sci. USA, 85:8998-9002 (1988). A cDNA clone missing either the 5' or 3' end can be reconstructed to include the absent base pairs extending to the translational start or stop codon, respectively. In some cases, cDNAs are missing the start codon of translation. The following briefly describes a modification of this original 5' RACE procedure. Poly A⁺ or total RNA is reverse transcribed with Superscript II (Gibco/BRL) and an antisense or complementary primer specific to the cDNA sequence. The primer is removed from the reaction with a Microcon Concentrator (Amicon). The first-strand cDNA is then tailed with dATP and terminal deoxynucleotide transferase (Gibco/BRL). Thus, an anchor sequence is produced which is needed for PCR amplification. The second strand is synthesized from the dA-tail in PCR buffer, Taq DNA polymerase (Perkin-Elmer Cetus), an oligo-dT primer containing three adjacent restriction sites (XhoI, Sall and ClaI) at the 5' end and a primer containing just these restriction sites. This double-stranded cDNA is PCR amplified for 40 cycles with the same primers as well as a nested cDNA-specific antisense primer. The PCR products are size-separated on an ethidium bromide-agarose gel and the region of gel containing cDNA products the predicted size of missing protein-coding DNA is removed. cDNA is purified from the agarose with the Magic PCR Prep kit (Promega), restriction digested with XhoI or Sall, and ligated to a plasmid such as pBluescript SKII (Stratagene) at XhoI and EcoRV sites. This DNA is transformed into bacteria and the plasmid clones sequenced to identify the correct protein-coding inserts. Correct 5' ends are confirmed by

comparing this sequence with the putatively identified homologue and overlap with the partial cDNA clone. Similar methods known in the art and/or commercial kits are used to amplify and recover 3' ends.

[0070] Several quality-controlled kits are commercially available for purchase. Similar reagents and methods to those above are supplied in kit form from Gibco/BRL for both 5' and 3' RACE for recovery of full length genes. A second kit is available from Clontech which is a modification of a related technique, SLIC (single-stranded ligation to single-stranded cDNA), developed by Dumas et al., *Nucleic Acids Res.*, 19:5227-32 (1991). The major differences in procedure are that the RNA is alkaline hydrolyzed after reverse transcription and RNA ligase is used to join a restriction site-containing anchor primer to the first-strand cDNA. This obviates the necessity for the dA-tailing reaction which results in a polyT stretch that is difficult to sequence past.

[0071] An alternative to generating 5' or 3' cDNA from RNA is to use cDNA library double-stranded DNA. An asymmetric PCR-amplified antisense cDNA strand is synthesized with an antisense cDNA-specific primer and a plasmid-anchored primer. These primers are removed and a symmetric PCR reaction is performed with a nested cDNA-specific antisense primer and the plasmid-anchored primer.

RNA Ligase Protocol For Generating The 5' or 3' End Sequences To Obtain Full Length Genes

[0072] Once a gene of interest is identified, several methods are available for the identification of the 5' or 3' portions of the gene which may not be present in the original cDNA plasmid. These methods include, but are not limited to, filter probing, clone enrichment using specific probes and protocols similar and identical to 5' and 3' RACE. While the full length gene may be present in the library and can be identified by probing, a useful method for generating the 5' or 3' end is to use the existing sequence information from the original cDNA to generate the missing information. A method similar to 5' RACE is available for generating the missing 5' end of a desired full-length gene. (This method was published by Fromont-Racine et al., *Nucleic Acids Res.*, 21(7):1683-1684 (1993)). Briefly, a specific RNA oligonucleotide is ligated to the 5' ends of a population of RNA presumably containing full-length gene RNA transcript. A primer set

containing a primer specific to the ligated RNA oligonucleotide and a primer specific to a known sequence of the gene of interest, is used to PCR amplify the 5' portion of the desired full length gene which may then be sequenced and used to generate the full length gene. This method starts with total RNA isolated from the desired source, poly A RNA may be used but is not a prerequisite for this procedure. The RNA preparation may then be treated with phosphatase if necessary to eliminate 5' phosphate groups on degraded or damaged RNA, which may interfere with the later RNA ligase step. The phosphatase, if used, is then inactivated and the RNA is treated with tobacco acid pyrophosphatase in order to remove the cap structure present at the 5' ends of messenger RNAs. This reaction leaves a 5' phosphate group at the 5' end of the cap cleaved RNA which can then be ligated to an RNA oligonucleotide using T4 RNA ligase. This modified RNA preparation can then be used as a template for first strand cDNA synthesis using a gene specific oligonucleotide. The first strand synthesis reaction can then be used as a template for PCR amplification of the desired 5' end using a primer specific to the ligated RNA oligonucleotide and a primer specific to the known sequence of the cardiovascular system antigen of interest. The resultant product is then sequenced and analyzed to confirm that the 5' end sequence belongs to the relevant cardiovascular system antigen.

[0073] The present invention also relates to vectors or plasmids, which include such DNA sequences, as well as the use of the DNA sequences. The material deposited with the ATCC (deposited with the ATCC on October 5, 2000, and receiving ATCC designation numbers PTA 2574 and PTA 2575; deposited with the ATCC on January 5, 2001, having the depositor reference numbers TS-1, TS-2, AC-1, and AC-2; and/or as set forth, for example, in Table 1A, 6 and 7) is a mixture of cDNA clones derived from a variety of human tissue and cloned in either a plasmid vector or a phage vector, as shown, for example, in Table 7. These deposits are referred to as "the deposits" herein. The tissues from which some of the clones were derived are listed in Table 7, and the vector in which the corresponding cDNA is contained is also indicated in Table 7. The deposited material includes cDNA clones corresponding to SEQ ID NO:X described, for example, in Table 1A (Clone ID NO:Z). A clone which is isolatable from the ATCC Deposits by use of a sequence listed as SEQ ID NO:X, may include the

entire coding region of a human gene or in other cases such clone may include a substantial portion of the coding region of a human gene. Furthermore, although the sequence listing may in some instances list only a portion of the DNA sequence in a clone included in the ATCC Deposits, it is well within the ability of one skilled in the art to sequence the DNA included in a clone contained in the ATCC Deposits by use of a sequence (or portion thereof) described in, for example Tables 1A or 2 by procedures hereinafter further described, and others apparent to those skilled in the art.

- [0074] Also provided in Table 7 is the name of the vector which contains the cDNA clone. Each vector is routinely used in the art. The following additional information is provided for convenience.
- [0075] Vectors Lambda Zap (U.S. Patent Nos. 5,128,256 and 5,286,636), Uni-Zap XR (U.S. Patent Nos. 5,128,256 and 5,286,636), Zap Express (U.S. Patent Nos. 5,128,256 and 5,286,636), pBluescript (pBS) (Short, J. M. et al., *Nucleic Acids Res.* 16:7583-7600 (1988); Alting-Mees, M. A. and Short, J. M., *Nucleic Acids Res.* 17:9494 (1989)) and pBK (Alting-Mees, M. A. et al., *Strategies* 5:58-61 (1992)) are commercially available from Stratagene Cloning Systems, Inc., 11011 N. Torrey Pines Road, La Jolla, CA, 92037. pBS contains an ampicillin resistance gene and pBK contains a neomycin resistance gene. Phagemid pBS may be excised from the Lambda Zap and Uni-Zap XR vectors, and phagemid pBK may be excised from the Zap Express vector. Both phagemids may be transformed into *E. coli* strain XL-1 Blue, also available from Stratagene.
- [0076] Vectors pSport1, pCMVSPORT 1.0, pCMVSPORT 2.0 and pCMVSPORT 3.0, were obtained from Life Technologies, Inc., P. O. Box 6009, Gaithersburg, MD 20897. All Sport vectors contain an ampicillin resistance gene and may be transformed into *E. coli* strain DH10B, also available from Life Technologies. See, for instance, Gruber, C. E., et al., *Focus* 15:59- (1993). Vector lafmid BA (Bento Soares, Columbia University, New York, NY) contains an ampicillin resistance gene and can be transformed into *E. coli* strain XL-1 Blue. Vector pCR[®]2.1, which is available from Invitrogen, 1600 Faraday Avenue, Carlsbad, CA 92008, contains an ampicillin resistance gene and may be transformed into *E. coli* strain DH10B, available from Life Technologies. See, for instance, Clark, J. M., *Nuc. Acids Res.* 16:9677-9686 (1988) and Mead, D. et al., *Bio/Technology* 9: (1991).

- [0077] The present invention also relates to the genes corresponding to SEQ ID NO:X, SEQ ID NO:Y, and/or the deposited clone (Clone ID NO:Z). The corresponding gene can be isolated in accordance with known methods using the sequence information disclosed herein. Such methods include preparing probes or primers from the disclosed sequence and identifying or amplifying the corresponding gene from appropriate sources of genomic material.
- [0078] Also provided in the present invention are allelic variants, orthologs, and/or species homologs. Procedures known in the art can be used to obtain full-length genes, allelic variants, splice variants, full-length coding portions, orthologs, and/or species homologs of cardiovascular system associated genes corresponding to SEQ ID NO:X or the complement thereof, polypeptides encoded by SEQ ID NO:X or the complement thereof, and/or the cDNA contained in Clone ID NO:Z, using information from the sequences disclosed herein or the clones deposited with the ATCC. For example, allelic variants and/or species homologs may be isolated and identified by making suitable probes or primers from the sequences provided herein and screening a suitable nucleic acid source for allelic variants and/or the desired homologue.
- [0079] The polypeptides of the invention can be prepared in any suitable manner. Such polypeptides include isolated naturally occurring polypeptides, recombinantly produced polypeptides, synthetically produced polypeptides, or polypeptides produced by a combination of these methods. Means for preparing such polypeptides are well understood in the art.
- [0080] The polypeptides may be in the form of the secreted protein, including the mature form, or may be a part of a larger protein, such as a fusion protein (see below). It is often advantageous to include an additional amino acid sequence which contains secretory or leader sequences, pro-sequences, sequences which aid in purification, such as multiple histidine residues, or an additional sequence for stability during recombinant production.
- [0081] The polypeptides of the present invention are preferably provided in an isolated form, and preferably are substantially purified. A recombinantly produced version of a polypeptide, including the secreted polypeptide, can be substantially purified using techniques described herein or otherwise known in the art, such as, for example, by the one-step method described in Smith and Johnson,

Gene 67:31-40 (1988). Polypeptides of the invention also can be purified from natural, synthetic or recombinant sources using techniques described herein or otherwise known in the art, such as, for example, antibodies of the invention raised against the cardiovascular system polypeptides of the present invention in methods which are well known in the art.

[0082] The present invention provides a polynucleotide comprising, or alternatively consisting of, the nucleic acid sequence of SEQ ID NO:X, and/or the cDNA sequence contained in Clone ID NO:Z. The present invention also provides a polypeptide comprising, or alternatively, consisting of, the polypeptide sequence of SEQ ID NO:Y, a polypeptide encoded by SEQ ID NO:X or a complement thereof, a polypeptide encoded by the cDNA contained in Clone ID NO:Z, and/or the polypeptide sequence encoded by a nucleotide sequence in SEQ ID NO:B as defined in column 6 of Table 1B. Polynucleotides encoding a polypeptide comprising, or alternatively consisting of the polypeptide sequence of SEQ ID NO:Y, a polypeptide encoded by SEQ ID NO:X, a polypeptide encoded by the cDNA contained in Clone ID NO:Z and/or a polypeptide sequence encoded by a nucleotide sequence in SEQ ID NO:B as defined in column 6 of Table 1B are also encompassed by the invention. The present invention further encompasses a polynucleotide comprising, or alternatively consisting of, the complement of the nucleic acid sequence of SEQ ID NO:X, a nucleic acid sequence encoding a polypeptide encoded by the complement of the nucleic acid sequence of SEQ ID NO:X, and/or the cDNA contained in Clone ID NO:Z.

[0083] Moreover, representative examples of polynucleotides of the invention comprise, or alternatively consist of, one, two, three, four, five, six, seven, eight, nine, ten, or more of the sequences delineated in Table 1B column 6, or any combination thereof. Additional, representative examples of polynucleotides of the invention comprise, or alternatively consist of, one, two, three, four, five, six, seven, eight, nine, ten, or more of the complementary strand(s) of the sequences delineated in Table 1B column 6, or any combination thereof. In further embodiments, the above-described polynucleotides of the invention comprise, or alternatively consist of, sequences delineated in Table 1B, column 6, and have a nucleic acid sequence which is different from that of the BAC fragment having the sequence disclosed in SEQ ID NO:B (see Table 1B, column 5). In additional

embodiments, the above-described polynucleotides of the invention comprise, or alternatively consist of, sequences delineated in Table 1B, column 6, and have a nucleic acid sequence which is different from that published for the BAC clone identified as BAC ID NO:A (see Table 1B, column 4). In additional embodiments, the above-described polynucleotides of the invention comprise, or alternatively consist of, sequences delineated in Table 1B, column 6, and have a nucleic acid sequence which is different from that contained in the BAC clone identified as BAC ID NO:A (see Table 1B, column 4). Polypeptides encoded by these polynucleotides, other polynucleotides that encode these polypeptides, and antibodies that bind these polypeptides are also encompassed by the invention. Additionally, fragments and variants of the above-described polynucleotides and polypeptides are also encompassed by the invention.

[0084] Further, representative examples of polynucleotides of the invention comprise, or alternatively consist of, one, two, three, four, five, six, seven, eight, nine, ten, or more of the sequences delineated in column 6 of Table 1B which correspond to the same Clone ID NO:Z (see Table 1B, column 1), or any combination thereof. Additional, representative examples of polynucleotides of the invention comprise, or alternatively consist of, one, two, three, four, five, six, seven, eight, nine, ten, or more of the complementary strand(s) of the sequences delineated in column 6 of Table 1B which correspond to the same Clone ID NO:Z (see Table 1B, column 1), or any combination thereof. In further embodiments, the above-described polynucleotides of the invention comprise, or alternatively consist of, sequences delineated in column 6 of Table 1B which correspond to the same Clone ID NO:Z (see Table 1B, column 1) and have a nucleic acid sequence which is different from that of the BAC fragment having the sequence disclosed in SEQ ID NO:B (see Table 1B, column 5). In additional embodiments, the above-described polynucleotides of the invention comprise, or alternatively consist of, sequences delineated in column 6 of Table 1B which correspond to the same Clone ID NO:Z (see Table 1B, column 1) and have a nucleic acid sequence which is different from that published for the BAC clone identified as BAC ID NO:A (see Table 1B, column 4). In additional embodiments, the above-described polynucleotides of the invention comprise, or alternatively consist of, sequences delineated in column 6 of Table 1B which correspond to the same Clone ID NO:Z (see Table

1B, column 1) and have a nucleic acid sequence which is different from that contained in the BAC clone identified as BAC ID NO:A (see Table 1B, column 4). Polypeptides encoded by these polynucleotides, other polynucleotides that encode these polypeptides, and antibodies that bind these polypeptides are also encompassed by the invention. Additionally, fragments and variants of the above-described polynucleotides and polypeptides are also encompassed by the invention.

[0085] Further, representative examples of polynucleotides of the invention comprise, or alternatively consist of, one, two, three, four, five, six, seven, eight, nine, ten, or more of the sequences delineated in column 6 of Table 1B which correspond to the same contig sequence identifier SEQ ID NO:X (see Table 1B, column 2), or any combination thereof. Additional, representative examples of polynucleotides of the invention comprise, or alternatively consist of, one, two, three, four, five, six, seven, eight, nine, ten, or more of the complementary strand(s) of the sequences delineated in column 6 of Table 1B which correspond to the same contig sequence identifier SEQ ID NO:X (see Table 1B, column 2), or any combination thereof. In further embodiments, the above-described polynucleotides of the invention comprise, or alternatively consist of, sequences delineated in column 6 of Table 1B which correspond to the same contig sequence identifier SEQ ID NO:X (see Table 1B, column 2) and have a nucleic acid sequence which is different from that of the BAC fragment having the sequence disclosed in SEQ ID NO:B (see Table 1B, column 5). In additional embodiments, the above-described polynucleotides of the invention comprise, or alternatively consist of, sequences delineated in column 6 of Table 1B which correspond to the same contig sequence identifier SEQ ID NO:X (see Table 1B, column 2) and have a nucleic acid sequence which is different from that published for the BAC clone identified as BAC ID NO:A (see Table 1B, column 4). In additional embodiments, the above-described polynucleotides of the invention comprise, or alternatively consist of, sequences delineated in column 6 of Table 1B which correspond to the same contig sequence identifier SEQ ID NO:X (see Table 1B, column 2) and have a nucleic acid sequence which is different from that contained in the BAC clone identified as BAC ID NO:A (See Table 1B, column 4). Polypeptides encoded by these polynucleotides, other polynucleotides that encode

these polypeptides, and antibodies that bind these polypeptides are also encompassed by the invention. Additionally, fragments and variants of the above-described polynucleotides and polypeptides are also encompassed by the invention.

[0086] Moreover, representative examples of polynucleotides of the invention comprise, or alternatively consist of, one, two, three, four, five, six, seven, eight, nine, ten, or more of the sequences delineated in the same row of Table 1B column 6, or any combination thereof. Additional, representative examples of polynucleotides of the invention comprise, or alternatively consist of, one, two, three, four, five, six, seven, eight, nine, ten, or more of the complementary strand(s) of the sequences delineated in the same row of Table 1B column 6, or any combination thereof. In preferred embodiments, the polynucleotides of the invention comprise, or alternatively consist of, one, two, three, four, five, six, seven, eight, nine, ten, or more of the complementary strand(s) of the sequences delineated in the same row of Table 1B column 6, wherein sequentially delineated sequences in the table (i.e. corresponding to those exons located closest to each other) are directly contiguous in a 5' to 3' orientation. In further embodiments, above-described polynucleotides of the invention comprise, or alternatively consist of, sequences delineated in the same row of Table 1B, column 6, and have a nucleic acid sequence which is different from that of the BAC fragment having the sequence disclosed in SEQ ID NO:B (see Table 1B, column 5). In additional embodiments, the above-described polynucleotides of the invention comprise, or alternatively consist of, sequences delineated in the same row of Table 1B, column 6, and have a nucleic acid sequence which is different from that published for the BAC clone identified as BAC ID NO:A (see Table 1B, column 4). In additional embodiments, the above-described polynucleotides of the invention comprise, or alternatively consist of, sequences delineated in the same row of Table 1B, column 6, and have a nucleic acid sequence which is different from that contained in the BAC clone identified as BAC ID NO:A (see Table 1B, column 4). Polypeptides encoded by these polynucleotides, other polynucleotides that encode these polypeptides, and antibodies that bind these polypeptides are also encompassed by the invention.

[0087] In additional specific embodiments, polynucleotides of the invention comprise, or alternatively consist of, one, two, three, four, five, six, seven, eight, nine, ten, or more of the sequences delineated in column 6 of Table 1B, and the polynucleotide sequence of SEQ ID NO:X (e.g., as defined in Table 1B, column 2) or fragments or variants thereof. Polypeptides encoded by these polynucleotides, other polynucleotides that encode these polypeptides, and antibodies that bind these polypeptides are also encompassed by the invention.

[0088] In additional specific embodiments, polynucleotides of the invention comprise, or alternatively consist of, one, two, three, four, five, six, seven, eight, nine, ten, or more of the sequences delineated in column 6 of Table 1B which correspond to the same Clone ID NO:Z (see Table 1B, column 1), and the polynucleotide sequence of SEQ ID NO:X (e.g., as defined in Table 1A or 1B) or fragments or variants thereof. In preferred embodiments, the delineated sequence(s) and polynucleotide sequence of SEQ ID NO:X correspond to the same Clone ID NO:Z. Polypeptides encoded by these polynucleotides, other polynucleotides that encode these polypeptides, and antibodies that bind these polypeptides are also encompassed by the invention.

[0089] In further specific embodiments, polynucleotides of the invention comprise, or alternatively consist of, one, two, three, four, five, six, seven, eight, nine, ten, or more of the sequences delineated in the same row of column 6 of Table 1B, and the polynucleotide sequence of SEQ ID NO:X (e.g., as defined in Table 1A or 1B) or fragments or variants thereof. In preferred embodiments, the delineated sequence(s) and polynucleotide sequence of SEQ ID NO:X correspond to the same row of column 6 of Table 1B. Polypeptides encoded by these polynucleotides, other polynucleotides that encode these polypeptides, and antibodies that bind these polypeptides are also encompassed by the invention.

[0090] In additional specific embodiments, polynucleotides of the invention comprise, or alternatively consist of a polynucleotide sequence in which the 3' 10 polynucleotides of one of the sequences delineated in column 6 of Table 1B and the 5' 10 polynucleotides of the sequence of SEQ ID NO:X are directly contiguous. Nucleic acids which hybridize to the complement of these 20 contiguous polynucleotides under stringent hybridization conditions or alternatively, under lower stringency conditions, are also encompassed by the

invention. Polypeptides encoded by these polynucleotides and/or nucleic acids, other polynucleotides and/or nucleic acids that encode these polypeptides, and antibodies that bind these polypeptides are also encompassed by the invention. Additionally, fragments and variants of the above-described polynucleotides, nucleic acids, and polypeptides are also encompassed by the invention.

[0091] In additional specific embodiments, polynucleotides of the invention comprise, or alternatively consist of, a polynucleotide sequence in which the 3' 10 polynucleotides of one of the sequences delineated in column 6 of Table 1B and the 5' 10 polynucleotides of a fragment or variant of the sequence of SEQ ID NO:X are directly contiguous. Nucleic acids which hybridize to the complement of these 20 contiguous polynucleotides under stringent hybridization conditions or alternatively, under lower stringency conditions, are also encompassed by the invention. Polypeptides encoded by these polynucleotides and/or nucleic acids, other polynucleotides and/or nucleic acids encoding these polypeptides, and antibodies that bind these polypeptides are also encompassed by the invention. Additionally, fragments and variants of the above-described polynucleotides, nucleic acids, and polypeptides are also encompassed by the invention.

[0092] In specific embodiments, polynucleotides of the invention comprise, or alternatively consist of, a polynucleotide sequence in which the 3' 10 polynucleotides of the sequence of SEQ ID NO:X and the 5' 10 polynucleotides of the sequence of one of the sequences delineated in column 6 of Table 1B are directly contiguous. Nucleic acids which hybridize to the complement of these 20 contiguous polynucleotides under stringent hybridization conditions or alternatively, under lower stringency conditions, are also encompassed by the invention. Polypeptides encoded by these polynucleotides and/or nucleic acids, other polynucleotides and/or nucleic acids encoding these polypeptides, and antibodies that bind these polypeptides are also encompassed by the invention. Additionally, fragments and variants of the above-described polynucleotides, nucleic acids, and polypeptides are also encompassed by the invention.

[0093] In specific embodiments, polynucleotides of the invention comprise, or alternatively consist of, a polynucleotide sequence in which the 3' 10 polynucleotides of a fragment or variant of the sequence of SEQ ID NO:X and the 5' 10 polynucleotides of the sequence of one of the sequences delineated in

column 6 of Table 1B are directly contiguous. Nucleic acids which hybridize to the complement of these 20 contiguous polynucleotides under stringent hybridization conditions or alternatively, under lower stringency conditions, are also encompassed by the invention. Polypeptides encoded by these polynucleotides and/or nucleic acids, other polynucleotides and/or nucleic acids encoding these polypeptides, and antibodies that bind these polypeptides are also encompassed by the invention. Additionally, fragments and variants of the above-described polynucleotides, nucleic acids, and polypeptides, are also encompassed by the invention.

[0094] In further specific embodiments, polynucleotides of the invention comprise, or alternatively consist of, a polynucleotide sequence in which the 3' 10 polynucleotides of one of the sequences delineated in column 6 of Table 1B and the 5' 10 polynucleotides of another sequence in column 6 are directly contiguous. Nucleic acids which hybridize to the complement of these 20 contiguous polynucleotides under stringent hybridization conditions or alternatively, under lower stringency conditions, are also encompassed by the invention. Polypeptides encoded by these polynucleotides and/or nucleic acids, other polynucleotides and/or nucleic acids encoding these polypeptides, and antibodies that bind these polypeptides are also encompassed by the invention. Additionally, fragments and variants of the above-described polynucleotides, nucleic acids, and polypeptides are also encompassed by the invention.

[0095] In specific embodiments, polynucleotides of the invention comprise, or alternatively consist of, a polynucleotide sequence in which the 3' 10 polynucleotides of one of the sequences delineated in column 6 of Table 1B and the 5' 10 polynucleotides of another sequence in column 6 corresponding to the same Clone ID NO:Z (see Table 1B, column 1) are directly contiguous. Nucleic acids which hybridize to the complement of these 20 lower stringency conditions, are also encompassed by the invention. Polypeptides encoded by these polynucleotides and/or nucleic acids, other polynucleotides and/or nucleic acids encoding these polypeptides, and antibodies that bind these polypeptides are also encompassed by the invention. Additionally, fragments and variants of the above-described polynucleotides, nucleic acids, and polypeptides are also encompassed by the invention.

- [0096] In specific embodiments, polynucleotides of the invention comprise, or alternatively consist of, a polynucleotide sequence in which the 3' 10 polynucleotides of one sequence in column 6 corresponding to the same contig sequence identifier SEQ ID NO:X (see Table 1B, column 2) are directly contiguous. Nucleic acids which hybridize to the complement of these 20 contiguous polynucleotides under stringent hybridization conditions or alternatively, under lower stringency conditions, are also encompassed by the invention. Polypeptides encoded by these polynucleotides and/or nucleic acids, other polynucleotides and/or nucleic acids encoding these polypeptides, and antibodies that bind these polypeptides are also encompassed by the invention. Additionally, fragments and variants of the above-described polynucleotides, nucleic acids, and polypeptides are also encompassed by the invention.
- [0097] In specific embodiments, polynucleotides of the invention comprise, or alternatively consist of a polynucleotide sequence in which the 3' 10 polynucleotides of one of the sequences delineated in column 6 of Table 1B and the 5' 10 polynucleotides of another sequence in column 6 corresponding to the same row are directly contiguous. In preferred embodiments, the 3' 10 polynucleotides of one of the sequences delineated in column 6 of Table 1B is directly contiguous with the 5' 10 polynucleotides of the next sequential exon delineated in Table 1B, column 6. Nucleic acids which hybridize to the complement of these 20 contiguous polynucleotides under stringent hybridization conditions or alternatively, under lower stringency conditions, are also encompassed by the invention. Polypeptides encoded by these polynucleotides and/or nucleic acids, other polynucleotides and/or nucleic acids encoding these polypeptides, and antibodies that bind these polypeptides are also encompassed by the invention. Additionally, fragments and variants of the above-described polynucleotides, nucleic acids, and polypeptides are also encompassed by the invention.
- [0098] Many polynucleotide sequences, such as EST sequences, are publicly available and accessible through sequence databases and may have been publicly available prior to conception of the present invention. Preferably, such related polynucleotides are specifically excluded from the scope of the present invention. Accordingly, for each contig sequence (SEQ ID NO:X) listed in the third column

of Table 1A, preferably excluded are one or more polynucleotides comprising a nucleotide sequence described by the general formula of a-b, where a is any integer between 1 and the final nucleotide minus 15 of SEQ ID NO:X, b is an integer of 15 to the final nucleotide of SEQ ID NO:X, where both a and b correspond to the positions of nucleotide residues shown in SEQ ID NO:X, and where b is greater than or equal to a + 14. More specifically, preferably excluded are one or more polynucleotides comprising a nucleotide sequence described by the general formula of a-b, where a and b are integers as defined in columns 4 and 5, respectively, of Table 3. In specific embodiments, the polynucleotides of the invention do not consist of at least one, two, three, four, five, ten, or more of the specific polynucleotide sequences referenced by the Genbank Accession No. as disclosed in column 6 of Table 3 (including for example, published sequence in connection with a particular BAC clone). In further embodiments, preferably excluded from the invention are the specific polynucleotide sequence(s) contained in the clones corresponding to at least one, two, three, four, five, ten, or more of the available material having the accession numbers identified in the sixth column of this Table (including for example, the actual sequence contained in an identified BAC clone). In no way is this listing meant to encompass all of the sequences which may be excluded by the general formula, it is just a representative example. All references available through these accessions are hereby incorporated by reference in their entirety.

TABLE 3

Clone ID NO: Z	SEQ ID NO: X	Contig ID:	EST Disclaimer Range of a Range of b	Accession #'s
HAHCL07	11	952661	1 - 1252 15 - 1266	AI472849, AA452197, AA216015, F16124, AA249665, AA211338, R15601, AA249623, AA404417, T82709, AA039429, AI800785, AI572463, and AA780204.
HAHCP26	12	681258	1 - 389 15 - 403	AC001234, and AF060568.
HAHCP41	13	712086	1 - 226 15 - 240	
HAHCP49	14	722659	1 - 242 15 - 256	
HAHCP55	15	865095	1 - 290 15 - 304	AF176915.
HAHCP67	16	756916	1 - 250 15 - 264	AW246326, T66078, T08451, AW068827, T35903, T66082, F12335, AA100537, W76237, R19223, F08087, Z43540, AA298126, F12331, W06986, AA298141, W07263, R47805, AC006252, Y17169, and AL136773.
HAHCP91	17	789998	1 - 274 15 - 288	AC005833.
HAHCR57	18	865096	1 - 474 15 - 488	T60981.
HAHEE04	19	922257	1 - 332 15 - 346	
HAHEE05	20	928673	1 - 408 15 - 422	AA453887, AI939557, T95411, AI369869, AW295606, AC005531, AF170301, AF170302, AF077659, and AF144573.
HAHEO46	21	718772	1 - 212 15 - 226	
HAHES10	22	961594	1 - 317 15 - 331	
HAHFX20	23	925753	1 - 125 15 - 139	
HAHHE12	24	969107	1 - 792 15 - 806	AA193162, Z24810, AA196396, AA194446, D58283, D80043, D80022, D80195, D59859, C14331, D80166, D80212, D80193, D59927, D51423, D59619, D80210, D51799, D80391, D80164, D59275, D80240, D80253, D59787, D80227, D81030, D59502, D80188, D80196, D80219, D57483, D80269, D80038, D80366, D50979, D59889, C14429, D50995, D59467, D59610, AW178893, D80378, D80024, C15076, D80045, AA305409, T03269, D80241, C14389, C75259, D51060, C14014, AA305578, AW352158, AW177440, D51022, AW179328, D80522, D80248, AW178775, D81026, AW378532, D51250, D80134, AA514188, AW360811, D80251, F13647, AW360834, AA514186, D80133, AW177501, AW177511, AW375405, D80168, C05695, AW178762, AW377671, Z19200, D58253, AI910186, D80268, AW176467, AW360817, AW366296, D80247, C14227, AW360844, D80132, AW375406, AW378534, D52291, AW179332, AW377672, AW179023, AW178905, D80439, D81111, AI905856, AW352170, AW352117, AW378540, D80302, C14407, AW352171, AW177505, AW377676, AW178906, AW177731, AW178907, AW378528, AW179019, AW179024, C14298.

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HAH004	25	925814	1 - 299	15 - 313	AL133572.
HAH001	26	913863	1 - 167	15 - 181	
HAH010	27	961425	1 - 158	15 - 172	
HAH008	28	955803	1 - 364	15 - 378	AW291127.
HAH042	29	695111	1 - 449	15 - 463	Z18875, and AA311441.
HCMBA95	30	508774	1 - 332	15 - 346	
HCMSC52	31	522615	1 - 110	15 - 124	
HCMSE09	32	530511	1 - 356	15 - 370	AC006368.
HCMQ77	33	862373	1 - 297	15 - 311	AC006463.
HCMSS72	34	526183	1 - 161	15 - 175	
HCMU37	35	706337	1 - 482	15 - 496	AI808918, AW339979, F29562, Z24811, F24581, and AC006333.
HCMX59	36	522598	1 - 362	15 - 376	
HELAF85	37	507230	1 - 309	15 - 323	
HELAI26	38	920922	1 - 203	15 - 217	
HELAL34	39	527994	1 - 196	15 - 210	
HELAV61	40	507205	1 - 327	15 - 341	
HELBD08	41	960106	1 - 221	15 - 235	

HELBD70	42	527677	1 - 223	15 - 237	
HELBK27	43	527669	1 - 280	15 - 294	
HELBN45	44	527666	1 - 244	15 - 258	AL031295.
HELBP62	45	527533	1 - 321	15 - 335	Z64392, and Z64391.
HELDG77	46	750478	1 - 209	15 - 223	
HELDK12	47	766209	1 - 219	15 - 233	
HELDO56	48	531576	1 - 250	15 - 264	
HELEA45	49	954371	1 - 157	15 - 171	
HELEE09	50	531415	1 - 298	15 - 312	
HELEF52	51	506677	1 - 300	15 - 314	
HELEQ47	52	577187	1 - 402	15 - 416	
HELER30	53	574038	1 - 277	15 - 291	AC006057.
HELEU12	54	574023	1 - 703	15 - 717	AA004637, T79961, AC005324, and AL080124.
HELEU37	55	522407	1 - 182	15 - 196	AA368196, AC005247, and AC007971.
HELEU73	56	574016	1 - 391	15 - 405	
HELEU91	57	851160	1 - 323	15 - 337	
HELEW62	58	574025	1 - 292	15 - 306	
HELFF40	59	574058	1 - 188	15 - 202	AC000119.
HELFFH33	60	576530	1 - 240	15 - 254	E02347.
HELFFJ03	61	921943	1 - 419	15 - 433	
HELFFQ54	62	728888	1 - 489	15 - 503	AF179680, and AL022162.
HELFFQ79	63	577248	1 - 359	15 - 373	
HELGA54	64	576374	1 - 426	15 - 440	
HELGC24	65	576377	1 - 369	15 - 383	
HELGC32	66	699375	1 - 317	15 - 331	
HELGC77	67	577317	1 - 230	15 - 244	W26021, and W27138.
HELGG77	68	825795	1 - 917	15 - 931	AI865213, AA857296, AI433247, AA501614, AI859834, AL037910, AW337454, AL045077, AI049996, AI471815, AA577748, AI769271, AI445815, AL047858, AI623899, AI215778, AI890348, R92640, F17700, H29951, F32171, H23467, AI343143, N39097, AA342681, R83097, AI246080, AI151261, AA663966, AI053786, AI754013, AA557486, AA484143, AA297968, AI569982, AL046782, AA652813, AW103415, AI755236, AI754923, AA219098, AA457685, AI287964, AI753951, AI282661, H05073, AI538540, AW079809, AI431240, AI469796, AA491955, AI979005, AW407578, AI222678, AI687750, H57826, AI216054, AI270476, AI696901, AW088049, AW192330, AI382614, AW152303, AI733856, AI754291, AA021552, AI865988, AI609972, AI623563, AA716755, AL110405, AW272758, U85195, AE000658, AC004067, AC006241, AL121657, AC005832, AC007845, AC006318, AC004590, AC007298, AL049759, AC004253, AC002347, AC004019, AC012599, AC002544, AL049766.

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HELGH89	69	545009	1 - 635	15 - 649	
HELGN53	70	963160	1 - 356	15 - 370	
HELGP50	71	576339	1 - 351	15 - 365	
HELQQ48	72	851178	1 - 332	15 - 346	Z86061.
HELGT48	73	879483	1 - 635	15 - 649	
HELGZ48	74	721742	1 - 394	15 - 408	
HELHB12	75	970863	1 - 392	15 - 406	AI307709, and AL020997.
HELHC49	76	576292	1 - 368	15 - 382	
HELHD46	77	719129	1 - 266	15 - 280	AB020722.
HELHF07	78	949067	1 - 327	15 - 341	

HELM29	79	883505	1 - 299	15 - 313	
HEMBC56	80	577797	1 - 404	15 - 418	
HEMB116	81	507220	1 - 207	15 - 221	
HEMBZ84	82	527989	1 - 216	15 - 230	
HEMCA89	83	527985	1 - 243	15 - 257	
HEMCM25	84	948738	1 - 483	15 - 497	
HEMDG56	85	715834	1 - 211	15 - 225	AL022311.
HEMDG83	86	576508	1 - 598	15 - 612	AI971563, AW236461, R66941, and AI867853.
HEMDK92	87	574278	1 - 291	15 - 305	H62575, and N31620.
HEMDM56	88	577251	1 - 280	15 - 294	
HEMDO24	89	577297	1 - 378	15 - 392	
HEMEA72	90	527804	1 - 297	15 - 311	
HEMEH76	91	574345	1 - 404	15 - 418	AA329192, AW074398, AI830390, AA319218, AI061334, R91994, N71557, H16048, AA659083, N71724, AA558697, AA457639, AI216799, AA405288, H13868, AI679379, AI679888, AI867386, AA523490, AW008062, AI537185, AA378580, AI887768, AW271917, AF150222, AA291631, W38648, AI246409, AA399172, AA366035, AA394147, AL037554, F31204, AA515128, AA077935, AA584749, AA557879, AL046409, AI350211, AI581068, AA077952, AW261871, AA077817, AI688846, AI613280, AW405016, AI474085, AA385100, AI963720, AA776236, AA332991, AI879000, AW089789, AI608674, AI301218, AI205181, AA378886, AA310158, AA661573, AA569187, H54443, AA079421, AA532877, AA580662, AA503258, AW303876, H55779, F37286, AW419262, AA743956, AW193432, AI431303, AI286264, AI653886, AW029574, AI284640, AI471481, AI872216, AA516207, AL119259, AA100884, AW274349, AI244758, AW193265, AW303196, AW301350, AA569202, AA225155, AI282907, F36273, AA984191, AA745410, AA494087, AI806850, AW276827, AA179136, AI341664, AA362440, AW273469, AI678392, AW407007, AA353408, AI287528, AI820539, R63003, AI305766, AA112864, AW157173, AW162314, AL040913, AI110770, AW162332, AI284467, AI890348, AA508882, AI015912, AI821387, AA508103, AI721122, AW338869, AW402864, AA713815, AW419118, AI669443, W04195, AW264973, AA377767, AL041412, AI610159, AA347040, AA501617, AA344959, AA327323, AI914706, AA297776, AI624024, AC008064, Z83849, Z77894, AL049766, AF196971, AC007750, AC005815, AC000134, AC005200, Z82205, Z69666, X52851, AC007065, AC006511, AC003037, AL008629, AC006042, AC002564, AL031588, AC007773, L13713, L13714, AC007206, AL031965, AL035587, AL022316, AC005040, AC007458, AF015152, AC000100, AL023807, Z82244, AC005414, Z93241, Z93020, AL008723, AC002451, AC006213, AC002094, AC006031, AC008372, AL022397, AC002347, AC003080, AC006043, AC000048, AC005600, AL021579, Z82210, AC006057, AC005399, AC005102, AF001298, AC004643, Z98051, AC004771, AC003982, AL132712, U80017, I51997, AC004193, AC005002, Z99289, AF002223, AL080239, AF055066, U67211, AC007238, AL035668, AP000328, Z83001, AC006128, AC004088, AP00055, AP000170, AP000123, AL080276, AL023803, AC010202, AC005215, AL033521, Z98257,

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HEMEK19	92	574209	1 - 297	15 - 311	
HEMEN63	93	578717	1 - 307	15 - 321	
HEMEU54	94	947801	1 - 438	15 - 452	X97818.
HEMFL58	95	576505	1 - 338	15 - 352	
HEMFn33	96	702564	1 - 322	15 - 336	
HEMFX20	97	840164	1 - 186	15 - 200	
HEMGL57	98	971118	1 - 302	15 - 316	AL049569.
HEMGL58	99	578091	1 - 440	15 - 454	R73040, AA005251, AA005165, and AF176815.
HHBBA47	100	720472	1 - 400	15 - 414	AW392670, U46347, AW384394, AW363220, AL043003, AL119484, AL119497, AL119439, AL119443, AW372827, AL119457, AL119319, AL119396, Z99396, AL119324, U46341, AL134528, AL119363, AL119341, AL119391, AL119355, U46350, U46351, U46349, AL119444, AL119483, U46346, AL119335, AL134533, AL119399, AL119522, AL119496, U46345, AL134531, AL042614, AL134132, AL134527, AL134538, AL119418, AL043147, AL042450, AL042965, AL042975, AL042542, AL042544, AL042970, AL043019, AL042984, AL043029, AI142134, AL119511, AL042551, AL119488, AL119464, AB026436, AR054110, A81671, AR060234, AR066494, and AR069079.
HHBBI11	101	959756	1 - 401	15 - 415	AI920923, AW016123, AI694192, AW085200, AA789137, AA563721, AI079897, R51594, AA831766, AA782525, AW169957, AW339110, AI190317, AI910943, AA917419, AA512984, AA775828, AI393486, AA913674, AI374931, AA716669, AI813594, N93954, AI272716, AI189330, AI827728, AA481275, AI568483, AI340006, AA857984, AI241121, AA129733, AI969188, AI862837, AI803017, AA284394, AW068473, AA701544, AI096997, AW103900, AA570016, AA028141, AI249182, AA991848, AI470495, AI354796, AI743676, T40513, AL041504, N78775, AA865611, AA101174,

					AI419551, AA133347, AA766811, AA806671, H52242, AL044039, R41974, AA027302, AI696783, AA058759, AA688050, AL041503, Z40289, AI915796, AA747265, D20480, AA937783, AA089759, AW237240, AA287007, and AB007930.
HHBK65	102	588062	1 - 411	15 - 425	R36520.
HHBL40	103	588066	1 - 541	15 - 555	AA526287, AI417476, AI473759, and AA604308.
HHBL53	104	588067	1 - 406	15 - 420	
HHBEA32	105	927399	1 - 286	15 - 300	
HHBEE70	106	697541	1 - 492	15 - 506	
HHBEM70	107	756949	1 - 229	15 - 243	AL119457, AL042544, AL119399, AL042382, AL079794, AL042440, AL119511, AL037081, AL119324, AL043152, AI110828, AW235489, AW082113, AI280670, AI064830, AI610362, AI352497, AW149925, AA809129, AL079741, AI886753, AI269862, AI364788, AL134999, AW151136, AL121270, AL047187, AI500061, AL043168, AI345111, AI491897, AW170674, AI624543, AL119863, AW117746, AI349598, AL041150, AW269097, AI933589, AI445992, AI922365, AL045500, AI824576, AI309443, AW087445, AI345416, AI345612, AW163834, AI345415, AL046931, AL121328, AW268302, AW026882, AI610307, AI567935, AW163464, AI620284, AI281772, AI445990, AA715307, AW051258, AI921248, AI611738, AI571909, AI619502, AI680162, AI632408, AI306613, AI677796, AI802542, AI433976, AI620089, AA449768, AI288305, AW118518, AI570807, AI635067, AI923370, AI627988, AL110402, AL047387, AI679174, AW168650, AI537677, AI670009, AI866770, AL047675, AI433157, AI702073, AI909696, AI554821, AW117882, AI284131, AI927755, AI174394, AW172745, N33175, AI539771, AL079960, AI582932, AI500659, AI633125, AI805769, AI698391, AI815232, AI801325, AI500523, AI915291, AL042628, AW071177, AI284517, AI923989, AI500706, AI491776, AI445237, AW151138, AA580663, AI521560, AI889189, AI500662, AI284509, N80094, AI889168, AI866573, AI633493, AL048323, AI434256, AW302973, AI289937, AI537244, AW268060, AW072719, AI888661, AI284513, AI888118, AI344785, AI889147, AL037454, AI440252, AW302965, AW072484, AI702019, AI634251, AI569309, AI433037, AI280732, AW071362, AW301300, AI348917, AI343037, AI499285, AW088134, AL120300, AL048340, F27788, AI446373, AI864836, AL043981, AI569328, AI307543, AI874166, AI307210, AI669526, AI340659, AI288285, AI801460, AI345005, AI311892, AI307736, AI783504, AL039276, AI349266, AI273048, AL119791, AL040241, AL045163, AI281762, AI494201, AI686554, AL042745, AI949960, AL079977, AI886123, AI524671, AL040243, AW050522, AI917252, AW083804, AI345471, AW149221, AL041862, AI673297, AI274508, AL039783, AL046926, AL045266, W74529, AI439745, AI922901, AI963846, AL042627, AL049085, AW198075, AL048334, AI872711, AI587606, AI468872, AI932794, AW081255, AI886181, AI690426, AI862142, AI873644, AI802826, AI445432, AL037582, AL037602, AL041772, AL036214, AL079963, AI345608, AW169658, AI559737, AW410972, AL037030, AI310575, AL039132, AI889376, AL047763, AI335363, AI538716, AW074993, AI591420, AI362580, AI499986, AI560023, R32821, AI432218, AW051088, AL038504, AI308032, AI537515, AI934011, AL045620, AI308035, AI349276, AI281782, AI564719, AI866510, AI909642, Y11587, U77594, AC004987, I89947, AL122049, I48978,

					AL133640, AC004686, AL080159, A08913, AL133072, AF090934, Y14314, AL133077, A08916, A08910, A08909, S68736, AL050138, AL137271, Z82022, AL050277, I48979, X82434, I89931, AL110280, I49625, A77033, A77035, AF087943, AF183393, AL122110, AL133080, AF091084, I09360, AL080060, U35846, AF026816, I33392, AL050149, AL133016, U80742, AL122121, E07361, AL117460, AL110221, AF090903, AL117435, AJ012755, AL049283, AF118070, AL137550, AF017152, AF146568, AL137463, AF113019, X84990, AF090900, AL133560, AF111112, E03348, AF113689, AR059958, AL133075, AL133565, AL049466, A65341, AJ000937, AR000496, U39656, AL117583, A08912, AL117585, AL133113, X93495, AL122123, X72889, AC004594, AL049300, AL049452, AL110197, A93350, AL117457, AR038854, AL096744, U91329, AF003737, AL049938, AL137557, AF106862, AF113677, U67958, E02349, AF079763, AL137538, E07108, AF113676, AF158248, AF185576, A03736, I26207, AF118094, AF067728, AL050024, AL049430, AF113699, AL133557, AF125948, A45787, AF177401, S78214, AF090901, AL050393, AR011880, AL080124, AF113690, AF118064, AL133093, AL122050, AL137560, AL137459, AJ238278, AL122098, U00763, AL080127, L31396, AL133014, AL080137, AL137527, AF079765, L31397, X63574, U72620, A58524, A58523, A93016, AL049382, I42402, AL050172, AF162270, AL050116, A12297, AF057300, AF057299, AF061943, AF119337, AL137556, I03321, AF113691, AF104032, AF017437, E15569, AF113013, AL049464, AF078844, Y16645, AF097996, Y11254, AL110196, AF111851, AF026124, AL050108, AF090896, AL122093, X65873, U42766, AL137521, X96540, AB019565, AF113694, AF090943, X70685, AL049314, AL137648, AJ242859, AF125949, AL050146, AL110225, AL117394, AL133606, AL137476, E08263, E08264, L30117, AL137533, AL137480, AF061795, AF151685, AL117440, AL133104, AL133067, L19437, S61953, AL137526, AF132676, AF061836, AF111849, AL137523, U96683, A07647, AR038969, X87582, E04233, E02221, AF153205, X98834, AL133098, Z37987, AL133568, AL034417, AC004383, AR013797, AF081195, AL137283, AL080074, E05822, AL137478, Z72491, AC002464, Y09972, AL023657, I00734, M30514, E00617, E00717, E00778, AF061981, U78525, AL117432, U58996, AF061573, AF081197, AL034400, AL137294, AF095901, A18777, A90832, and E08631.
HHBEN34	108	703745	1 - 368	15 - 382	
HHBFL31	109	800035	1 - 209	15 - 223	AC007967.
HHBFW44	110	716283	1 - 144	15 - 158	
HHBFW75	111	958692	1 - 437	15 - 451	
HHBGN42	112	698774	1 - 227	15 - 241	AL119319, AL119522, AW392670, AL042551, AL119439, AL119484, AL119391, AL119401, U46350, AW372827, AL119457, U46347, U46351, AL119324, AL119418, AI142139, U46346, U46349, AL042614, AW363220, AI142137, AW384394, AL119363, AL119444, AL119443, Z99396, AL119497, AL119355, AL119483, AL043019, AL134524, AL037205, AL134525, AL119335, U46341, AL119399, AL119396, AL134518, AL134528, AL134538, AL042544, AL042542, AL119496, U46345, AL042450, AL042896, AL042984, AL042965, AL042975, AL043029, AL043003, AL119464, AB026436, AR069079, AR060234, AR066494, AR043113, A81671, and AR054110.

HHBGN52	113	726391	1 - 266	15 - 280	AC007377.
HHBGN68	114	752745	1 - 41	15 - 55	
HHBGR37	115	708457	1 - 294	15 - 308	
HHBGT39	116	940578	1 - 54	15 - 68	
HHBGY59	117	792027	1 - 538	15 - 552	
HHBHE83	118	780875	1 - 62	15 - 76	
HHBHK08	119	958649	1 - 287	15 - 301	AL031984.
HHBHK84	120	858431	1 - 336	15 - 350	AL031719.
HHBHO63	121	906947	1 - 296	15 - 310	
HHBHP27	122	676601	1 - 433	15 - 447	Y16241, and AF047368.
HHFBD39	123	826307	1 - 219	15 - 233	AA346547, and AA346371.
HHFBD50	124	724763	1 - 287	15 - 301	AA346559, AA428211, H56371, H56372, C16964, and AC007193.
HHFBF32	125	502872	1 - 395	15 - 409	
HHFBH26	126	502843	1 - 256	15 - 270	AA047753, AA236652, and AA234860.
HHFBI05	127	932961	1 - 355	15 - 369	
HHFBJ81	128	502954	1 - 344	15 - 358	AA347517.
HHFBL16	129	509237	1 - 387	15 - 401	Z62184, and Z62183.
HHFBL30	130	509238	1 - 341	15 - 355	
HHFBL32	131	509233	1 - 291	15 - 305	AP000687, and AP000688.
HHFBL36	132	707930	1 - 300	15 - 314	AI285706.
HHFBL39	133	509637	1 - 226	15 - 240	AC005343, and AL137658.
HHFBL60	134	739670	1 - 353	15 - 367	AA421695.
HHFBP60	135	503453	1 - 307	15 - 321	AA347874, AA346832, and AC002126.
HHFBX77	136	959805	1 - 411	15 - 425	AB023161.
HHFCA64	137	720849	1 - 312	15 - 326	AA347017, AA902341, AI356882, AA346959, and AC004948.
HHFCF70	138	518435	1 - 407	15 - 421	AA347521, and AA347377.
HHFCH59	139	526389	1 - 337	15 - 351	AA347433.
HHFCI73	140	518427	1 - 198	15 - 212	AA347520, and AA347376.
HHFCK71	141	781725	1 - 227	15 - 241	AA347681, and AC005829.
HHFCL91	142	509628	1 - 340	15 - 354	AA132492.
HHFCP67	143	536062	1 - 281	15 - 295	AA347928, and AA347923.
HHFCZ01	144	509163	1 - 305	15 - 319	AA347978.
HHFDA67	145	509387	1 - 286	15 - 300	
HHFDG32	146	502957	1 - 312	15 - 326	AA347334.
HHFDH02	147	921297	1 - 377	15 - 391	
HHFDH38	148	536551	1 - 338	15 - 352	AA055018, AA346973, H71821, Z80771, AL008626, Z95331, AL031177, Z69923, AC002467,

						AC007161, AP000078, AL133233, AC004222, AL049767, AC004526, AC003976, Z95124, Z82210, AC005036, AL031229, AC004614, AL031119, AP000472, AC006052, AL121871, AJ006995, AC007372, AL049837, AC005261, AC007423, and AC005181.
HHFDI07	149	954404	1 - 288	15 - 302		
HHFDI42	150	500877	1 - 326	15 - 340		AA347955.
HHFDI62	151	745569	1 - 378	15 - 392		AL033527.
HHFDI66	152	573283	1 - 387	15 - 401		
HHFDJ27	153	534909	1 - 427	15 - 441		
HHFDJ87	154	575105	1 - 338	15 - 352		
HHFDM05	155	932863	1 - 414	15 - 428		AL037595, AA347423, and AA632734.
HHFEJ18	156	525616	1 - 246	15 - 260		AC006453.
HHFEO24	157	525611	1 - 295	15 - 309		
HHFES51	158	525609	1 - 167	15 - 181		Z72519, and AF001905.
HHFFG41	159	575009	1 - 188	15 - 202		
HHFFO64	160	523769	1 - 316	15 - 330		AI242160, AI247651, AA775915, and AW393719.
HHFFO66	161	500910	1 - 204	15 - 218		AA347624, AA347709, and I45588.
HHFFO96	162	894076	1 - 172	15 - 186		
HHFFT69	163	662462	1 - 991	15 - 1005		AA127759, AA121515, AI984304, AI983026, AI360098, AI239945, AA961058, AA058699, and AB007972.
						AL133312.
HHFFX20	164	525617	1 - 104	15 - 118		Z93024.
HHFFX75	165	507394	1 - 248	15 - 262		
HHFFY80	166	732614	1 - 386	15 - 400		AA558357, and AA558032.
HHFFZ04	167	927869	1 - 531	15 - 545		AI091840, AI275088, AI088323, AA347574, AL132641, and AB007865.
HHFFZ19	168	509630	1 - 453	15 - 467		
HHFGA21	169	573584	1 - 343	15 - 357		AA501872, U91322, AC005387, AC004531, AC005253, AC005914, AC005004, AL035659, AL133245, AC005971, AC006285, AC007225, AL022163, AC002563, AL031685, AL049830, AP000359, AC005086, AC006006, AC007444, AC002094, AC004583, AC005409, AL049760, AC006064, AC006449, AL022721, AC010072, AC005520, AL031228, AL031729, AL035078, AC016025, AL121595, AC005229, AP000117, Z99716, AL022323, AL133246, AC007226, Z84469, AC009516, AC005071, AC005225, AL031390, AL096775, and AC007032.
HHFGC14	170	741650	1 - 358	15 - 372		
HHFGC69	171	573491	1 - 263	15 - 277		AC007002.
HHFGC93	172	576487	1 - 338	15 - 352		
HHFGC95	173	795968	1 - 396	15 - 410		
HHFGE01	174	917137	1 - 394	15 - 408		
HHFGJ85	175	524890	1 - 280	15 - 294		

HHFGM50	176	506635	1 - 453	15 - 467		
HHFGN31	177	908508	1 - 442	15 - 456	AC005324, and AL080124.	
HHFGN67	178	573509	1 - 308	15 - 322		
HHFGP71	179	573860	1 - 402	15 - 416	Z97989.	
HHFGR35	180	573510	1 - 304	15 - 318	AC005369.	
HHFGS09	181	526331	1 - 403	15 - 417	AA348101, AW299437, AI640149, AW135484, AI636408, Z42797, AW269210, AI271987, AA922757, AI765884, and AL008733.	
HHFGS40	182	888332	1 - 300	15 - 314		
HHFGS92	183	871899	1 - 319	15 - 333		
HHFGT10	184	968109	1 - 399	15 - 413	AC006312.	
HHFGY13	185	573473	1 - 362	15 - 376		
HHFGY37	186	711364	1 - 404	15 - 418		
HHFGY75	187	573483	1 - 458	15 - 472		
HHFGZ54	188	573477	1 - 227	15 - 241		
HHFGZ63	189	661248	1 - 406	15 - 420		
HHFGZ69	190	918322	1 - 404	15 - 418		
HHFHA44	191	573498	1 - 261	15 - 275		
HHFHC02	192	920510	1 - 449	15 - 463	AC005940.	
HHFHC44	193	716763	1 - 213	15 - 227		
HHFHC57	194	573506	1 - 148	15 - 162	AA077889, and AC004084.	
HHFHC72	195	766128	1 - 252	15 - 266	AA524846, AW029626, AI888050, AW169469, AA230221, AL119063, AI061158, AA809104, AI821945, AI446618, H91711, R79396, AA385094, AA847341, AI537800, AI281622, AI002863, AI940546, AA947352, AA834891, AA935827, AA496941, AI570067, H98162, W27084, AA196287, AW407007, AW022796, AA362440, AA846036, AW085811, AA665102, AI884404, AI634466, H81012, AA364147, AI434103, AW157128, N49298, AW028376, AI567676, H86399, AI640905, AI268465, AA353081, AW104040, AA112864, AA349923, AW152451, N49540, AA812133, R64110, AA828840, AI520984, AA593168, AA364082, AI801479, AA020882, R92390, AI038029, AA394283, AI581006, AI708565, AA601336, AI890283, W02419, AA196994, AA613189, AI805373, C75332, AA507975, AI345256, AA761454, AA411337, AA419014, AI805556, AW131109, AW190437, AI207534, W07542, T96411, AA101744, AA618531, AA730795, AA581317, AI820978, H94598, F35374, AA804838, AA419107, AA229316, AA554289, AA779599, AA230024, AI760850, AA525324, AI174701, AA296656, AI825901, AA714190, AA436949, AI343808, AL046487, AI149177, AA828613, AL080243, AL133371, AC004883, AC006390, Z75744, AC007731, AC005500, AL021332, AL035361, AP000692, AC004812, AC004821, U85195, AE000658, AC006974, AL049780, AF139813, Z83820, AC007055, AC008040, AL022721, Z93020, AC006538, AC002106, AC006263, AC003957, AC005911, AC006261, AC004228, AC007011, AL139054, AC007263, AC005516, AC004000, AC006023, U65590,	

HHFHE28	196	506630	1 - 348	15 - 362	AC007201, AC003092, AC004148, AL031229, AC001551, AC006315, AF111169, AC006360, Z85986, AC005412, AC005355, AC004673, AL035464, AL021546, AL109952, Z81364, AF047825, AF124730, AL049562, AL031121, AL117339, AF109907, AF111168, AC005245, AC002492, AC008179, AC006468, AL034420, AC007899, AC004019, AC000075, AC005664, AL122020, AC006547, AC008125, AC007390, AC005759, AC005581, AC003025, AC005993, AC005553, Z83826, AC005630, AF051976, Z86090, AL133275, AP000359, AC006006, AC004921, AL132994, AL034379, AC004881, AC006142, AF196779, AL050348, Z94801, AC005411, AL008710, AC000353, AC016026, Z95113, AC005751, AL022313, AL049643, AC006079, AL031177, AC002395, AL117330, AC005624, AC005102, AC002120, AL133245, Z97184, AC020663, AP000703, AC004099, AP000279, AC009399, AC004084, AC003036, AC006001, AC006958, AL008725, AC007934, AC005189, AP000039, AP000107, AC016025, AL109984, Z98752, AC008171, AC003999, AC005520, AL035443, AC004797, AL121658, AL022165, AP000038, AP000106, AC004835, Z97056, AC004801, AL031295, AC004477, AL008721, AF001975, AC004112, Z95116, AB023049, AC005484, AC007845, AL049759, AL008628, AP000512, AC005329, AC005180, AL050333, Z98304, AC005015, AC005482, Z99571, AL121603, AC005599, AL133448, AF001549, AF205588, AC005069, AP000247, AL023807, AL031670, AC005781, AP000076, AC003991, AL031662, AC005264, AC006125, AC002407, AC007666, AF003529, AC000052, AC016830, AC002044, AC005253, AC002430, AL109613, AL031848, AL079342, AC007676, AC005730, AC007384, AC005821, AC007686, AF107885, AC005682, AC005231, AC005066, AC012099, Z69917, AC005337, AC002558, Z84487, AC005288, AC005722, AC005529, AC012627, AC002045, AC002465, AC007066, AC007312, AL049743, Z76735, AL080317, AF196971, AC005585, U95742, AC005775, AP000280, Z93017, AC002563, and AL031257.
HHFHE58	197	526391	1 - 512	15 - 526	
HHFHE76	198	506578	1 - 423	15 - 437	R10859, AA347294, and H87292.
HHFHF91	199	526396	1 - 357	15 - 371	AA346979.
HHFHJ46	200	576949	1 - 658	15 - 672	AI827607, AA007488, AA007421, H49821, H49565, AI241634, AW408635, and AC007371.
HHFHJ72	201	575030	1 - 363	15 - 377	
HHFHM77	202	934027	1 - 175	15 - 189	
HHFHN54	203	506624	1 - 211	15 - 225	
HHFHQ86	204	572923	1 - 396	15 - 410	
HHFHU63	205	572871	1 - 338	15 - 352	
HHFHX11	206	967321	1 - 114	15 - 128	AL022476.
HHFHY47	207	720473	1 - 339	15 - 353	
HHFHY66	208	573294	1 - 341	15 - 355	AL135049.
HHFJC02	209	918318	1 - 389	15 - 403	
HHFJI11	210	883731	1 - 285	15 - 299	

HHFJL11	211	965931	1 - 399	15 - 413	
HHFJM56	212	857990	1 - 254	15 - 268	AC005998.
HHFJN01	213	913798	1 - 436	15 - 450	AA348215.
HHFJN02	214	918358	1 - 427	15 - 441	AA346443, AC005301, and AC007064.
HHFJO06	215	934168	1 - 492	15 - 506	AA347342.
HHFJO12	216	969624	1 - 422	15 - 436	
HHFJR06	217	934093	1 - 295	15 - 309	AC005360.
HHFJX18	218	907658	1 - 328	15 - 342	
HHFKB03	219	922803	1 - 445	15 - 459	AL138381, AA353533, AA437014, and AW372500.
HHFKC28	220	857948	1 - 364	15 - 378	
HHFKC43	221	906903	1 - 467	15 - 481	AI051548, N54917, AI056521, and AA693909.
HHFKE05	222	920550	1 - 460	15 - 474	
HHFKH82	223	857810	1 - 323	15 - 337	AC000075, AC000097, AC006547, and AC005664.
HHFKI02	224	918288	1 - 408	15 - 422	
HHFKJ68	225	934045	1 - 308	15 - 322	AW375009, and AI935760.
HHFKK95	226	952082	1 - 496	15 - 510	
HHFKM10	227	963184	1 - 465	15 - 479	
HHFKU12	228	887244	1 - 408	15 - 422	
HHFKU44	229	857923	1 - 520	15 - 534	T70846, T85471, and R18037.
HHFKX11	230	965874	1 - 365	15 - 379	
HHFKY11	231	965876	1 - 455	15 - 469	
HHFLA69	232	933869	1 - 203	15 - 217	
HHFLH34	233	857907	1 - 408	15 - 422	AA502532, AA644090, AA552586, AI687343, AI369580, AA128511, N23913, AA501867, AA908687, AA504818, AA704393, AW340905, AW023111, AW169038, AI334464, AW275971, H04977, H61871, AI732151, AI366993, AI344812, AA715814, F00564, AI270559, AA427636, AA464739, AI609972, AI440117, AA502991, AW275719, AI733856, AI859438, AW265735, AL041453, AI923052, AI554471, AA559241, AA578621, AI742168, AA507822, AW271904, AA640410, AA640430, AW005974, AA877992, AI049709, AA515138, AA720774, AA481887, AW268973, AA283730, R44593, T07039, AA084609, AA570740, AA483606, H58354, AI056177, H63660, AA225406, AI580250, AI753037, AA127078, AA602557, AL048275, AI366902, AI223968, AL047429, AI754653, AA701080, AA714110, AI076228, N25272, AA484208, N72170, H53217, AI144101, AI758435, AI061313, AW150077, AW022655, AL079734, AI249683, AW007980, T06828, AA600341, AA297666, AW020150, AA362349, AI251576, AI342183, AI933714, AA586667, AA632757, AA654778, AI491765, H66577, F35374, AI417469, R95840, AA013168, AI792521, AW272294, AI597820, AI583252, AI696955, AI471914, C75034, AI345418, AA477503, AA779783, AA828802, AA828781, AW302711, AA054085, AA744018, AI446259, F05592, AA523792, AI565084, R98160, AA508809,

					<p>AL138329, AA578832, AI635440, AI270476, AI635028, AW188742, AA829036, AA351003, AA640260, AA847395, AA584423, AA568204, AA469327, AW245354, AA749235, AC005775, AC007263, AC005666, AL022322, AL034449, AC007161, AJ246003, AC004531, AC008033, AC004408, L78810, AC006057, AL096791, Z84480, AL121603, AC006511, AL020995, AL031588, AL049795, AL031575, AL022302, AL034420, AP000692, Z99716, AC002314, AC005300, AC005690, U91326, AP000967, AC008372, AC007773, AC003971, AL121655, AC004883, AC006305, AC005988, AC006211, AC004596, AL121658, AL022163, AC005899, AL031003, AC007225, AL049709, AC005746, AC000353, AC004771, AC020663, AC005546, AC004966, AC006120, AC005736, AF001549, AC005229, AC005841, AL035604, AC003007, AC004517, M87889, AF003528, AL133445, AP000553, AC002289, U52111, AC007011, U80017, AL049779, AC002350, AC005409, AL035462, AL035249, AC004000, AC005379, AC006946, AC005696, AC005529, AC005291, M63543, AC002430, Z98051, AC006468, AD000812, AC005209, AL021707, AP000044, AP000112, AC005632, M63544, AC000392, AL049869, AP000694, AC007384, AC005480, AC009516, AC005488, AC005694, AC005335, AC004814, AC006059, AJ009610, AL023284, AC003690, AC004552, AF053356, AC002477, AL022323, AC004598, AL034379, AC004760, AC008062, AP001060, AC004686, AL078463, AL050341, AJ010597, AL133246, AL109827, AC006014, AC007193, AC007360, AL031311, AC005914, AL035659, AC012384, AC007114, AC006127, AC005011, AC004678, AF130343, AL049776, AL022238, AC006251, AC004130, AF190465, AL022165, AL121782, AC005081, AC004217, AC002551, Z97200, Z98744, Z98752, AP000556, AL035086, AL133244, AC007201, AC002425, AC005486, AP000552, AF196969, AC005102, AC004743, AC000134, AL049569, AC006101, AF165926, AC016025, AC006130, AL035420, U91318, U08988, AL049759, AC005042, AC006160, AC007191, AL035405, AC004651, AC005365, AC004491, AC007541, AC005527, AC005231, AC004757, AC005740, AC004655, AL008723, AL049830, AC007981, AC015853, AC006277, AP001050, AC002492, AC005940, Z83826, AC005288, AP000962, AC005520, AF111169, AF064861, AC005256, AL021940, Z68756, AC005411, AL031662, AC005207, AC005005, AC005031, U89335, Z97632, AF187320, AP000557, AC002984, AC003692, AC005175, AL035071, AL117694, AF165176, AC009247, AC007686, AC002126, AL109801, AC007536, AC005187, AC003043, AF027390, AC005500, and AC005962.</p>
HHFLM06	234	933868	1 - 405	15 - 419	U51560, and Z80896.
HHFLP28	235	857888	1 - 437	15 - 451	<p>D57483, D80253, D58283, D80024, D80366, D59859, C14389, D51423, D59467, D80043, D59889, D80166, D59619, D59610, D80210, D51799, D80240, D81030, D80188, D80391, D80212, D59787, D80022, D59275, C14331, D80219, D80195, D80164, D80227, D59502, D80196, AA305409, D80241, D80251, C15076, D59927, D51022, D80038, AA305578, D80269, D80248, D50979, D50995, D80193, AA514188, D81026, D80133, D80378, AW177440, D51060, AA514186, C14429, C14014, AW178893, D80045, D80522, C75259, AW360811, AW352158, T03269, AW179328, D58253, AW375405, D80268, C05695, AW378532, D80134, AW177501, AW178775, AW177511, AW377671, AW177731, AW366296, AW360844, AW360817, AW375406, AW378534, AW179332, AW377672, AW179023,</p>

					<p>AW178905, AW178762, D80132, D80247, D51250, D80439, AW369651, D80302, D51079, AW177505, AW352171, AW377676, AW178906, AW352170, AW179024, AW178907, AW179019, D59373, AW352117, AW176467, AW360841, F13647, AW179020, D80949, D52291, AW178909, AW177456, AW179329, AW178980, AW177733, AW378528, AW178908, AW178754, AW179018, D80168, AI910186, C14227, D81111, T11417, C14298, AW179004, D80064, D80157, AW179012, D51103, AW178914, C06015, AW378525, D51759, C14407, AI905856, AW177722, AW352174, D58246, AW179009, AW177728, AW178774, AW178911, AW378543, AW352163, Z21582, AW360834, C14975, AW178983, D59503, AW378540, AW178781, T48593, D58101, D45260, D59653, AW177723, AW352120, D51097, D59627, D80014, AI525235, D80258, H67854, AA285331, AW378533, AA809122, AI535850, D50981, AW367950, C14957, C03092, AI557751, H67866, AW367967, D80228, AW178986, AI525923, D51213, AI525917, D59474, AW177508, D51231, D51221, T03116, AW177734, D45273, AW177497, C14973, D59317, AI525920, C14344, AA514184, D60010, AI557774, AI535686, AI525227, D59551, AI525222, D60214, C14046, T03048, D80314, Z33452, AI525912, AI525215, AI525242, AW378542, AI525925, AI535961, AW378539, C05763, C16955, T02974, AI525228, AI525237, AW360855, AR018138, AR008278, A62298, AJ132110, A62300, A84916, AF058696, AB028859, Y17188, X67155, D26022, Y12724, A25909, A67220, D89785, A78862, D34614, D88547, A82595, X82626, I82448, A94995, AR060385, AB002449, AR008443, AR025207, I50126, I50132, I50128, I50133, AR066488, AR016514, AR060138, A45456, A26615, AR052274, AB012117, Y09669, A43192, A43190, AR038669, AR066487, AR066490, AR054175, A30438, A85396, D88507, AR066482, A44171, X68127, I18367, I14842, AR008277, AR008281, A85477, I19525, A86792, D50010, Y17187, X93549, A63261, X64588, AR008408, AR062872, A70867, AR016691, AR016690, U46128, D13509, A64136, A68321, AR060133, I79511, AF123263, AR032065, Z82022, and AR008382.</p>
HHFLU04	236	870085	1 - 353	15 - 367	AA578033, AI908783, T06477, AA309342, and AL034548.
HHFMA58	237	853959	1 - 339	15 - 353	<p>D80164, C14389, D81111, AW177440, D51799, D80195, AW369651, C15076, D80227, D80038, D59502, D80269, C14227, D81030, D80166, D59275, D59467, D58283, D80022, D59859, C14331, D80064, D80193, D59619, D80210, D80391, T03269, D80240, Z21582, D51423, D59787, AW178893, D80253, D80212, D80043, D80196, D57483, D80188, AA305409, D50979, D80219, D80378, D59927, D59610, D80366, D59889, T11417, D51022, D80024, AA305578, D80045, D50995, D80241, D51060, D80251, C14429, C14407, AW360811, D81026, AW179328, D59695, AA514188, AI557751, D59503, C05763, C06015, C14014, AW176467, AW375405, D58246, AW360817, AA285331, C75259, C14298, AW377671, D80248, D80168, AW378533, AW366296, AW360844, AW378532, D58101, D80258, D51250, D52291, D80522, AW178775, AW178762, T03116, AA514186, D80133, AW360841, AW177508, C05695, D80949, D80268, AA809122, AW177497, D80014, AI910186, AW375406, AW352158, D59627, AW378534, AW179332, AW377672, AW179023, AW178905, AI535686, AW177456, AW352171, AW177734, D59551, C03092, T02974, H67854, D59653, H67866, AW178907, AW352170, AW177731, AW177505, AW178906, C14077, D80439, AW377676, AW179019,</p>

HHFMB01	238	914951	1 - 295	15 - 309	AW179024, AW179020, D80247, D51103, D80302, AW178909, D59317, D80157, F13647, AW179329, AW178980, AW179018, AW178914, AI525903, AW177733, AW378528, AW178754, AW178986, C14973, AI535961, AW179004, D45260, D51759, AW177728, AI525920, AW179012, AW378525, D59474, D51221, C14344, D60010, AI525923, D60214, AI525917, AI525227, AW352163, AI525925, C14957, AI557774, AW177722, AW378543, AA514184, AW179009, AW360834, C14046, AW367950, D59373, AW178774, AI525242, AI525235, D45273, AI525912, AW178911, AW352120, AI525215, AW378542, AW178908, T48593, C16955, Z33452, AI525237, C13958, AW178781, T02868, D31458, Z30160, C04682, AW360855, D51213, AW378540, D51053, D59976, AI535959, AI525222, AC004477, A84916, AJ132110, A62298, A62300, AR018138, AR008278, AB028859, I82448, AF058696, Y17188, D26022, X67155, A67220, D89785, A78862, D34614, A25909, AR060385, AR054175, I14842, A82595, Y12724, AB002449, AR016808, I50126, I50132, I50128, I50133, AR008277, AR008281, A94995, AR008443, I79511, AR016514, Y17187, AR060138, A45456, A26615, AR052274, A43192, A63261, A43190, AR038669, AR062872, A64136, A68321, A70867, AR066488, Y09669, AR066487, A30438, X68127, AR016691, AR016690, U46128, AF123263, AR032065, AR060382, and AR008408.
HHFME70	239	926497	1 - 353	15 - 367	AA984829, AA558487, AA492161, AA046737, AI049701, AA603558, AL035686, AC016027, AC016830, AC002565, AC004168, AL031120, U95740, Z98941, AC007546, AC005841, ALI32826, AL035555, AC005755, AP000694, AC006088, AC002365, AC004821, AL008730, AC002375, AC004805, AC020663, AL023575, AC006597, AC007021, AC008975, AC005182, AC006449, AL109802, Z99758, Z74739, U85195, AC004685, AE000658, AC004701, AC003950, ALI33500, AC006480, AL021155, AC007057, AC005578, AC002404, AC005535, Z84469, AC006539, Z93017, AB003151, AP000688, AF111168, AC005081, AC004858, AF109907, AL031311, AC005972, AC005369, AF001548, AC009363, Z97630, AC002425, AL031602, ALI09623, AL009051, AP000555, AC007283, AC005914, AL021368, AL031774, Z73988, AF108083, AC005486, AC007444, AL050347, AC005484, AC005934, AL034420, AC005037, AC005015, AC002546, AC002123, U78027, AL035422, AL121595, AC005261, AP000248, AC007731, AP000045, AC005231, AC005500, AC004946, AC002126, U95742, AC007216, AC004605, AC004409, AC005003, AC005520, AC005071, U62293, and AC009399.
HHFMH85	240	872838	1 - 277	15 - 291	R05702, AA479449, T97899, AI040466, AA180508, and T10419.
HHFMI58	241	857856	1 - 529	15 - 543	AA077459.
HHFMO03	242	922708	1 - 412	15 - 426	H06469, R18079, AA489067, AA505171, AA346630, AA889356, AA629200, AA534443, AA488820, and Z84474.
HHFMO94	243	957955	1 - 395	15 - 409	AI911241, T72210, T87002, R08341, R08392, T85654, T99624, T99625, R02406, R07180, R59607, H62539, H99689, W63788, AA083979, AA102095, AA131697, AA131541, AA148259, AA151763, AA193069, AA220926, AA416768, AA430164, AA483282, AA613379, AA747801, C00103, AA292662, AA401454, AA402018, AA625743, AA405177, AA773305, AA970146, AA985342, AA985358, AI004081, T19343, F07893, AI301484, and AI190719.

HHFMQ70	244	840039	1 - 320	15 - 334	AI284640, AW301350, AW303196, AW407578, AL119691, AW088202, H71429, AW103758, AW274349, AL046409, AW029038, AL119984, AW247819, AA469451, AI076616, AW021583, AI583466, AW276435, AA720702, AI783494, AI929531, AA584201, AA502860, AW276817, AI339850, AI687343, AA488746, AA581903, AI358571, AI434695, AI144101, AL038785, AW265385, AW405021, AI267818, AA584752, AI537955, AL042853, AI457397, AA491814, AL138265, AW302013, AI017415, AI589230, AA847499, AW276827, AA323644, AI679782, AI368745, AW304584, AI312309, AI357551, AA826303, AW103981, AI251002, AW271904, F36273, AI708009, AW162049, AI745325, AI357288, AI364809, AI064952, AI281697, AI246119, T09071, AW238278, AI890348, AI610607, AI653636, AW089322, AA862180, AW023270, AW028392, AI251576, AI801600, AI821271, AL120269, AI568678, AI281754, AI903462, AI110688, AA586661, D83989, AL121658, AP000208, AP000130, AP000247, AC005703, AC006004, AL009181, AC016831, AC004030, AF015156, AF124523, Z98050, AF042090, AL109985, AC004986, Z82189, AC003006, AC007666, AL031577, AL049869, AL080278, AP000313, AC004149, AC009044, AC007226, AC005901, AL008718, AL034420, AC003962, AC005323, AC002544, AC002303, AC005899, Z97352, AC006958, AC004895, Z69917, AL121603, AP000050, AC007262, AP000049, AC002072, AC004584, AC005217, AL022329, AP000555, AL132987, AL133304, AC004447, AC007564, AC007462, AP000117, AC007298, AC004832, AL035411, AC004040, AL035423, AC004593, AL078593, AP000311, AJ239322, AL050341, AL034379, AF001549, AC005046, AC004987, AL008582, AC002404, AL034451, AC007363, AP000245, AC008079, AP000459, AL035468, AC010722, AC003109, AJ006996, AC005529, AL133445, AC004638, AL096805, AC005295, AC006037, AL008629, AC004158, U66059, AC006285, AL135744, AC003684, AC006238, AC005242, AC004417, AL031283, AC007687, AL031054, AC005694, AC002379, AL021368, AL049691, AC004386, AC004653, AC004883, AC009247, AL079300, AC005229, AC006456, AC007128, AC004940, AL133246, AL034373, AP000088, AL035448, AP000228, U91323, AC004692, AC009516, AC008169, AC007537, AC008372, AC007055, AC004804, AC002429, AJ010598, AC004815, AC004884, AC005082, AC000118, AC005197, AL023803, AL121934, AL022163, AC005907, AC004972, AC006288, AL050348, AC004858, AC002067, AC002456, AP000140, AC007237, AL022323, AL031584, AC006006, Z97181, AF015151, AL022238, AL031848, AC003982, Z68870, AC005527, AC005998, AJ246003, AC007216, AC007324, AC000379, AC007685, AC007773, AF195658, U07562, Z97195, Z84480, AC004383, AP000193, Z93023, AC005144, AC004686, AC007845, AC005520, AL033525, AC005324, AL049570, AL122126, Z95152, U91326, AC007030, AL035089, AC002395, AC007637, AC002369, AC005919, Z82190, AC005164, AC005228, AC003042, AC003101, AC005154, AL133371, AC011311, AL096701, AL022328, AC005829, AC016025, AC007486, AC005562, AC010168, AC016026, AC005799, AF109907, AL022723, AC005104, AL031446, AC002430, and
HHFMZ40	245	974299	1 - 565	15 - 579	
HHFNA49	246	914838	1 - 319	15 - 333	
HHFND10	247	963140	1 - 437	15 - 451	

HHFNF41	248	857825	1 - 381	15 - 395	AC006442.
HHFNI49	249	857850	1 - 304	15 - 318	AP000355.
HHFOC27	250	857816	1 - 390	15 - 404	AA346789.
HHFOC66	251	857955	1 - 228	15 - 242	AL049835.
HHFOF07	252	952062	1 - 210	15 - 224	AW160814, AW452242, AI393255, AI356203, AW290992, AI640362, AI640129, AI365982, AF088886, AF132894, AF136279, and AJ007331.
HHFOF40	253	930839	1 - 361	15 - 375	AL132987.
HHFOI05	254	930856	1 - 225	15 - 239	AA347058, and AC000015.
HHFON08	255	957974	1 - 218	15 - 232	AL031282.
HHFON15	256	857792	1 - 245	15 - 259	
HHFON19	257	910891	1 - 1126	15 - 1140	AA527292, AA915932, AI215158, AA926744, AI283262, AA356476, AI916043, AI470481, AW372085, AW384295, AW372101, AW384294, AW372104, and AC003072.
HHFON32	258	858034	1 - 439	15 - 453	AA507612, and AL133245.
HHFON87	259	857783	1 - 327	15 - 341	AA346793, AA494051, R96249, AI932599, AI672860, T16700, H09486, H07125, AA569178, AC006449, AC004703, AC004386, AC005231, AC005274, AF031078, AF030876, AB016897, AC006511, AC003071, AC002565, AL033547, AC005412, AC002400, AB011399, AL009181, Z95114, AC006512, AC005529, AC002543, AC005081, Z83826, Z93023, AL049793, AC004876, AC004522, AL139054, AC005049, AC002288, AL049758, AC006050, AC004228, AP000010, AC004953, AF047825, AC006064, AL080243, AC005058, U47924, AC006538, AF053356, AL031680, AL049761, AL008719, AC007011, AL049712, AC006012, AL031255, AC004882, and AC007308.
HHFSB02	261	921364	1 - 297	15 - 311	AA347106.
HHFTC88	262	500903	1 - 345	15 - 359	AA347696.
HHFUB15	263	534520	1 - 300	15 - 314	AA776649.
HHFUB23	264	928063	1 - 375	15 - 389	AC004985.
HHFUB77	265	772691	1 - 291	15 - 305	AW080134, AA515051, AA229785, AI339850, AA482711, AI929531, AI284640, F29989, AI282832, AI205126, AW029038, AI962050, AW023672, AI358229, AI469003, AI251002, AA745582, AA826303, AI358343, AA843450, AW088202, AW406755, AI049722, AA347927, AI049634, AA594145, AA074130, AW440836, AI365988, AW265294, AA318652, AI625244, AW276827, AI151261, AW193432, AI569086, F28576, AI919029, AA503258, AA469451, AA347930, AI206785, T29180, AI198376, AA649642, AW162049, AW339687, AW166815, AI918421, AL138265, AW129001, AI890923, AI688846, AA441788, AA985038, AI635272, T06828, AI133636, AI357551, AA747276, AI567674, AA568778, AA350859, AI382614, AI350211, AA747480, AA720025, AI053672, AW193265, AI537955, AI446464, AW440976, AW276435, AW236342, AA364456, AA515435, AW021583, AA492132, AI298710, T06556, AA503283, AI679782, AA515751, AA713815,

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HHFUC24	266	524840	1 - 354	15 - 368		
HHFUC26	267	960331	1 - 371	15 - 385	AC007686.	
HHFUC42	268	525603	1 - 313	15 - 327	AW135348, AW204310, AA996205, AI697749, AC004836, and AC005069.	
HHFUC45	269	525600	1 - 198	15 - 212		
HHFUC47	270	525599	1 - 334	15 - 348		
HHFUC83	271	507459	1 - 488	15 - 502		
HHFUC92	272	507018	1 - 329	15 - 343	AA347389, AA280938, AL079866, AI936976, and AB011134.	
HHFUK58	273	525604	1 - 191	15 - 205		
HHFUL75	274	675569	1 - 343	15 - 357		
HHFUN56	275	530953	1 - 210	15 - 224		
HMEBA75	276	530303	1 - 146	15 - 160		
HMEBY61	277	947868	1 - 385	15 - 399	AA303737.	
HMEDF58	278	738427	1 - 480	15 - 494		
HMEDR48	279	529173	1 - 356	15 - 370		
HMEEF64	280	918746	1 - 377	15 - 391	T99598.	
HMEEX61	281	742085	1 - 487	15 - 501	AA173199, and AA347039.	
HMEFR17	282	664438	1 - 459	15 - 473	H29936, H29845, W27872, AW380042, AF085864, and AB028981.	
HMEFX12	283	661951	1 - 446	15 - 460	AA339614, and AA374928.	
HMEGB93	284	573814	1 - 352	15 - 366	AF093097.	
HMEGF48	285	573821	1 - 404	15 - 418		
HMEGG44	286	796421	1 - 445	15 - 459	N44889, and AL110204.	
HMEGH46	287	887791	1 - 363	15 - 377	AB033054.	
HMEGI07	288	953815	1 - 556	15 - 570	AW363121, R24201, AW025914, and AA770692.	
HMEIG42	289	931114	1 - 394	15 - 408	AW192773, AA953251, AW372190, AW274877, AI669009, and AB014592.	
HMEIM40	290	523589	1 - 211	15 - 225		
HMEIU49	291	722988	1 - 359	15 - 373		
HMEIW23	292	682863	1 - 263	15 - 277	AL110334, AW411094, AL135489, AL135458, AI136879, AA876722, AA719995, AI053577, R98359, AI494405, AA381147, AA483204, AW151713, AA953228, AA834707, H96467, AA970967, AC005156, AC005232, AC004527, AL008638, AC005477, AC006205, AC009501, AL022165, AP000689, AC004559, AF067845, AC007298, AF110824, AC005225, AC004821, AC006597, AL020997, AC005520, AC004491, AC005899, AC008282, AB016897, AC005368, AC004542,	

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HMEJD13	293	657231	1 - 257	15 - 271	AC003976, AC005702, AC005562, and AL117394.	
HMEJJ84	294	781983	1 - 124	15 - 138	Z98744.	
HMEJU60	295	740392	1 - 322	15 - 336		
HMEKA53	296	711664	1 - 246	15 - 260		
HMEKJ43	297	715893	1 - 367	15 - 381	H25268, and Z83309.	
HMEKS76	298	767517	1 - 249	15 - 263	AA505833, and AC006960.	
HMEKX51	299	727154	1 - 302	15 - 316		
HMEKX89	300	786055	1 - 70	15 - 84		
HMELC56	301	745773	1 - 306	15 - 320		
HMELQ62	302	719681	1 - 359	15 - 373	AA166769, W94197, AA166767, AA460380, T97509, N88106, AI751026, N90626, AA356483, AW340411, AW407849, AA446049, W94104, AI814281, AI085368, W01030, AI762027, AI693754, AW001517, AA704878, AI023779, AA166957, AA704992, AF083248, and AC002536.	
HMELR10	303	964629	1 - 322	15 - 336	AF174601, and AB020682.	
HMELS59	304	720341	1 - 307	15 - 321		
HMELV19	305	668665	1 - 266	15 - 280		
HULAF89	306	791261	1 - 86	15 - 100		
HULAI37	307	708923	1 - 160	15 - 174	AW302954, AW301754, AW268302, AI345477, AW072719, AI336582, AW268122, AI308032, AW301513, AI310575, AW074993, AW302965, AI312152, AW269097, AI344928, AL036980, AI307543, AW301300, AI307708, AW075207, AW301505, AI343037, AI336495, AW268072, AI335208, AI310582, AI307520, AI313320, AI336633, AI345677, AI340582, AI334450, AI312399, AI345608, AW269083, AI251963, AI344789, AW074869, AW071417, AW071380, AW301500, AI348897, AI345471, AI340511, AI344785, AI309401, AL036214, AI334930, AI345745, AI345347, AW075084, AI334889, AI340533, AI349967, AI336513, AI311159, AI348895, AI336654, AI345735, AI343030, AI345562, AI345817, AI349028, AI349637, AI345397, AI349645, AW302973, AW268060, AI312428, AI251221, AI802833, AI345111, AI334445, AI335214, AI345224, AI366992, AI336503, AI307210, AI345739, AI345587, AI307494, AW301375, AI366968, AW072484, AI366974, AI345737, AI366959, AI345736, AI343062, AI343059, AI348847, AI349614, AI349933, AI340664, AI308035, AI349256, AI345253, AI343112, AI345026, AW071412, AW268253, AW071362, AI349598, AI309431, AI312325, AI348854, AI340659, AI335476, AI340627, AI309443, AI334884, AI345251, AI345666,	

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HULAX31	308	868930	1 - 205	15 - 219		
HULBU59	309	636253	1 - 453	15 - 467		
HULBY15	310	659557	1 - 422	15 - 436		AA362604, AF150274, AL038735, AI348980, AL048672, AL048673, AL048657, AF150161, AL037601, AI224190, AL038991, AF150181, AL037348, AL038038, AF174394, AR067468, AF100694, AL080096, AF118386, AL049963, AF125570, E04157, and AL080106.
HULDF69	311	754381	1 - 243	15 - 257		AL134132, AL043003, AL043147, and U46347.
HULFA03	312	918691	1 - 372	15 - 386		
HULFB76	313	767873	1 - 196	15 - 210		
HUMBE61	314	838469	1 - 400	15 - 414		AF150274, AL038735, AI348980, AL048657, AL037601, AL048673, AL048672, AF150161, AL038991, AI613343, AI224190, AI431323, AF174394, AF100694, AL080096, AF125570, AL049963, AF118386, AL080106, AL133076, AL133074, and Y17793.
HUSAY26	315	527909	1 - 360	15 - 374		AI858923.
HUSCA57	316	527800	1 - 250	15 - 264		
HUSCD26	317	527799	1 - 347	15 - 361		AL022323.
HUSCH45	318	507197	1 - 354	15 - 368		
HUSCH77	319	527801	1 - 117	15 - 131		
HUSGH88	320	871776	1 - 689	15 - 703		AI653117, AA922010, AW008076, AI127949, AI655942, AI142458, AI701082, AI608993, W46422, N37061, AI858207, AI273519, AA977111, N24696, AI985411, AA233273, AW137630, N72855, AI919359, AA302412, Z46073, H07031, AA232970, AI742640, and F05394.
HUSGK23	321	675951	1 - 303	15 - 317		AW389364.
HUSGL13	322	575798	1 - 306	15 - 320		AA776615, AI394186, AI623747, AI473932, AI744215, N48461, N75917, AW272349, AW088808, AI920827, AW081119, and AB011139.
HUSHH64	323	576459	1 - 434	15 - 448		
HUSHJ55	324	576381	1 - 324	15 - 338		AA985295, AJ012590, and Z98044.
HUSHL83	325	868883	1 - 335	15 - 349		
HUSIA38	326	709472	1 - 421	15 - 435		AA035379, AI494330, AA035378, AA446855, AA325787, C14480, AA487892, N91747, AW439703, AA700664, AA809787, H16875, W73597, N23062, AA358852, AA206062, AI871691, AW341955, AW408596, AA347237, AA085902, AA368749, AA11870, AA633039, AI680547, AL134167, AI206078, AW151761, AI922850, AP000252, AP000134, AP000030, AC005562, Y08864, AC004913, AP000152, AC007298, AC005598, AC005342, AP000563, AC005193, AP000141, AP000088, D87675, AP000133, AP000211, AL096712, AC004834, AC007510, AC006480, AC008115, AC004922, X94912, AP000350, AC007227, AC006014, AC005488, AC007425, AC003109, AC007676,

HUSIA43	327	575768	1 - 418	15 - 432	AC002470, AL030997, AL096818, AC002115, AC002365, AF111168, AC005325, AC006120, AL049631, Z84469, AP000227, AL079301, AP000087, AC004893, AC005756, AL117328, AC006130, AC005207, AC002364, AC005940, AC007687, AC002094, AC005821, AC002310, AF016898, AC004659, AC007182, AL049636, AC004962, AL034429, AP000340, AP000156, AP000014, AC006326, Z49258, AC004799, Z69714, AC005365, AC000105, AC002558, AL023553, AL080317, U91326, AC007057, AL049872, AC004032, AC004223, AC004983, U91323, Z98742, AC005899, Z69921, AC003004, Z68326, AF003626, AC000066, AP000692, AC004815, AC003982, AC006343, AC005180, AC007934, AJ010770, AC008154, AC007276, AL121577, AL080243, AC007156, AC012384, Z95331, U95742, AC003665, AC006285, AC005666, AC004216, AC004548, AL049697, AC007546, AC002352, AC002472, AC004383, AL049713, AC005102, AC004765, AL137191, AL049871, Z98949, L78833, AL031680, AC006449, Y10196, AL049759, AC006000, AC003010, AL049539, AC007540, AC006071, AC005264, AC005262, AF045555, AL009181, Z96811, AC005081, AC005519, AC002477, AC006080, AL049538, AL035079, AL031311, AC007011, AC005736, D84394, AC007308, AC004106, AB000462, AF130343, AD000833, and Z68279.
HUSIF23	328	862494	1 - 433	15 - 447	AI350419, AI563971, AI208906, AW198165, AL135224, AA974279, AI223023, AI049928, AI283630, AI097446, AI648516, AI016385, AA324880, AW248808, AI991136, AW085678, AI937038, AI364515, AA709404, AA639864, AW250882, AI160941, AA854011, AL135233, AA552424, AA485734, AA583601, AA769102, AA250968, AA552593, HI7500, H98072, H18108, AA678516, H38440, AW190935, R88426, AA765348, R23499, H41112, H50888, W92991, W52172, AA151984, H52131, AA809403, T54339, H46149, AA100930, D29154, D53226, R89522, AA678890, and AL035681.
HUSIS60	329	727153	1 - 343	15 - 357	AI193047, AI203647, AA757210, AI130814, AI344478, AA582236, AI288858, AI148643, AI146994, AA524479, W45709, AI168644, AA453739, AA491660, AA730161, AA557746, AI750017, AA927666, W44356, AI610804, AI685002, AI190610, AA652628, AI141208, AA490862, AA025400, AA316493, AI475353, AI859485, AA453820, Z99396, AL038837, AL037051, AL036725, AI859458, AL039074, AA631969, AL039085, AL039564, AL039156, AL039108, AL039109, AL039128, AL039659, AL038531, AL039625, AL039648, AL045337, AL039678, AL039629, AL039150, AL037526, AL039423, AL036924, AL040992, AL042909, AL037726, AL036858, AL039410, AL038447, AL036196, AL037094, AL037639, AL036238, AL045353, AL036190, AL036973, AL038851, AL036767, AL037082, AL044407, AW392670, AL037615, AL039386, AL036117, AL036733, AL037077, AL039440, AL036268, AL039924, AL036418, AL037085, AL038509, U46347, AL037021, AL036998, AL036679, AL037027, AL037178, AL039538, AL036191, AL044530, AL036765, AL037016, AL036719, AW384394, AL037054, AW363220, AL119484, AL036158, AL038821, AL043003, AL036964, AL038520, U46351, AW372827, AL119457, AL119443, AL119439, AL119497, U46350, AL119319, AL119324, AL119483, U46349, AL119391, AL119444, AL119335, AL119522, AL119418, AL119363, AL119355, U46341, AL119341, AL119396, AL134132, AL134525, AL037205,
HUSIW10	330	963324	1 - 380	15 - 394	

				<p>AL119496, AL134530, AL134519, AL043147, AL134531, AL119401, AL134527, AL134528, AL039566, U46346, AL042614, AL036836, AL134533, U46345, AL119399, AL042984, AL042965, AL042975, AL042542, AL134538, AL042544, AL042989, AL043019, AL043029, AL042450, AI142134, AL042551, AL036808, AL119464, AL036886, AL036774, AR060234, AR066494, AR064706, AR023813, Y11449, Y11447, AR064707, A81671, AB026436, AR054110, AR069079, and Y11458.</p>
<p>HUSJW78</p>	<p>331</p>	<p>772956</p>	<p>1 - 403</p>	<p>15 - 417</p>

HUSKI76	332	914084	1 - 425	15 - 439	<p>AI805657, AW105425, AI684850, AA609319, AI445561, AW087416, AI569649, AI052449, AW005296, AI884876, AI683390, AI821774, AI857542, AI375889, AI498223, AI937172, AI052455, AI126807, AI276854, AW300679, AI148078, AI812099, AI079310, AI301571, AI832389, AA448176, AA634578, AA813907, AI159912, AA583197, AI081042, AA130045, AA960856, AA781740, AA078817, AI500194, AA037280, AA757372, AA577413, F17150, AA604543, AI694019, AA405506, AI025798, AI127345, AA889088, H78344, T50735, AI814129, AA002152, AA625807, AI352262, T23478, AI280471, AI240763, AW004806, H26970, H14637, AA933720, F03913, AA203660, AW327749, AA715028, M78972, M78956, AW074558, F36821, AA428254, AA427399, AI475077, F29918, T98945, R11215, R46235, R85210, F29924, AA878694, AA865297, AA910724, AA132925, R11273, AI147818, AA844613, AA564700, AA653527, AI214070, AW151132, AL042686, AA580663, AI432644, AI623302, AI431307, AI866786, AI431316, AI431238, AI955221, AI358271, AI440260, AI537677, AI494201, AI804505, AI500659, AI815239, AW058275, AI866465, AI815232, AI866691, AI801325, AI500523, AI538850, AI887775, AI582932, AI872423, AI590043, AI284517, AI923989, AI500706, AI491776, AI445237, AI926593, AI289791, AW151138, AI421662, AI889189, AI521560, AI500662, AW151974, AI285417, AW172723, AI539800, AI284509, AI582912, AI538885, AI889168, AI440263, AI927233, AI866573, AI633493, AI434256, AI866469, AI434242, AI805769, AI888661, AI500714, AI284513, AI888118, AI285439, AI859991, AI436429, AI355779, AI889147, AI623736, AI581033, AI371228, AI491710, AI440252, AI440238, AI567971, AI860003, AI610557, AI242736, AI539260, AI828574, AI887499, AI539781, AI889191, AI539707, AI702065, AI654286, AI885949, AI285419, AI559957, AW089557, AI696583, AI521571, AI469775, AI866581, AI567953, AI815150, AW074057, AI446495, AI867068, AI952433, AI225248, AI798359, AI698352, AI282249, AI890907, AI371229, AW084105, AI687944, AW194509, AI431315, AW151979, AI868931, AI924051, AI539771, AI872315, AI866458, AI687588, AL047422, AI540354, AI371251, AI889157, AI866510, AA829775, AI620864, AW151136, AI866461, AL047398, AI923046, AL042655, AW406745, AL039390, AI432666, AI561170, AI567954, AI469764, AI690946, AI648567, R20540, AI433157, AI932620, AA853473, AI249936, AI049859, AW029457, AL048403, AI362495, AL047611, AI799313, AI309306, AI801286, AI554821, AL045166, AI888022, AI433011, AI521596, AW129310, AI371243, AW151970, AL046681, AL039287, D50913, AL031732, AC003042, AR050959, AL133084, AL133070, AL049423, U30290, AL133047, AC002540, AL133053, AL133607, AL133049, AC004213, Z93784, AF124728, AF032666, L30117, E13998, X97332, A77033, A77035, AL133655, AL133076, AF081571, AL033523, AC007012, AR038854, AF090940, AF090432, AL034417, AC007114, Z82206, AC005968, AC007172, A41579, X83544, E12580, AL133015, AL133608, AL133088, AL122101, AR034821, I89947, AL133665, AI8777, X82434, AL133619, I48978, Z82250, AC006221, AL034374, AC002416, AC009113, AF206503, AF095901, AC005886, X98066, AF044323, AF139986, AF162270, A08910, AL080124, A08909, AL122049, A65340, D83989, I42402, X63162, AJ005870, AL117435, AC002538, AL031656, AL022723, A08908, S59519, AL122118, S77771, AC002564, AC006203, AF000167, AF003737, AF003738, AR015970, D38178, U69730, U95739, AC005353, AL096776, AC005250,</p>
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<p>HUSXK92</p>	<p>333</p>	<p>848959</p>	<p>I - 474</p>	<p>15 - 488</p>	<p>AP000020, AP000161, AC0005091, AL122021, AL022147, AC0005048, AC004686, Z94277, AL022722, AC004066, AC006501, AC008067, AC004057, AC018767, AC006222, AC008014, AC007056, AC006112, AC005291, AC007298, U66059, AF002985, A65341, AP000458, Z98744, Z49216, AL117587, AL050138, AF008439, AC005815, AF053356, AE000664, A86558, AF215669, AC007748, Y14314, AL110228, X66366, AL133051, X83508, AL133623, AC006373, AL034376, S70057, AL110280, AP000208, AP000130, AP000247, Z83840, AL049557, AL031274, AL020994, AC004690, AL137530, AL137574, AF172400, M64936, Z49258, U89335, AL080245, AC004989, AC006336, L05367, AC002301, AC003977, AL034400, AC007877, AL136520, AC002531, AL031054, AC007392, A21103, X00474, AL137478, A76337, Z13966, AF183393, AF026008, X93328, I48979, AF116573, Z98036, AL049742, AC006944, AP000697, AC005411, AC004554, AF013214, D44497, E03168, and X70514.</p>
<p>HUSXO30</p>	<p>334</p>	<p>973266</p>	<p>I - 540</p>	<p>15 - 554</p>	<p>AA081241, AW014362, AW262136, R82455, AW058401, AI422211, AI394480, AA983672, AI342274, W35127, AA181256, AI246708, AA411749, AI291504, AI417724, AI304761, AI952055, AI653254, W02704, AI348150, AI242604, AI284964, W20374, AI318380, AI699314, AI933232, AA676646, AI249266, AA063542, AI167529, AI648485, AA908300, C00986, W25658, AA384416, AI535997, AA410298, N70938, AA410480, and AA411748.</p>
<p>HUSXO30</p>	<p>334</p>	<p>973266</p>	<p>I - 540</p>	<p>15 - 554</p>	<p>AA421248, AA706819, AI831655, AW001127, AI659943, AI936705, AA482102, AI601264, AA609988, AW157288, AI249746, AI673452, AA100758, AI168496, AI334090, AA291557, AI300503, AA838311, AI032723, AI446090, N92238, AA548418, AA458972, AA723811, AI243467, AI608877, AI720973, AI744302, H99292, AI762325, AI445510, AI248324, AI354517, N33480, AA999919, AI080097, AA837993, N26709, AI299967, AA459641, AW406362, AA523728, AI076417, W86074, AI222030, AA699459, AI052485, AI149225, AI018107, AI091825, AA961603, AA464265, AI983959, AI356935, AW263743, AI762657, D53076, AW070434, AA304075, R54623, AA484009, AA953293, AA806590, AA835477, AI309964, AA481610, AA464376, AI086019, W42436, AA641534, AA533309, AA303091, AI523186, AI969104, AA550930, AA506454, AA479918, AW182773, T57831, AA459188, AI077915, H78028, T40539, R81765, AA065082, AI248883, D30930, H67864, W42839, AW238626, AI278707, AA373915, AI749543, AA502726, AW068093, AA508653, AA480137, AW015934, AW338581, H67188, AI673126, AA514511, H46429, H78027, AA878251, AA952963, AA352423, AA428506, N55859, AI381737, T63660, AI419779, AA496458, H52178, AA658417, AA303090, AI286174, H25782, N43871, AW407913, AA758370, AA494208, AA552063, AI991234, AA961889, AA301776, AI609606, AA506757, AA370233, AW132067, AI654782, AA459415, W42551, H25788, AI434926, AA364016, AI866432, AI078057, AI825290, D81186, AA314590, AA291876, AI720956, AW103581, AA532661, AA353183, AA853831, AA481544, AA595944, AI468311, AA897049, AA151954, R71996, R54886, AA327953, AA371679, T82388, AA860424, AI128633, H52592, AA100822, AW170175, W42749, AA285031, AA331050, H19087, AA938023, H28635, N34590, AA373337, N25824, AI922550, AI887381, AL121286, T30322, AW161202, AA916133, AA825548, AA908294, AI690738, AI870192, AW025279, AI565172, AA464646, AW162194, AI559752,</p>

					<p>AI114703, AW020419, AI500714, AI554343, AL079963, AI537076, AI285439, AW104056, AA975952, AI433611, AW020693, AI494201, AI539800, AI801325, AW163834, AA828415, AW366372, AW082532, AI805688, AI491710, AI289791, AI524652, AI382670, AI357049, AW129117, AW163554, AW071349, AI812003, AW162189, AI933992, AA761557, AA808175, AI656270, AI310575, AI633061, AL046466, AI340533, AA279795, AI345396, AI445620, AL039858, F27788, AI333104, N99092, AI537863, AI309306, AL037454, AI813986, AI499570, AA127565, AW022636, AW021717, AW089844, AI539723, AA806719, AI973236, R65859, AI590043, AI690813, AW262983, AI586931, AF031147, Z82022, X80340, AL133665, AF017437, AL117416, U96683, E01314, AI8777, AJ242859, I32738, AL133049, AF000301, I89947, E04233, A08913, AR038854, L19437, Y11587, AL110296, AL050116, A08912, AL137556, I48978, A93350, AJ005690, X96540, U92068, AF132676, AF061836, AF106697, A45787, AF057300, AF057299, S76508, AL137530, AL133619, A65341, A77033, A77035, E12806, AF026124, A23630, AF032666, Z97214, A08910, AL133067, A08909, A08907, I89931, A65340, A08908, AF113676, AF106657, S77771, AF091084, I49625, AL122100, I09499, AL080126, AJ006417, AF115410, AL137271, M86826, AF047716, E06743, M27260, AF061795, AF151685, X72889, A15345, A08911, I89934, AL133558, X63410, AL137276, AL080154, AF183393, AL117460, AL117578, X57961, AF106862, AF000145, AF008439, A58524, A58523, I79595, AF002985, AL080086, AF119337, AF110329, AL110221, AL080148, AF081197, AF081195, AF114170, AF036941, AL122106, AF195092, AL096751, AF079765, S54890, AJ001838, X06146, Y11254, AF038847, AL133062, AL050155, AF030513, AF002672, AR034821, I00734, X66862, Y10823, AL117463, A08916, AF159615, AJ238278, AF090903, AL023657, U00686, I66342, AF040751, E00617, E00717, E00778, AJ003118, AL137660, AL137495, AL122093, X67813, AL137641, U35846, AJ012755, X83508, I68732, D83032, AL049324, A07647, A12297, AF026816, AF012536, AF118094, S36676, AF215669, AF107847, E01812, AF11849, AL117649, Z37987, AL133075, AL110158, X57084, AF125948, AF044323, AF061981, E02221, AL133112, AL137479, AL137537, I89944, AR020905, X66871, AL049460, A76337, I33392, AR029490, AL137640, AF153205, AF017790, AL133016, U37312, AF177401, AJ010277, AF004162, AL050138, AL133010, DI6301, M92439, AF055917, Y08769, AF111112, AF162270, AF113019, E03348, X87582, E05822, E03349, L13297, AF069506, X84990, AL122098, U57352, A90832, X72387, U80742, S79832, AL137548, L04504, AF022363, U89295, A18788, E12747, L04849, AL080159, AL137560, AF115392, AF017152, AL137281, U87620, AL137256, AL049452, AF185576, AL122118, AL117435, AB008792, AF061573, U77594, AB008791, AL110280, AR053103, I29004, AL133560, AB019565, AF067790, AR013797, AF028823, AF126247, AF175903, AF090943, AF097996, AF067728, AL137478, Y10936, AL049430, AF051325, AL137258, E02349, X63162, AF176651, U55017, X67688, AL080162, AL117440, U78525, Y07905, U42766, E01614, E13364, and U51587.</p>
HUSYA63	335	928021	1 - 428	15 - 442	AA909334, AI056548, AA723669, AA156125, AA303333, A W409843, A W263540, AA156120, AA157141, and AA151564.
HUSYB16	336	868843	1 - 423	15 - 437	AC008975.

HUSYD15	337	699195	1 - 401	15 - 415	AI264637, AW440517, AA045417, AA308065, AA127626, T96809, W39584, F22528, AA304050, AA082078, AI333981, AI087224, AI289816, N32838, AI042559, AA513003, AA716353, AA121528, AA302332, AI208270, W44935, AI805206, AA112905, AI024761, AA677140, AI087291, AA448463, AA101212, AA704993, AI097092, AA704961, T97914, T97458, AA203274, R09226, AA045311, AW451722, AI685445, N42284, AA062780, T97730, AI094396, AA932240, AA973273, AA062735, AA331180, T96692, AA431571, AI309788, AI248836, AI911056, and AI086794.
HUSYO46	338	868827	1 - 433	15 - 447	T96489, AI820673, T96482, AI732251, T96405, and T96398.
HUSYP67	339	575787	1 - 105	15 - 119	AW008247, F03615, H14592, H16768, AC007425, AP000519, AB023056, AF055066, AL049869, AC004172, AC004192, AB023058, AP000521, AL022723, and AC003001.
HUSZV72	340	851170	1 - 398	15 - 412	N79736, AW149788, AA187127, and AB011095.
HUSZH03	341	922852	1 - 785	15 - 799	R36618, R82444, R26337, and AC006443.
HUSYX03	342	922840	1 - 398	15 - 412	HI4379, R44811, H08865, F03387, and AL135783.
HUSYO86	343	784691	1 - 443	15 - 457	AI373275, T89685, AI718639, AA041276, R89363, AI192953, W80851, AW262845, AI861933, AI913971, AI810948, AI524062, AI970561, W23739, W35338, AA652221, H39865, AI871006, AI122618, AA197299, C75047, AA004293, AA594157, AP000356, AL031005, AC003684, AC006160, AL022721, AL109963, AL031003, AL035684, AC004678, U91323, AL022476, AC006312, Z78022, AC004983, AF001552, AL034548, AF135025, AL049569, AF047825, AF196969, AC007546, AC005412, AL050307, AC005280, AL050318, AL109758, AB023049, AC003043, AC006965, AC005914, AC005529, AC005746, AC003950, Z93930, AC003104, AL035086, Z92542, AL035413, AC005324, U91318, Z95331, AL133448, AL035455, AC007842, AC002350, AF067844, AC003003, AC004821, Z98044, Z85987, AC005482, AP000563, and AC007021.
HUSYN33	344	651293	1 - 450	15 - 464	R42079, AI215849, AI860946, AI024831, AI095766, AI523478, AW168267, AI554112, AI333039, AW263148, AI199955, AI708228, AA909572, AW264918, AI568327, AA936422, AA251096, AA010338, AA133384, AA731460, AA557232, AA058742, AA085448, AI097188, N52329, AA608709, AA031496, AA018410, AI123990, AI124972, AA416589, AI961604, N64588, R68411, R52688, AA593634, AI289991, AI284433, R51734, AA442321, AA975850, AA861668, R23934, AI735426, AI523604, AW317004, AA227638, AI263691, AA480016, AI699675, AW377524, AI499248, AI273115, AA889622, C01392, AA621372, R68066, AA377337, Z40503, W19549, F01878, AI203798, F01877, H88553, N24559, AA214352, AA085784, AW006661, AA814174, Z19952, AI955892, AL048323, AL048340, AL043152, AW157096, AI041393, AI954721, AI074008, AA830839, AI085582, AL046944, AI682932, AI266652, AW167328, X68497, AJ001202, AF129131, AL137478, AJ003118, and AF131821.
HUSYN11	345	943237	1 - 348	15 - 362	AI570590, AW391281, AI524309, AW103371, AI868831, AI687375, AI567351, AI538716, AI680113, AI281779, AI433976, AI568870, AI673256, AI366549, AI753683, AL119791, AW162071, AI866002, AW074869, AI497733, AI682841, AI952114, AW169653, AW071349, AL036759, AL036146, AI340582, AI521012, AI349614, AI859733, AI343112, AI349645, AI349598, AW274192, AW074993, AI800453, AI800433, AW238730, AI702406, AI498579, AI349004, AI349772, AI312152, AI349937,

AL040243, AW068845, AI349933, AI590128, AI866608, AW301409, AL135661, AL036980,
 AL119049, AI500553, AI433157, AI863014, AW148320, AI500077, AL045903, AI249257, AL036396,
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 AI635461, AI631107, AI800411, AI818683, AI499393, AI610645, AI745485, AI445432, AI815383,
 AW302992, AL048871, AI436456, AA508692, AI207510, AI307558, AI920968, AI909662, AI434281,
 AI687376, AI934036, AI469532, AI889839, AI610307, AI866780, AI580190, AW149287, AI345111,
 AL040169, AI697137, AW071412, AI564247, AI874109, AI475371, AI439745, AI609592, AI269696,
 AW166645, AW167776, AI500659, AI811845, AI283941, AI919058, AI628205, AI631057, AI446606,
 AI687415, AI539771, AA493647, AI818206, AI580984, AI683684, AW080838, AI799199, AW075351,
 AI312542, AI799305, AI754897, AI569616, AI909666, AI624668, AW118557, AI811863, AL036260,
 AI907070, AA528491, AL047041, AA585422, AI149592, AI802542, AI620868, AW026882,
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 AI282281, AL042753, AI696846, AI696398, AW193134, AI811509, AI432229, AI318280, AW183130,
 AI273142, AI818977, AI598061, AL121014, AW002342, AL036247, AI499131, AI609580, AI922901,
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 AL050149, I89931, AF090896, AL122050, AL050108, X84990, U42766, AL050116, AL049466,
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 AL096744, AL137557, AF113699, AJ238278, AL133565, AL122121, AL133080, AL117585, E07361,
 AL117583, AF125948, AL137283, A08910, AL110225, X63574, AL117394, AL050138, AL049464,
 AL137459, AF146568, AF091084, Y16645, AF111851, X82434, AJ000937, AF017437, Y11254,
 AL137550, AL133560, AR011880, A65341, E02349, AF177401, AF079765, A08912, E07108, U91329,
 A08909, AL049430, X93495, AL049300, U72620, U00763, A58524, A58523, AL137463, AF118094,
 U80742, X70685, AL049382, AF183393, AL117435, X96540, AL137648, AL122098, AL133113,

					<p>X65873, AL137538, AL080127, X72889, Z82022, A12297, I03321, I09360, AF097996, A77033, A77035, AL137271, U35846, AL050024, I33392, E15569, AL122110, I26207, A03736, AL080159, AF087943, AF067728, E08263, E08264, X98834, U67958, AL122049, I42402, AL137521, AL133077, AL133014, AF061943, AL137556, AL049283, AL133072, AL121603, AL110197, AR038969, AC004690, S61953, AC006840, AF153205, AL133568, AF111112, AC007298, AR000496, U39656, Y14314, AC006336, AJ012755, AF119337, AC007390, AL096776, AL137560, A90832, AF026816, AC005488, AF026124, AL110280, AF003737, AF162270, AL133098, A93350, U58996, AC004987, AC006371, AF000145, AL133104, AL137526, E08631, AF185576, U96683, A45787, AL117440, AL137476, A08911, AL080074, L30117, M30514, Y09972, X83508, AR038854, I17767, I00734, E02221, AF057300, AF057299, AL133067, AL050172, AF079763, AC004200, A07647, E00617, E00717, E00778, X87582, Z72491, U66059, AL035587, AF051325, AF132676, AF061836, AF095901, AF109906, X92070, U68387, AJ006417, AC006222, E04233, E05822, AL137523, AC002467, AF091512, AF111849, I41145, AF106827, and X53587.</p>
HUSYM49	346	723015	1 - 257	15 - 271	<p>AA525157, H54430, AI370548, N68565, T91791, AC007263, AC007676, AC004616, AC005089, AC005225, AC004757, AC002550, AC006966, AC004531, AC006441, AC005412, AC002485, AC002044, AL020993, AC002073, AC005792, AC005338, AC005015, Z84487, AL079342, L44140, AC006121, AC004890, AC007934, AC003035, AC004587, AC002350, AC007279, AL121653, Z93023, AC005049, X55448, AF111168, AC006120, AC004865, AL049712, U91323, Z94161, AL109963, AB015355, AC003037, AC008115, AP000512, AP000553, AC005666, Z83822, AC006511, AC007226, AL049795, AL080243, and AP000691.</p>
HUSYM37	347	464221	1 - 324	15 - 338	<p>AI251034, AI251203, AI251284, AI250552, AI251944, AI349748, AI284543, AI354397, AW268231, AL046746, AW303098, AI345629, AI307588, AA469327, AI345394, AI250577, AA837715, AI223626, AI254770, AI225179, AI271217, N69399, F25761, AI267823, F33126, T52745, AI246061, F23326, AI754105, AI755214, AI249853, AC004560, AC007358, AC005479, AC004030, AL031280, AC005777, AC006126, U91323, AC007792, AC005332, AC005900, AC005632, AC002389, AL035461, AC006930, AC002044, AC004125, AF207550, AF111169, AC005765, L78810, Z98044, AC005264, AC005620, AC005952, AC003070, Z97832, AC003101, AC002492, AC002350, AL121603, AC002299, AC003007, AC002303, AC002045, AC005778, AC005305, AL049749, AC004841, AL008583, AC004382, AC000039, AC005291, AC004821, AC004832, AC008372, AL022315, AC004887, AL035683, AL031595, AC002352, AC002316, AC000070, AC004517, AL035684, AL049538, AL034423, AC008040, AC005562, AL023879, AC005335, AC004112, AC005775, AC003684, AL035659, AL049712, AC005578, AC004525, AC005197, AC006125, AC007193, AC005880, AL136295, AL022323, Z98752, AC004703, AC003982, AC002375, AL023807, AC000026, AC007934, AC006952, AF196779, AC007191, AC004967, AC005177, AC007878, AC004938, AC005480, AC005786, AC003957, AC005157, AL031283, AL022316, AL109939, AC002477, AC003664, AP000142, AC005015, L47234, AF002223, AC010205, AC006079, AC005913, AC004671, AC005944, AL050317, AC004032, AL008735, AC003026, AC005210, AL031289, AC004685, AF001548,</p>

HUSYI13	348	657288	1 - 802	15 - 816	AC002544, AC000063, AL022314, AL021528, U91326, AL049576, Z92547, AL021391, AC004851, AC004885, AF123462, AL034429, U91318, Z83851, AC002070, Z93017, Z97987, AL021155, AL049871, AC005790, AC006312, AL034430, AL035588, AC005779, AL049759, AC005932, AF047825, AC004104, AC007386, AC005839, Z86090, U80017, AC016831, AC004216, AC005339, AC004584, AC002072, AC004067, AC005668, AC006071, AL020993, AL117694, AF107885, AC005821, AC002554, AL035685, AL109628, Z81369, AC004024, AL031585, AC005520, AC005488, Z85994, U62293, AL050307, AC004983, AC005764, AC005031, AC005355, AC000353, AL035089, AC002467, AC007073, AL022324, AL022476, AC007226, Z85996, AL049611, Z97056, AF001549, AC006511, AC005859, AC006013, AC004973, AJ003147, AL079295, Z83826, AC002511, AC007425, AC003956, AC006531, AC007052, AL031284, AC005594, AD000092, Z83840, Z86064, AC006023, D87675, AC005822, AC003010, AC005011, AC005722, AC002059, AC008041, AC004590, AC006014, and AC002378.
HUSYG24	349	677258	1 - 662	15 - 676	N25018, H98802, AW294590, AA553572, AW236050, AI268116, AA777178, AA417117, AW236049, AA463827, and AA445940.
HUSYF74	350	554723	1 - 465	15 - 479	N63953, N40973, H23529, T78668, F08173, Z44774, F08664, and F08221. AA688133, W15472, AA603105, AA773036, H05310, AI242746, AI279200, AI573250, T03740, R38903, AI342482, AI818093, AI221800, AA577570, AI285452, AA872045, T03417, W04515, AI758880, AL041772, AI539153, AW102785, AL039086, AW023590, AL038505, AW161579, AW071417, AI634224, AW238730, AL079963, AI358701, AL041150, AI635067, AI344785, AI567582, AI349645, AI284517, AI923989, AL119836, AL042538, AI345608, AI921379, AI446606, AI312428, AI812080, AI436429, AL110306, AI345471, AI612759, AI929108, AI872910, AW161156, AL120853, AI521012, AI627988, AW089179, AL121328, AL036403, AI874166, AA580663, AI670009, AW059828, AI635942, F27788, AI625589, AI567351, AL048656, AI348897, AW082113, AL119791, AI567993, AI815232, AW302965, AL038605, AA640779, AI340603, AA613907, AA572758, AI950892, AW068845, AI923370, AI612920, AI783504, AI499285, AI620284, AI859464, AL119863, AI445992, AI537244, AI538342, AI866770, AI433157, AL036631, AW188539, AI702073, AI538829, AL049085, AI340511, AW269097, AL036396, AI269580, AI499986, AI174819, AI500061, AI689420, AI251830, AI288285, AI633125, AI345347, AI310575, AI698391, AI251221, AI801325, AI500523, AA493647, AI915291, AI582932, AL121365, AI500706, AI340533, AW026882, AI521560, AI889189, AI500662, AI343059, AI345745, AI284509, AI312542, AL041220, AI866573, AI830029, AI343091, AA833760, AW022682, AI866798, AI888661, AW403717, AI340627, AI308032, AW074993, AI349933, AI349614, AI431424, AW022699, AI343112, AW193134, AW302992, AW105601, AI919345, AL036980, AI686906, AL047422, AW268253, AI862144, AW301300, AI567612, AI349598, AA225339, AI440263, AI890806, AL036664, AW075207, AI349256, AI554821, AI589267, AI312152, AI636719, AI955906, AI345735, AW268072, AW075084, AW191003, AI950664, AI468872, AW152469, AI698427, AI349937, AI499920, AI364788, AW089572, AI334884, AI335426, AI348777, AL036274, AI307708, N71180, AI312325, AI500659, AA641818, AL038445, AI890507, AA579232,

				AI933589, AI313320, AI089748, AI612885, AL134999, AA494167, AI432040, AI863321, AI609911, AI445990, AW020693, AI307520, AL036638, AW074869, AI445237, AW151138, AW243886, AI312146, AI312339, AI345258, AI889168, AL040241, AA508692, AI745713, AI434256, AW151136, AW150578, W33163, AW195969, AW020419, AW163834, AI866608, AL048644, AW050522, AI570807, AW081255, AI471361, AL045500, AI267502, AL036802, AI457113, AI343037, AI862142, AI174394, N71199, AI866002, AL038959, AL036214, AI784230, AI679724, AI446373, AI340582, AW073898, N33175, AL134259, AI539687, AI345737, AI537677, AB002372, A08916, X62580, A08910, I89947, A08909, X92070, A08913, I48978, AL122050, X70685, AL137459, AF113691, AL117460, AL137658, I89931, I49625, AF113690, I48979, A12297, AF061943, AR011880, AL080060, AL110196, AR038854, AF177401, AL049430, S78214, AL133568, Y11254, AL117583, AF090901, AL133113, AL133565, AF026816, E03348, AF017437, A65341, AR059958, AL110221, AF125948, AL133077, AF158248, AL050108, AF113013, X93495, AL133606, A58524, A58523, AF078844, AF118094, AF097996, AL133640, I42402, AF111851, E08631, AF113676, AL137527, AL133093, U00763, AL137557, I33392, E02349, AL137648, AL080158, A93350, AF090886, AF090900, AF090903, AF185576, AL117432, AB019565, AF090934, AF113677, AF118070, AL049452, Y10080, AL133557, AL122093, X63574, AL122121, X96540, X98834, AL050277, AF113694, AF113019, AF113689, Y16645, AL049466, Y11587, AJ000937, Z72491, Z82022, AF183393, U91329, AL122123, AF091084, AR013797, AL133104, AR038969, AF118064, AL050024, AJ238278, E07108, AF125949, AJ003118, AL117435, U42766, E01614, E13364, X72889, AL133560, A08912, A93016, AL137283, X87582, AL049283, AL133080, AF113699, AL137550, AL137538, AL117457, AL050116, AL050146, AF090896, AF079765, X82434, AF067728, A77033, A77035, AF087943, AL049382, AL137271, A07647, AL096744, AL117394, AL050393, A03736, AF057300, AJ012755, AF057299, AF104032, AL122110, AF119337, AF003737, I26207, A18777, AF017152, S68736, U80742, S79832, AF022363, AL049464, AL049314, AF079763, AJ242859, AL117585, AL122118, AL133072, X65873, AJ006417, U72620, AL080086, X72387, AF090943, E06743, AF132676, AF061836, AL050149, L31396, AL110225, L31397, AL122049, U67958, I03321, AF118090, AF153205, D16301, AL133075, E15569, AL080137, AL050155, AL137521, AL110280, AL080124, AL137429, E04233, AL137560, X84990, AL080127, AL137705, U35846, AL137300, AF106862, AL133098, AL122098, A08908, AL133016, AF146568, I00734, AL137463, X81464, S61953, AF176651, AF031147, AF026124, E00617, E00717, E00778, AL133014, AL137479, AL137476, I41145, AF162270, Y10655, AL137526, AL049300, I09360, AL049938, AR029490, A90832, AL122111, AF111849, U68233, I92592, AL050092, AL050138, AL137480, AF061573, E07361, AR020905, AL133067, AF065135, AL080159, AF051325, M30514, U58996, U68387, AL096751, AF028823, AF126247, L19437, AL110197, I17767, AF142672, Y09972, I09499, U88966, AF111112, and AL080074.
HUSYA27	351	934423	1 - 624	15 - 638
HUSXW61	352	741856	1 - 623	15 - 637

HUSXM28	353	703326	1 - 418	15 - 432	T84537, R92899, and AC007999.
HUSXI71	354	760415	1 - 155	15 - 169	N77614, and AL034417.
HUSXH57	355	859907	1 - 656	15 - 670	AA894530, AI336165, AI379833, AI870419, AI339336, AW173013, AI660120, AI697018, AI418065, AA946777, AI372055, AI961630, AI281293, AI018252, AA918864, AI804228, AI280166, AI191797, AA115687, AI476152, AA938579, W58372, AI124079, AI123356, AA460235, AA961355, AI201697, AA806449, AA181956, AA633371, N54918, AI284979, AA975500, AA948109, AI262806, T86966, AA864307, AA126483, AA670154, AA187579, AI285113, AA928294, AI282777, AA856633, AA554905, W04639, H01916, AA952898, AA358260, H04478, AA939258, AI498851, AA283086, AA070685, AA503091, AI473325, T56012, AA553782, AI718566, N21275, N78134, H78232, T31842, AA651925, AI583297, W31735, AA383311, AA383310, R70784, D20722, AA296522, AI381360, N40501, AA282901, W58050, C14037, AA932915, AW188939, AA770225, AI284357, AA969062, AA918735, AI658500, and AB034206.
HUSKA86	356	784887	1 - 411	15 - 425	N72485, H71940, AF072873, and AB012911.
HUSKA65	357	868860	1 - 490	15 - 504	AA551165.
HUSJW03	358	923035	1 - 700	15 - 714	AI057455, AA699325, H75865, H75866, AP000247, AC004216, AC005071, AL035415, AC005790, and AL121603.
HUSJN66	359	886987	1 - 766	15 - 780	AA426047.
HUSIT75	360	679416	1 - 453	15 - 467	AA040679, AI669256, AI763048, AI902903, AW245958, AW237088, AF039235, U25751, AI312767, D80899, AI571378, AA362530, AW296090, AI354976, AI093187, AI680102, AA625161, C01220, AW119180, AI140327, AA934553, AI201269, AA559846, AA040597, AI991982, AA359868, AI203368, AW087508, AA497000, AW268813, AW152391, AI243335, AI185996, D80898, AI887841, AA489585, F31194, and AI700879.
HUSIS59	361	739327	1 - 217	15 - 231	
HUSIS54	362	730734	1 - 188	15 - 202	AI149061, AW130563, D87675, AP000089, AP000142, AC005182, AC005089, Z83822, AC004832, and AC007229.
HUSIS08	363	959536	1 - 421	15 - 435	AA663486, AA635417, and AA196796.
HUSIR04	364	709228	1 - 422	15 - 436	H77990, H90576, and AI267628.
HUSIN12	365	970759	1 - 481	15 - 495	AI689603, AL039203, and AW104130.
HUSIE95	366	967176	1 - 482	15 - 496	AI186511, AI905032, AW248242, W30830, AI908041, AA287850, and AF212940.
HUSIE18	367	666523	1 - 404	15 - 418	H47045.
HUSIE08	368	908574	1 - 964	15 - 978	AA736450, AW205616, AI492501, AI275895, AI806754, AA426438, AA437170, AI825464, AI984990, D81011, D81007, AI954689, AI962153, and H26441.
HUSHL86	369	960355	1 - 1399	15 - 1413	AA703915, W19899, AI926481, C06034, AL120774, AI926508, AI889895, AI125240, AA508101, AI140921, AI620543, AI889904, AA557537, AI198792, AI222307, AA744258, AI400233, AI630644, AI266510, AI832176, AI699153, N91246, AA312954, AA258943, AI718296, AA053015, and AF151805.

HUSHE34	370	703409	1 - 549	15 - 563	AA253268.
HUSHB71	371	766060	1 - 329	15 - 343	H79732, and H79731.
HUSHB60	372	746560	1 - 462	15 - 476	AA132883, AA253947, and AB033047.
HUSGW06	373	935574	1 - 625	15 - 639	AI375142, AI041354, AI739576, AW449593, HI2704, AI684781, HI2705, AW151325, AL137763, and AL031431.
HUSGV84	374	813557	1 - 433	15 - 447	N22167, AI469417, AA186334, AI084312, AL048280, AL048279, AA845906, AA542871, AA164584, AI927103, N92214, AA482803, AA482818, AI206093, AA884457, AA167321, AA548958, AI925703, AI537994, AI973197, AA985451, AW072297, AW054739, N64610, AW151542, AW105365, N93598, AI866140, AI399865, AA525978, AA516263, AA587848, AA663007, AI857882, AA594987, AA173554, AA156124, AA830434, AA125898, AA834145, AA620469, AA843345, AA844552, AI023983, AI041347, AA045631, AA854158, AA582010, AA618385, AI872043, AA101123, AA187231, AI924029, AI126870, AA595697, AI338472, AA524686, AA469343, AA865364, AA652110, AA657769, F24916, AI720143, AI698664, AA862692, AA469127, AW263715, T34217, AA501497, AI687698, AI253667, AI745562, AI669479, AA748114, AW440479, AI033755, AI598103, AI282490, AI567685, AA527738, AW304954, AA046680, AI630921, AI687740, AA927656, AW169855, AA195478, AI301902, AW243866, AI253769, AA541719, T51486, AI984248, AI360533, AA224320, AA176133, AA121062, AA635576, AA635568, AW151767, AI709168, AA112117, AI052129, AA227540, AA565009, AW275898, AI275685, AA662712, AA527766, AI744375, AA514849, AW316620, AA971114, AA227680, AA931889, AI199685, AI306714, F33796, AI954557, AI609269, H73139, AA480503, T93062, AA469196, AA834505, T92777, AA167699, AI523421, AA853136, AI472161, AI560670, AI567024, AI358189, AI244950, AI222622, AA593985, AI922122, AI253759, AW071035, AA223905, AI890437, HI9976, AA224846, AI460153, N64480, AI8900697, AI444954, AI972952, Z28473, AI889384, AI708079, H06213, T41240, AI671926, AI041981, D12312, D51107, AI038910, H30023, AI687614, AI869809, AA716547, AA530894, AI749102, AI833109, AI749897, AA661582, F19628, R71226, AI720476, AW440666, AI719996, AI091016, AI961304, AI954378, AI274494, F28330, AW078568, AI807358, AA508357, AA570600, AI493435, AA507860, AA425416, AW167098, AA687857, AA724960, AW167109, F27045, AW363237, AW363233, T93147, AI422648, AA167142, AI312755, D56789, AI380771, F25929, AI676180, AI312752, AA738139, C16070, AI783456, AA775238, D57103, AI932746, D57956, F01287, AA962120, F28415, F29404, AI269032, AI871878, AI434478, AI925288, F30481, AW198053, N75639, AA541559, AI718158, AI750135, F30485, F20314, AA487950, AI932857, AW374950, F35602, AI632607, D54610, AI864772, N55135, AA480577, AA247574, F00097, AI131951, and AJ225898.
HUSGU08	375	959540	1 - 429	15 - 443	AI745055.
HUSGT01	376	916620	1 - 509	15 - 523	AA610520, AW296489, AA179163, AI824978, AA827817, AA483268, AC004966, AL049761, AC004216, AL031591, AC002059, AC004626, AF109907, AC006014, AF064861, Z84466, U62317, AL031904, AC000026, AL022324, AP000099, AP000260, AC005775, AC003662, AC004973, and AC015853.

HUSGS35	377	707777	1 - 666	15 - 680	AI271425, AI223830, AA564436, AA251799, AI167485, N26127, AA143235, AI051406, AA975269, AI927242, AI565174, AI052812, AA405571, AA251929, AA610292, AA826503, AW371603, AW103340, AI289757, AI472362, and AI431964.
HUSGQ62	378	745727	1 - 492	15 - 506	R93146, AA704227, AI340024, and AC005021.
HUSGM24	379	425180	1 - 773	15 - 787	R81604, AI928098, and AI347338.
HUSGJ68	380	753059	1 - 352	15 - 366	AA767257, AI799645, AA906290, W57567, AA729117, AA171892, AA526416, AI732502, AI791301, AA205911, AI791458, T71257, AA658087, AA743698, AA551400, R36518, H47143, AA330897, AA446645, AI057588, AA225380, N91747, AI748842, H69661, AI339725, H73306, H52510, AA358852, AI475758, AA424008, AA167159, AA487281, AC003003, Z68277, AC002430, AC007384, AP000699, AC002420, AC007786, AC007536, Z99755, AC011504, AF111167, AC005071, AC006047, AP000509, AC002350, AC007066, AC005180, AC005821, AC002288, AC004644, AC006111, AL117344, AL023883, AL049697, AC006204, AL034377, AC007488, Z98304, AC004885, M89651, AL008725, AC004910, Z95152, AC005839, Z94277, AL049742, AC020663, AC007371, AL022721, AC006071, AC005911, AC005323, AL137191, AL022316, AL049776, X90590, AC004638, AC007993, AL049871, AC004587, Z99754, AD000092, AL022726, AC005933, AC004750, AC002077, AC000387, AL022315, AC006449, Z82176, AC005702, and AC005204.
HUSGH09	381	625647	1 - 726	15 - 740	T98941, AA777690, AA704182, and AF057709.
HUSGF79	382	775309	1 - 424	15 - 438	AA262313, R67992, AA262917, AI420959, and AI695670.
HUSGF59	383	576784	1 - 302	15 - 316	F34498, AA491814, AL119691, AA661921, AA689526, AI284640, AA493708, AA527630, AA714453, AA502103, AA063173, AA580808, AA613591, AA613397, AA658362, AW303196, AW274349, AI754955, AA507547, AI281697, AA502860, AA316905, AI338350, AA491862, AW270382, AW028392, AA559290, AA618452, AA847409, AI282511, AW168618, R77905, AA525824, AA362349, AA848134, AW103758, AI687343, AA857486, AA346458, T94842, AI358571, AA806796, AI367975, AA514854, AA491650, AA469451, AA847516, AL046409, N27763, AA491284, AI499487, AW301350, R89294, AI084294, AA362698, AW265385, R98359, AA491831, AA364429, AA219225, AA812281, F17891, M78005, AI821271, AA641052, AA483256, AA531079, AI678316, AA828227, F17555, D52587, AA713891, AI798489, AI281881, D51681, AI537077, AA501600, AA630925, D83989, X75335, X55923, AF077058, U67827, U67829, M87925, AF015151, AF015156, M87919, AF010317, AL133246, S70707, L10641, AL031255, AC006292, AC006596, AC000353, AC004638, AL031650, AP000555, U62293, AC002564, L49046, S43650, AC009510, AL132800, Z49769, AD000684, AL133276, Z69666, AL031054, AL031542, AC005288, AL031281, AF001549, AL031668, Z70042, AC002045, AC000118, U49740, AB019437, AC004016, AL096765, Z97205, AC004931, AC005696, AC000379, AP000431, AL132712, AC005257, AB020859, AC005913, AC006213, U66059, AC007682, AC005603, AL110120, U38950, AC004134, AC008079, AL080242, AC007285, AL023882, AL031657, AC010382, AC007043, X14448, AP000159, AC004987, AC006128, AC006130, AL035668, Z98742, AC006057, AL023755, AL133494, AC005597, AC005837, AL022302, U85195, AC005839, AC006315, AC004675, AC005862, AL023800, AL049544, AC005740, AC006155, AL020993,

						AC007324, AC003103, AL078615, AC005026, AP000557, AC004041, AC007919, AF045448, AC008101, AE000658, AC004946, AC007319, Z74022, AC007666, AL031682, AC007263, AL009179, AC007064, AC004690, AL078581, U91321, AC004972, Z98051, AC006538, AF042090, AP000114, AP000046, AC002350, AC004650, AC006045, AF064861, AC009247, X69907, AF088219, U72787, AC009069, AP000459, and AP000090.
HUSGF10	384	964844	1 - 564	15 - 578		
HUSGE22	385	888829	1 - 446	15 - 460		
HUSGB36	386	572924	1 - 418	15 - 432		
HUSGB01	387	916804	1 - 423	15 - 437		R33929, and AC004099. T70191, AC004812, AC007263, AC005412, AC004686, AF111168, AC004253, Z84469, AC008044, AC006111, AC000353, AC006128, Z98941, AC004216, AC005057, AC005484, AC005911, AL031005, AC016027, AF067844, AC006312, AB023051, AL049843, AC016830, AP000512, AC006449, AF196779, AL035413, AC008040, AC005785, AC005667, AL009183, Z98884, AC004491, AC006948, AC004150, AC005037, AC004526, AC005004, Z95329, AC004019, AL133445, U62293, AC005792, Z99716, AC004972, AC007386, AL109623, Z84487, AC005736, AC005345, U63721, AC005081, AL031681, AC005776, AC007207, AL031283, AF053356, AC005086, AL022315, AC004752, AC005696, AF001549, AC004382, AL121655, AC005067, AL022336, AL031846, AL031602, AF045555, AC008372, Z85987, AC005585, AC020663, AL049569, AL031666, AC004685, AC004605, AC007773, AC006511, AC007114, AC006974, AL034549, AC005874, AF134471, AC002316, AP000689, Z84466, AC002565, AL109798, AC006057, AC003665, and AC006571. H53955, and T95446.
HUSFH89	388	786970	1 - 500	15 - 514		
HUSFF03	389	924616	1 - 577	15 - 591		AA769109, AA283754, AA883471, AB023137, AF033276, AF033275, and AF033274.
HUSFE05	390	932106	1 - 796	15 - 810		AA251680, and AA219333.
HUSDA09	391	461656	1 - 475	15 - 489		AA180076.
HUSAY21	392	920403	1 - 508	15 - 522		R66556, R66555, AA305729, AI903265, AA648467, and T03611.
HUSAO27	393	955287	1 - 320	15 - 334		
HUSAM87	394	529783	1 - 134	15 - 148		
HUSAM35	395	558191	1 - 245	15 - 259		
HUSAM22	396	523674	1 - 100	15 - 114		M63005, M63543, M63480, and M63544.
HUSAL04	397	927719	1 - 316	15 - 330		AC004547.
HUSAJ57	398	678932	1 - 339	15 - 353		
HUSAJ15	399	522056	1 - 243	15 - 257		R45895, T18597, R28735, R29445, AA585325, D54897, D60765, R28892, D60844, AA585098, AA170832, R29657, R29218, AA585101, R28895, D61185, Z32887, D59751, C15406, D53161, C16315, D61254, AI546999, D55233, D57491, Z32822, R28965, AA585439, AA283326, AI557262, Z28355, AI546875, C15069, R28967, AI557864, AI541356, D59436, D53472, C16294, AI557734, C16293, AI525316, C15120, D52835, AA585476, AA585155, D53447, AI526140, AI546971, AI541365, AI525500, AI557740, C15762, AI541383, AI525431, AI547250, AI547202, AI546945, AI541374,

HULAG30	400	788577	1 - 461	15 - 475	AI525306, C16292, AI541205, AI547039, AI526184, AI557763, AI526078, AI540903, AI541517, AI541013, C15737, C16300, AI526109, AI557731, AI557718, AI557727, AI526016, AI541307, C16305, AI541535, AI525556, AI541034, AI526194, D60730, Z33559, AI546891, AI557084, AI525320, AI557602, AI557787, C16296, R29179, Z30131, AI547006, AI546921, AA585356, AI557807, AI525339, AI557758, AI541346, AI546996, AI540967, AI526195, AI557809, AI541523, AI535639, D57186, D51433, AI526191, D54850, AI526113, AI557408, AI557533, D59458, C14208, AI557155, AI547196, R29262, AI546831, R29172, AI557852, C14391, AI557808, C16290, AI541527, R29177, AI547137, AI556967, T41289, AI540974, AI541027, AI525856, AI526024, AI526117, AI541321, AI526112, AI526158, AI557279, AA585453, AI546901, AI541422, AI526146, AA514191, AI526073, AI524904, AA585430, AI535660, AI541492, T19407, AI525286, AI541506, AI546829, AI557799, AI540920, AI557264, AI526180, AI525332, AI524890, C14322, AI525076, T41329, AI546828, AI541510, AI557039, AI541515, AI525168, AI541415, AI525656, AI546954, AI540882, C14210, AI557317, AI547189, AI536138, AI526205, AI541423, AA174170, AI540944, AA585434, AI557810, AI541345, C14723, AI557786, AI525114, AI557041, AI541390, AI526196, AI541017, AI525040, AI557238, AI557082, AI524891, AI557785, AI557285, AI541514, AI546841, AI526169, AA585420, AI526125, AI541508, AI547138, AI046024, AI526187, AI526026, AI540928, Y09813, AR062871, A25909, AR038855, X82786, X76012, AJ244005, Y16359, AF082186, AR038762, Z32836, AR054723, X81969, D50010, D13509, AJ244004, A20702, AR062872, AR062873, A20700, D78345, A43189, A43188, X55486, AR017907, AJ244003, AJ244006, AJ243486, AR031358, AR031365, A98420, A98423, A98432, A98436, A98417, A98427, AR003381, AC005913, X82834, AR017826, A98767, A93963, A93964, I63120, and Z30183.
HMELV25	401	678120	1 - 491	15 - 505	R21151, AA053860, AA256918, AA054011, AA258280, AA026671, R72975, N48017, R69294, D79117, W47268, W78713, W56158, AA417682, H03608, AA379320, AA019166, AA026702, R34494, H84115, AA131247, AA044911, AA164369, AI301065, N36665, N73920, and AA131515.
HMELV14	402	876087	1 - 385	15 - 399	T97544, AA811921, AW237809, AA256699, and AL031591.
HMELR45	403	717696	1 - 178	15 - 192	AI026625, AA897168, AA846392, H30053, and AA989218.
HMELM86	404	784702	1 - 235	15 - 249	AL078634, AF031075, AF030876, U52112, AC004213, AL022723, AC006199, AL122021, Z68869, AC002425, and AC002352.
HMELM85	405	783536	1 - 211	15 - 225	C06367, and AL034374.
HMELM03	406	924168	1 - 302	15 - 316	H70012, H69999, AA188729, AI623442, AI078409, AA584765, AA729384, AW237905, AA302690, H73550, AA595770, AW304580, AA833896, AA833875, AA713705, AI298079, AI742168, AW265688, AA601728, AA582746, AI272052, AA536040, R91816, AA481887, AA654874, AA279649, T60666, N71729, AI369580, AI491755, AL040430, AA995373, AI282629, AW300749, AW194046, AA912287, AA663461, AA564642, AI024339, T17332, AI963679, AA455252, AA680253, N35306, AA525293, AI792439, AA689351, AW002831, AA525379, AI917132, Z30294, AA360245, AL045476, AA582374, AA346436, AA493808, AA715277, AA485343, H52397, AI583448, C14480,

				AA525807, AI224619, H82636, AA508036, AI918419, AL121287, AA829490, T73699, AW304536, AA502498, AL110215, AP000501, AL135744, AC005484, Z96243, U17576, AL022238, AL109627, AC003982, AL079342, L78833, AC005224, AC004821, AL035659, AP000689, AL021808, AC002432, AC002126, AB003151, Z93241, AC004595, AC002301, AC005288, AC009946, AC006241, AC006966, AF196969, D87675, AL031447, AP000503, AP000569, AC007308, AC002395, AC002565, AL008726, AL121769, U62293, AC003007, U63721, AL031848, AL035405, AC009247, AC005736, AC004149, AC004805, AC004817, AC006480, AC006430, AC005632, AC005340, AC005102, Z98036, AC005231, AF072711, AF111169, AF047825, AC006111, AC005041, AF134726, Z85987, AC005527, AC006509, AC000085, AL049631, AC004955, AC005005, AC005920, AF001548, AC005088, U80017, AC002470, AC004893, AC005189, AL133163, AP000141, AC006285, AC004531, AC004650, AC003029, AL121748, AC003104, AC005839, AC004143, AC006013, AC007011, AC004655, AC003108, AC004000, AP000305, AL049761, AR004690, AL049696, AL121754, AC005015, AC004491, Z98742, AL031427, AC005057, U62292, AC005280, AC002299, AC005089, Z86090, AC007242, AC005921, AL049834, AC005488, AC004922, AL035462, AC006315, AC005944, AL031296, Z82206, AP000030, AC004834, AC005306, AC005625, AL035420, AF128893, Z98752, Z83826, AL022323, AP000300, AP000497, AC005529, AL035652, AP000555, AL078581, AD000812, AC006030, AC005332, AL022311, AF207550, AC007066, AL021707, AC002991, AC004106, AJ009610, Z84476, AC005602, AC005512, AC020663, AL031589, AL031311, AL035089, AL049856, AC005907, AC005409, AC005666, AP000031, AP000047, AL021939, AL008730, AP001060, AL109839, AC005701, AL109865, AC004596, AP001052, AL121655, AL031685, AP000301, AC007326, AL049766, AC005730, AL109984, Z93930, AC004597, AC005777, AP000066, AC002378, AL031681, AD001502, AC002544, AL034402, AC007226, Z98884, AC005694, AL049839, AC005755, AP000359, AL121653, AC005082, AC005790, AP000557, AD000092, AC004560, AC006441, AC004477, AC004755, U07562, AL049757, AL049779, AP000502, Z95116, AL096701, AC003080, AC004973, AC004263, AL118516, AC007566, AC010205, AL035400, AL031577, AC012085, AC007649, AC007390, AL022327, AC004985, AL133448, AC007565, AC006277, AC005553, AC004605, AC005048, AC006271, AC007193, AC006538, AP000045, AP000113, X96421, AC004659, Z84480, AL022326, AC005585, AL022165, AC005932, AC006115, AC003962, AC004858, AC007546, AP000114, AL031291, AF111168, AC005911, Z82901, AC003663, AL031295, AL009183, AC005257, and AP000115.	
HMELI57	407	734769	1 - 556	15 - 570	AA182703, AI275893, AI312591, AW081314, AI890203, AI192785, AI376547, AI741045, AI382078, R19548, AI769235, AA927822, AI338465, AI074270, AI807959, AI370112, AA725073, AI051770, AA598799, AI023985, AA129014, and AB033055.
HMELH60	408	422844	1 - 416	15 - 430	AA807514, AA348342, AA280883, AA827687, AW188273, AI565521, AA037530, W21023, C15105, AA232584, R29652, L23320, X69821, AF040250, Z22642, and A37862.
HMEKZ06	409	935467	1 - 299	15 - 313	AA449734, AA427598, AW444685, AW449906, AI795836, and AI089108.
HMEKW07	410	953369	1 - 610	15 - 624	AA878223, and AC003663.
HMEKQ19	411	668659	1 - 571	15 - 585	AA429954, and R16779.

HMEKO03	412	924172	1 - 395	15 - 409	AI243588, AA521176, and AA280671.
HMEKJ40	413	711187	1 - 327	15 - 341	R09458.
HMEKH73	414	923893	1 - 581	15 - 595	AA424126, AA446776, W77829, W72193, AA662191, AI678126, AI927019, AA248915, AA432090, AA424038, AA282355, and AB032954.
HMEKC72	415	760637	1 - 407	15 - 421	AI668582, AI733530, and H27330.
HMEJW50	416	724396	1 - 301	15 - 315	T87438.
HMEJJ81	417	777945	1 - 485	15 - 499	W86772, AI057384, AA778241, AA447568, AA806287, and AI566837.
HMEJF25	418	678131	1 - 424	15 - 438	AA135338.
HMEIV22	419	674611	1 - 490	15 - 504	H38908.
HMEIS07	420	922703	1 - 374	15 - 388	AW245436, AA527311, AI590091, AI983410, AI091713, AI346717, AA398347, AW080183, AA512959, AW005087, AA058970, AW128940, AI089097, T53469, AA657971, AA025746, N92837, AI472329, AI056168, AI802669, AI468989, AA232933, AI250941, AI500614, AI245602, AA764762, AI269006, AI470306, R43430, AI984174, R40489, AA025898, AA858342, AI687814, AA836964, and AA410714.
HMEIA06	421	935966	1 - 240	15 - 254	AB020860, AC006312, and AL096702.
HMEGK14	422	796443	1 - 710	15 - 724	AA005070, W90563, and AA379086.
HMEGH92	423	790629	1 - 481	15 - 495	AA252756.
HMEFD72	424	766185	1 - 398	15 - 412	AA215529.
HMEEL38	425	733649	1 - 588	15 - 602	N52853, T69848, T70384, AA307828, AA325554, N27041, AA361398, R88485, T26592, AW368306, AW408494, H08241, T80355, W28865, AA447395, AA426157, AW138787, AW236918, AA382949, AW362933, AI908338, RI7363, AA164794, and T23060.
HMEDR76	426	529897	1 - 161	15 - 175	AC002357.
HMECQ10	427	968500	1 - 311	15 - 325	AA306797, AA278590, AA315885, and Z56144.
HMECH43	428	715568	1 - 291	15 - 305	AA211808, AW405016, R01660, AI246409, AI049534, AW277135, AI146266, AW249720, and AC004690.
HMEBY95	429	796058	1 - 337	15 - 351	AA251522.
HMEBG01	430	921763	1 - 281	15 - 295	AI668626, AW029612, and H42199.
HMEAN12	431	655220	1 - 390	15 - 404	R81266, AW385354, AA968573, AW069537, R81167, AW391238, and AA570569.
HMEAI38	432	709207	1 - 490	15 - 504	H93846, and AL096710.
HMEAH31	433	698403	1 - 249	15 - 263	T69104, T69027, AA092794, AI907131, AA622562, AF149045, and AF149046.
HMEAE24	434	880925	1 - 156	15 - 170	AI354388, AW089663, H98198, AI612070, AI611533, AA834814, AL041749, AA769429, AA224238, AW008089, AA715280, R92172, AA173041, AI933505, AL096774, AC005231, AC003982, AL022320, AC003080, AL008712, AC007666, AF196779, AL096791, M89651, AC008122, AL021397, Z93783, AC003007, AC005907, AP000114, AC002369, AF207550, AC005480, AC006166, AC005324, AL035454, AC004983, AC005632, Z97630, AC005971, AC004056, AC004796, AC006449, AL121825, AC007216, AC002316, AL022333, AC004491, AC004966, AC004167, AC004596, AC004820,

HMEAE01	435	916744	1 - 299	15 - 313	<p>AC006059, Z97056, AL031311, AB023051, Z97054, AL049611, AF053356, AC005670, AL049780, AC005837, AL031685, Z68756, AL035249, AL021707, AL049694, AP000512, Z69705, AC004812, AP000501, AC004754, AL109827, AC004913, AC004859, AL049759, AC006026, AL008721, AC005015, AP000692, AC004236, AL133448, AC005332, AC005924, AC005291, AC008372, Z83847, AC004706, AC005004, AC005102, AC004381, AC005598, AC004000, AL031276, AC005071, AC005372, AC003030, AC004520, AL135744, AC006125, AC006130, AC006515, AC007546, AC005253, AC002544, Z82176, AL022311, AC006273, AP000030, Z93017, AC020663, AL021453, Z82201, AC006071, AC007011, AC005399, AL020997, Z99716, AC002045, U96629, AC007052, AC005094, AC005081, AL109963, AC005484, AC005529, AC004560, AC005006, AC005881, Z84469, AC004510, AC006371, Z81370, AL035587, AC004084, AP000251, AC006312, AC005261, AC007487, AC005920, AL049830, AC002310, AC002365, AC005578, AC002565, AC003043, AL049757, AL021154, AC005089, AC006079, AC005288, AC004858, and U95742.</p> <p>AL135643, FI3749, AI791610, AI751162, AI821467, AW162288, AA230143, AI696793, AI073888, AA563770, AA669709, AA176605, AA579184, AW168479, AW440976, AW168483, AW236342, AW368401, AA828867, AA574286, AI301218, H91844, AI076236, AA360260, AI886365, AW271917, AA657835, AI061111, AI904944, AA357285, AI982634, AA837715, AA331482, AI648558, F23327, AL043098, AL046746, AI753365, AA366601, AA228263, AA608520, AA828047, AA992126, AA847099, AA311156, N59562, AW157005, AA130647, AI028510, AA743811, AI090334, H62670, AA865262, AW384449, AI358089, AA365586, AI566408, H73704, AA569065, AI309384, AW270258, AA747243, H15032, N23260, AA557911, H05821, AA573578, AA365587, AA467730, AA515677, AA761795, F31654, H63806, AA457249, AI357551, AW191886, AI244254, R24915, H53168, F25203, AW327624, AA772016, AL037952, AW327282, AI291124, AA302980, AA578967, AA574442, AA574353, AI709174, AI811460, F32893, AA513234, AA192330, AI291268, AI539776, R92640, AA077776, H79308, AL031393, AC005808, AC005154, AC004263, AL031053, AC002470, AC010582, AC005988, AC005940, AL031587, AC009516, AL034553, AL008635, AL022165, AL096818, AC007308, AC003982, AL031311, Z84480, AL121825, AC004983, AC002425, AC012627, Z99289, AC005971, AC005057, AP000049, AP000116, L44140, AP000311, M30688, AL133163, AC003964, AL049576, AL117536, AC006511, AL122003, AC006430, AC004072, AL109799, AC004517, AF037222, AL034420, AC006273, AP000692, Z84469, AP000503, AC006077, AL008718, AL022316, AF111163, AF147277, AC005274, AL031589, AC010197, AL022476, AC002394, AC007774, AL049794, AC005618, AF134726, AC004134, AC007406, AC004837, AC000353, AC002563, U67093, AR028159, AP000557, AC004706, AC004904, AC006241, AL031774, AC004887, AP000689, AC005856, AJ133269, AL031584, AL049589, AC006538, AC006530, AC005410, AB003151, AP000045, AC006063, U14702, AC008033, L47234, AC006088, AC004232, AC004080, AL035530, AC002480, Z69917, AC007041, AP000509, U73649, AL049869, AL096701, AC005736, AC006254, AC005209, AP000511, AC007564, AC006537, AC005062, AL136295, AC006509, AL096766, AC006356, AC002301, AC003692, AL109963, AP000512, AC005696, AC004985, AF117829,</p>
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HMEAD86	436	785802	1 - 344	15 - 358	AA251058, and AA807055.
HMEAD47	437	720638	1 - 407	15 - 421	T79734.
HMEAA17	438	921765	1 - 464	15 - 478	H10273.
HHFUB83	439	800580	1 - 277	15 - 291	
HHFOU02	440	918070	1 - 715	15 - 729	AW296654, AI498432, AI498430, AI758371, W73054, and U82695.
HHFOL43	441	974002	1 - 498	15 - 512	
HHFOK10	442	961346	1 - 342	15 - 356	AA280678, AI128307, AI890650, AI538161, AW190537, AI207930, AI358856, AI913895, AI114875, AA564510, AA401182, AA225175, AW273466, AI358915, AI743933, AI037933, AA604799, N72011, AA362732, AW276723, AW276763, AW157028, AA745570, R84431, AA864787, AI479583, AA085683, AA486832, AA487152, AC004883, AC006160, AC004217, AL022575, AC002070, AL034343, AL080241, U55729, AL021578, L11910, Z93930, AC002994, Z95114, AC002096, AL109839, U91322, AF111168, AC005291, Z85997, AL031733, AP000501, AC005274, AD000812, AL035398, AC002126, AF047825, AC007308, AC007160, AL021579, AL031280, AL035690, AC005875, AC005482, AL024507, Z77249, AF029081, AP000047, AP000115, AL031285, AC007052, AC005562, AC000075, AL033392, Z99916, AC004813, AC005664, AC005844, AC004985, AC000097, AC007386, AC006547, AF067844, AC004491, U82828, Z83822, AL009181, AC003669, AF165926, AL049780, AC007055, AF053356, AC001227, AC002101, AC005074, AC005808, AP000260, AL008637, AL034421, AP000099, AC004087, AL049759, and AC005014.
HHFNJ05	443	930899	1 - 430	15 - 444	AI538184, AW007485, AI363114, AI953529, AA910212, AI695319, AA910204, AL121657, and AF214736.
HHFMX34	444	945385	1 - 453	15 - 467	
HHFLU06	445	857884	1 - 316	15 - 330	
HHFLT84	446	857890	1 - 460	15 - 474	AA015945.

HHFLL08	447	958103	1 - 399	15 - 413	AA664191.
HHFLJ51	448	857898	1 - 453	15 - 467	H55219, AL040362, and Z80897.
HHFLI10	449	963162	1 - 652	15 - 666	
HHFLI07	450	952081	1 - 588	15 - 602	AF064860, AC003109, AC005189, AP000010, AP000151, AP000215, AC005529, AP000556, AC004882, AC002350, AC006160, and AP000337.
HHFLH62	451	857908.	1 - 314	15 - 328	AA460477.
HHFLE12	452	969531	1 - 498	15 - 512	AI191562, AA297666, AI887235, AI476049, AA659832, AI272052, AA595499, AW167154, AI598003, AW194325, AW023302, AI859280, AL031650, AC012627, AC002519, AC007308, AC002369, AC006011, AL020993, AL109628, U91323, D87675, AC005037, AP000555, AC006236, AC005920, AL049776, AP000695, AL133246, AC005231, AC006001, Z85986, AC007546, AC005094, Z98200, AC005332, AC007216, AL049856, AC004659, AC007066, AF029308, AC005399, AC007690, AP000337, AP000240, AL035495, AC007227, AC002310, AC005548, AC007225, Z97056, AC006538, AC007999, AC005005, Z95113, AC004104, AC005899, AP000251, AC005225, Z95115, AL022476, Z84480, AP000212, AP000134, AL133163, AC005833, AC005664, AC005089, AP000030, AC002316, AC006115, AC005295, AL023575, AC004884, AC004477, AL121769, AC004222, AL049712, U91328, Z93017, AC003687, AC002082, AC005288, AC006064, AC005988, AC007285, Z94721, AC002546, AC002289, AC007151, AC009509, AC004474, AL121595, AC004815, AL021154, AR036572, AC002477, AP000216, AC004526, AC006160, AF053356, AP000350, AC007450, AL139054, AL133485, AC005409, Z95118, AP000692, AC000025, AF178030, AL049872, AC005527, AC003109, AC005971, AC004134, AB023049, AP000359, AF111167, AC005859, AP000338, AL031230, AC007036, AC002347, AC004966, Z97632, AP000513, AP000248, AL031427, AC006509, AC005412, AC003082, AC006077, AC007041, and AC004882.
HHFKX28	453	971102	1 - 844	15 - 858	AI740820, AA482031, AI565169, AI628285, AA947029, AW190175, N50136, AA707674, AI332610, AA223261, AA189165, AA767472, AI276839, AA804584, AA894857, N59367, R46372, N72682, AA774827, AA219127, AW188325, W02461, AA417592, D29223, AA322537, R08745, AA315300, AW377015, H60482, R08746, AA939277, AA872005, AI810734, AW118290, T30177, D29202, R68574, AI167609, and AI832198.
HHFKB24	454	887025	1 - 420	15 - 434	
HHFJM64	455	958384	1 - 1457	15 - 1471	AA263151, W39493, AW292417, AI703130, Z41877, R67724, and AA578849.
HHFIA58	456	858011	1 - 406	15 - 420	Z47297, and AJ011930.
HHFIA13	457	657405	1 - 410	15 - 424	AA001994, AL046468, AW367920, AA057078, W96490, D87443, and AL078475.
HHFHY95	458	795053	1 - 384	15 - 398	T62723, AA282638, and AC005839.
HHFHR63	459	745215	1 - 630	15 - 644	H58858, R20870, and AC005177.
HHFHP68	460	753144	1 - 479	15 - 493	R34604, AI472929, N67108, AI312095, AI077416, AI080088, AW000975, AI218568, AA305614, AW270427, AA922273, AW268569, and AL021920.
HHFHN74	461	765758	1 - 786	15 - 800	HI1548, T76951, T65348, H23112, H08748, H18004, F13243, F11922, R39092, and T16788.

HHFHM22	462	674841	1 - 420	15 - 434	H05872, and AC006487.
HHFHJ90	463	675218	1 - 437	15 - 451	R02560.
HHFHD38	464	709082	1 - 259	15 - 273	H65332, and H25516.
HHFGX13	465	656806	1 - 694	15 - 708	AW020496.
HHFGX03	466	924753	1 - 421	15 - 435	AA731491, AW088849, AI570996, F32413, AI827137, and AW386082.
HHFGR31	467	953204	1 - 391	15 - 405	W07246, AA423994, and AL049795.
HHFGR30	468	692887	1 - 335	15 - 349	AA167587.
HHFGP91	469	800328	1 - 845	15 - 859	AI208872, AI651750, AA367948, AA852183, AA383420, AI948798, AC004453, and AB028991.
HHFGP69	470	918393	1 - 699	15 - 713	AA570361, AA173853, AW239179, and AF117756.
HHFGL77	471	490379	1 - 494	15 - 508	AI688557, AI799116, AI202945, AI358494, AI697899, AW293458, AI698391, AA765656, AI537677, AI918370, AI621341, AI560227, AI696570, AA824496, AI689614, AW129616, AI559976, AA488429, AI537643, AI891102, AI289400, AI570966, AI953765, AI590043, AI445620, AI611743, AI696583, AI918955, AI537244, AI927233, AI554516, AI874107, AI801793, AI345688, AI491710, AI863002, AI590020, AI475371, AL138386, AI819663, AI433611, AW025279, AW029186, AI800171, AL042944, AW162194, AI567769, AI333104, N49165, AI589004, AI819014, AW105431, AI581139, AI955945, AL119863, AL045672, AI648458, AI567582, AL039011, AI690620, AW059765, AW103726, AI591228, AI635950, AI557426, AW022636, AI075658, AW079432, AI434223, AI670895, H89138, AI536836, AW089275, AW105087, AI560545, AI859644, AI912434, AI873998, AA665587, AI952306, AI499285, AI699823, AW104141, AI589428, AI886355, AI244343, AI474646, AI285439, AI202203, AW148303, AI933992, AI370623, AW055252, AI818358, AI287449, AI925404, AI335231, AI539260, AI287476, AI445611, AI570857, R65859, AW169626, AI095003, AA732937, AL119791, AI572730, AI267532, AI499986, AI702902, AI249877, AI277008, AA641818, AI538885, AI633125, AL043975, AI860027, AI538564, AI434242, AW152182, AI648699, AI345477, AA916133, AI345415, AI440238, AI583578, AI473845, AA602414, AI434255, AI801619, AW305233, R80916, AL039716, AI921087, AA693331, AI473240, AI783792, AI619820, AI251485, AI561356, AI096771, AL121365, AI918809, AW081311, AI890576, AI536601, AW161098, AI431962, AW192109, AI950892, AW051088, AW411235, AI254727, AW020164, AI797794, AW265004, AI247082, AI564186, AI274500, AA229532, AW073926, AW082623, AW410259, AI802240, AW007284, AL046466, AI289791, AI619777, AI627714, AW029329, AL047675, AI334445, AI354998, AW084801, AI499325, AI539771, AI696340, AI539690, AI801325, AI671931, AW131065, AW105383, AA744713, AI801536, AI884318, AA749425, AI803935, AL045997, AW130134, AA127565, AW195253, AW080379, AW131999, AI539723, AA808175, AW411351, AA575874, AL038529, AW059568, AI567993, AW083775, AL047344, N25033, AA678835, AI499581, AI521799, AI379711, AI434731, AL135047, AW301409, AI225000, AI800159, AW080374, AL040243, AI918435, AA824435, AI929108, AI811912, AA767144, AI656270, AI371442, AW411265, AW073865, AW085786, AI620287, AI765469, AW410902, AW243876, AI568773, AW410696, AI540674, AI355779, AW005612, AI540832, AW170773, AW087816, AI499279, AW075382, AI952249, AI685517, AI564290, AI697178, AW020397, AI874166,

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HHFGH81	472	778193	1 - 329	15 - 343	<p>R56912, AA888618, AA460448, AA554077, AA458950, AI865116, AA019611, AA410313, R55713, AA081407, AA724795, AA648850, AA019450, AA552550, AA177050, AA854071, AA152380, AA844117, W37842, AA192171, AA468546, AI269758, AA987694, AA586585, AA746215, R39789, R43005, AA216405, AA059379, and AR038867.</p>
HHFGH43	473	573495	1 - 521	15 - 535	R73359, R83531, H44511, H44513, H44528, and AW376878.
HHFFZ50	474	513773	1 - 643	15 - 657	
HHFFT05	475	932675	1 - 123	15 - 137	
HHFFT01	476	880757	1 - 388	15 - 402	X97818.
HHFFR95	477	796677	1 - 427	15 - 441	H05133, R36902, and Z40451.
HHFFR75	478	766630	1 - 493	15 - 507	AA812058, AL120483, AI859744, AA593428, AI368873, AA683031, AW008212, AA601218,

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HHFFR32	479	699723	1 - 300	15 - 314
HHFFP17	480	880667	1 - 436	15 - 450
HHFFO46	481	530501	1 - 310	15 - 324
HHFFM05	482	932738	1 - 458	15 - 472
				AA234902.
				AI493068, and AL024498.
				H65231.

HHFFL66	483	530503	1 - 138	15 - 152		
HHFFK30	484	858051	1 - 264	15 - 278	AA523376.	
HHFFI59	485	739587	1 - 510	15 - 524	N80165.	
HHFFI08	486	960254	1 - 664	15 - 678	T99205, Z30071, T96773, W90185, T98729, and AB020638.	
HHFFH76	487	767623	1 - 534	15 - 548	AA446796, W24782, AA476520, AR050683, AF104922, and AF033855.	
HHFFG82	488	530662	1 - 313	15 - 327	AI190744, AA885487, W69997, AA861491, and AW104913.	
HHFFF92	489	790572	1 - 782	15 - 796	AA020789, AA001701, AW452804, AI375739, N78745, AW027244, AA731202, AI672595, AA279753, W16651, AA894594, AA019106, and AI383433.	
HHFFF07	490	954258	1 - 564	15 - 578	AA699816.	
HHFEB86	491	785653	1 - 648	15 - 662	N77740, AI623295, AW385146, AW089125, and AA961452.	
HHFDN80	492	781634	1 - 413	15 - 427	AA001465, AA100624, AA314602, H04982, AA351833, and AL021997.	
HHFDI82	493	499010	1 - 506	15 - 520		
HHFDH26	494	685188	1 - 427	15 - 441	R36135, AW001383, AA243866, AB014580, and AL078593.	
HHFDC10	495	968647	1 - 725	15 - 739	AA664192, T71388, and H60250.	
HHFDA13	496	667804	1 - 324	15 - 338	T99849.	
HHFCT63	497	572784	1 - 251	15 - 265	AA347973, H57111, and AI217870.	
HHFCP39	498	429442	1 - 279	15 - 293	AA347868, W01938, AI697383, AA347867, AA017179, W92433, W92446, H86133, AA018375, W96275, F31654, AW117723, AW117704, N22058, AW026276, AI056174, AA993165, AI754286, W45073, H05449, AI274006, AI921692, AI744381, AI567831, AI445768, AA586553, D25667, AI889648, AI613487, AI336206, AA516214, AA515728, AI635819, AA827978, AA515924, AA570224, AI061147, AA678491, AI820796, Z82202, AC002036, AL035541, Z97053, Z49235, Z98946, AC005574, AC000379, AC002312, AC004408, AC009464, AC003065, AL009172, AC005033, AC006543, AL020989, AC007363, AC005919, AC005180, AC006544, AC004985, AL035419, AC004694, AC005219, AC012398, AC011718, AC008132, AC007325, AC004148, AC006455, AC006346, AL121769, AC004012, AC009509, AL034423, AL122020, AC003071, AC004777, AL132826, AL096791, AP000354, AC000387, AL031737, AL031584, AL109807, AC002113, AC000367, AC005781, and AF001552.	
HHFCO13	499	500899	1 - 328	15 - 342	R82827, and AA347799.	
HHFCN59	500	739657	1 - 543	15 - 557	W05481, and AA347756.	
HHFCN13	501	667805	1 - 387	15 - 401	AA676441, W84872, AI240587, and AA347693.	
HHFCM51	502	509631	1 - 139	15 - 153		
HHFCH52	503	911570	1 - 343	15 - 357	AA347276, and AA347277.	
HHFCF58	504	575183	1 - 517	15 - 531	R92935, N99077, AI809891, AA347287, AI017165, and N91783.	
HHFCE73	505	764763	1 - 404	15 - 418	H69189, R06505, T72747, and AA347297.	
HHFCE40	506	712866	1 - 465	15 - 479	R51510, AA825938, AA347032, and AI274639.	
HHFCD43	507	714353	1 - 242	15 - 256	AA347175, and AA152489.	

					R64559, AI860587, AI285753, AW302315, AI282511, T06648, H86363, AI149478, AA968680, W28893, AA661921, AP000010, AP000152, AC006055, AP000514, AF156495, AC003688, AB020861, Z93023, AL049745, AL020997, AC002395, AC007091, AC005324, AC007363, U68030, AF200923, Z83840, AC012384, AC005933, AB014077, AC004819, U66341, U66340, AC006139, M33198, AC006322, AL078584, AC007406, Z68755, AL008719, AF047825, AC006512, AJ006996, AC005040, AF129756, AL080241, AF135028, AB022430, AC004778, AL031721, Z93848, AC005568, AC004496, AD001502, U89336, AC002378, AC007199, AC004913, AP000159, AP000017, AP000094, AL049539, AC004150, AC006014, AC004848, AC005630, AP001172, AL122020, AP000237, AC002070, AC007686, AC006111, AC005036, AP000014, X81001, U45984, AF036110, AC005013, AC004497, AC005338, AC005788, Z70280, Z68871, AC005327, AC004030, AC006277, AC005783, AC005337, AL109830, AL078596, AP001051, AL035681, AC004935, AP000504, AP000123, AL022163, Z85987, AL023279, AC002477, AL022152, AC004000, AC005738, AL034554, AC004884, AC007285, AL024497, AC002432, AP001052, AC005880, AL031652, U95740, Z98200, AC019014, AC005730, AP000354, AC005224, AC007546, AF176315, AP000355, AC005772, AC008151, AC005768, AC005234, AC007537, AC005261, AC005035, AL133500, AC007298, AL139165, AC005071, AC005015, Z99716, AF053356, AC000353, AC008372, X91841, AC004638, L20345, AL096794, AC003104, AC005377, AC007324, AC008101, AC008079, AL135744, AC004626, AC004651, AC004760, U62293, U63721, AC007160, AL031651, AC004209, AC002347, AF118808, U96629, U91323, AJ010598, AC004648, AC000086, AL031346, AC004808, AL133246, AC005057, AL122023, AC005019, AC005539, AJ131818, AF024533, AL022320, AL096770, AC005086, AL021154, AC007666, U52112, AC007685, AL022323, AC000052, AP001137, AC004019, AC004526, AC005529, AC007664, AC006255, AC002316, AC005320, AL121593, AC006463, AC007297, AL096678, AL031685, AL031848, AC007308, AL137408, AC002416, U07562, AL031224, AF157816, AB029343, AB023060, AC005606, AP000509, L05367, AL133249, AC002472, AC009498, AF055584, X12641, A00794, AF012654, Y11873, Y12855, AP000307, AL034546, Z68276, AC004028, D00591, AC002106, AF050154, U76377, AP000558, AF146367, AC002540, AL049733, AF104455, AC005661, U82668, AL034555, AF045555, AC006071, AL031597, AF095725, AP000115, AP000499, AB020865, AP000130, AP000208, AL009051, AF124523, AC005846, AC006476, AC002425, AC006409, AP000247, and AC005090.
HHFBM11	518	968002	1 - 503	15 - 517	AI937790, F06528, AA446518, AA446340, AA446353, AA346668, and AA446534.
HHFBD83	519	781525	1 - 590	15 - 604	AA001411, AI160471, AI433691, AI923694, AI625789, AA521470, AA442451, T70594, AA719773, AI377638, AI003601, T96901, AA770076, AA766033, AA346585, AL137658, and AC005343.
HHFBD42	520	712899	1 - 548	15 - 562	AA151917, AI076693, AI801676, R67388, AA346551, R26159, AI240747, AI868514, R22968, AW370946, and AW370942.
HHFBB14	521	522375	1 - 447	15 - 461	T54874, AA346439, and AL050173.
HHFBA11	522	967991	1 - 361	15 - 375	AA346357, and AA346358.
HHFAB62	523	824590	1 - 700	15 - 714	R49113, HI7411, AA346385, AA857224, HI6518, AW373989, AL046035, AW374001, AW373994,

HHFCC60	508	739669	1 - 459	15 - 473	H05854, and AA347121.
HHFCC45	509	858066	1 - 203	15 - 217	AA346956, R85908, and H86351.
HHFCC20	510	600231	1 - 591	15 - 605	AA347077, AI829548, AI732247, AA338281, Z82243, AC008072, AC002073, AP000344, AC004463, AC004461, Z83844, AC003037, AC004462, AP000553, AC003662, L77570, AF111169, AC005919, AL031286, AC005049, AC002300, AC004988, AP000692, AL022576, AL031985, AC008009, AF001548, AF050154, AF121781, AC000353, and Z93023.
HHFBW92	511	575156	1 - 539	15 - 553	R92655.
HHFBU63	512	745661	1 - 655	15 - 669	T82006.
HHFBU07	513	954478	1 - 564	15 - 578	AI824082, and AI863730.
HHFBT24	514	508067	1 - 436	15 - 450	H67854, D80014, D51423, D80043, C17376, H67858, D80038, D50995, D51022, H67866, D31458, C14973, T11417, C03092, D58283, F13647, D80022, D51079, C14331, D80247, D80522, D59859, AI525907, D80188, C14389, AA809122, D80251, D57483, C15076, D80366, AI525235, D59889, D80439, D58246, D81030, D59275, D80253, D80258, D80157, D81026, D80269, D80166, D80212, D80268, D80195, AA305578, T03116, D80196, D59467, D59619, D80133, C14227, D80210, D51799, D59503, D80391, D80164, D80240, D59317, D80045, D50979, D80219, C06015, D59787, D80227, D59502, D80064, AA305409, Z33452, T02974, AI525914, AI557774, D59551, AI525922, Z21582, C16955, D80168, C14077, D51213, AI535686, AI535665, AI525920, AI525917, AI525923, D45273, Z30160, C14298, D59627, AI525242, AI525912, AI525227, AI557751, AI525237, AI525215, AA514184, T03048, AI525228, AI525238, AI525216, AR054175, A62300, AR008277, AR008281, AR018138, A82595, AF058696, AB002449, A84916, A62298, I14842, AB028859, AR060385, AJ132110, AR008278, I82448, I79511, and X64588.
HHFBQ94	515	796838	1 - 302	15 - 316	N69862, AA196591, W94557, AW445181, N99038, AI695808, W92641, AA346845, AA181501, AA100353, AA196590, C04454, and AF086522.
HHFBP29	516	710894	1 - 364	15 - 378	T80420, AI056302, T97347, T85277, H61413, N57950, AA378460, AA227248, AW402041, AA346817, AA659435, AA187022, AI065081, T85741, R15986, AA236609, H59659, and AC004382.
HHFBN17	517	589798	1 - 537	15 - 551	AI733856, AI923050, AI791475, AA381011, N54894, AW021735, AA515725, AW024042, AI168167, AI433008, AI580250, AI869978, AA063173, AA584170, AA524687, AA524955, AA838190, AA513893, AI937250, H09071, AA551117, AI491817, AA651632, AW340844, AI061647, AL119713, AI460009, AW074242, AA669155, AI053911, AL041619, AL119921, AL045813, AL037632, AA343946, AI056177, AA362719, AW298643, AA122243, AA610688, AW023865, T99179, AI818231, AA669564, AA330418, AA548058, AW080965, AA983199, AA487180, AA487239, AL134330, AA811208, AI084012, AA323701, AI745553, AI808248, AI732800, AA442105, AW020340, AI613389, AW401372, AW021597, AA410788, AL036382, AI891080, AA769720, AA778992, AA579179, AL119941, AA486131, AL038936, AI801482, AA425118, AL043719, AW022897, N75702, AA010299, AW080777, AI306324, AA305249, AW102846, AA577824, AA864493, AL036070, AA493695, AA507282, AL045053, AA191659, AI821947, AI791211, AI687343, AW338883, AI344822, AI805547, AW403720, AI133164, AA179683, AI567076, AW270343, T52097, AA385798, AI754211, AA343824,

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HHBGN74	524	765214	1 - 545	15 - 559	AAI12990, Z25197, AA214259, AA214140, AA214253, and AF177292.
HHBGJ53	525	909912	1 - 388	15 - 402	N49341, N31123, and AL135424.
HHBGG10	526	963849	1 - 475	15 - 489	AI042164.
HHBGC75	527	767042	1 - 562	15 - 576	AA426500, AA195328, and AA195188.
HHBFT06	528	934826	1 - 537	15 - 551	C18811.
HHBFM77	529	771816	1 - 447	15 - 461	AA064965, and AA129388.
HHBEV93	530	792041	1 - 508	15 - 522	H41579, H23896, and H49582.
HHBES89	531	786667	1 - 453	15 - 467	R35959, H16638, R59412, F13165, T77625, and AC004744.
HHBEM49	532	722337	1 - 718	15 - 732	AA143472, and AI023326.
HHBEG80	533	951688	1 - 430	15 - 444	AI095759, AI493168, AW206042, AI738997, AA921950, AI968444, AW197610, AI079592, AW043953, AW242819, AI744109, AI861845, AI193079, AI668960, AW182363, AI640258, AI092922, AA722466, N21525, W73601, AI140933, AA021471, AI720404, AA708907, AI123135, F30816, AI366183, AI768468, T77057, AI968632, AA045707, AA259196, AA127350, H11390, F32206, AI767021, H24345, AI418672, AW383731, N46355, AA905163, AA018209, F36514, AI564847, T83879, F01296, AA070435, AA921795, R20767, F00344, AA196850, AA311411, AA045706, AI969655, AI824576, AI440239, AI633062, AI250663, AI613038, AI815855, AW193872, AW262565, AL045672, AI923989, AI251876, AL119863, AW080402, AI568138, AI926878, AI590227, AI654037, AI478123, AI698391, AI636588, AW161579, AW129929, AL042745, AI805603, AI890507, AW078800, AW130930, AW020419, AI866002, AI537677, AI673785, AI306705, AL036403, AW051226, AI811785, AI288305, AI873644, AW131331, AW079572, AI580198, AI497733, AI431408, AL040827, F27788, AA225339, AI866770, AI889168, AW151136, AL038605, AI919345, AI954504, AI630252, AI890907, AW089275, AI826225, AI632408, AW087445, AI702073, AL120695, AW162194, AL045266, AI564749, AW088162, AI868204, AA470491, AL037582, AL037602, AI270183, AI470648, AI499381, AW268220, AI620075, AI802542, AI800138, AW050578, AW168031, AI955906, AI312428, AL079963, AW161156, AI334445, AW302965, AI241923, AI345477, AI624548, AW302992, AL036638, AL110306, AI648473, AA572758, AW196105, AI886753, AI269862, AI612750, AI251221, AW022682, AA494167, AI929108, AW302988, AW163823, AI340603, AW074869, AI494201, AI349957, AI491775, AI677796, AI308032, AI284131, AI858827, AI934035,

<p>AI635492, AI874166, AI284517, AI537837, AI621179, AA427700, AI590830, AI254226, AI335209, AI699857, AI860783, AI919500, AI570807, AW004886, AI263331, AI358701, AI624293, AI623941, AI536574, AW238764, AW054931, AI829327, AW268302, AI419650, AW089405, AI569583, AI863382, AW072719, AI433384, AI499285, AA911767, AW169653, AI869377, AL037454, AW087915, AI564259, AL036980, AW169604, AL042744, AI439762, AI251830, AI890806, AI554821, AI812032, AI589267, AW170635, AI524526, AI916419, AI620284, AI571046, AL039086, AI950664, AI638798, AW020095, AI433976, AI889189, AI345745, AI473536, AI612885, AI783504, AL046926, AI445990, AW089572, AW051088, AI886123, AW168485, AI690835, AI554344, AL036804, AI610799, AI679620, AI801325, AW403717, AI863191, AI590686, AI969601, AL118781, AI445992, AL036361, AI886415, AA580663, AI434741, AI886181, AI568870, AI471361, AI590134, AL117457, AF134803, AF134802, L29468, U78525, U42766, X63574, I89947, I48978, AF026124, AF113694, A08916, A08913, A08910, AL049430, AJ238278, A08909, E02349, AL080148, AL122049, A07647, AL050277, AF091084, AL049466, AL049283, AL050024, AF087943, Y09972, AL133016, AF177401, AL137480, AF146568, AL110222, AF028823, AR038854, AL050146, I89931, A08912, AF132676, AF061836, I49625, AL133560, AF097996, AF090900, I48979, AL122093, E06743, AL133080, AF111851, AF111849, AL049464, AL137533, AL122110, U35846, AF079765, AF104032, I00734, AL050393, S61953, AF113019, Y16645, AL049300, AL137557, Y11254, AL122050, AL137459, AF079763, AL133557, AL080127, AL050116, E00617, E00717, E00778, AL117394, AI2297, AL117435, AF057300, AF008439, AF057299, X72889, AR011880, AJ000937, AL133640, AL137271, Z72491, AL110221, AF090903, E08631, AF090896, E12747, AF113689, AL049452, AL049314, E07108, S78214, AF113676, AF158248, AL133072, AL137463, AF061943, AF118094, E04233, X84990, AL122098, A93350, U68387, AL117440, AL137521, AL080124, AR020905, AF067728, AL137478, AL137550, AL117583, AL133098, AF017152, Z37987, S68736, X83508, U49908, AF118064, AF118070, AL137560, X70685, AL117460, I09499, A45787, AL096744, AL133014, A08908, AF067790, AF113677, AL110196, AF183393, X92070, AL133075, AF125948, AL133565, A03736, AF026816, AF106862, AR013797, X82434, A65341, A77033, A77035, Z82022, AL050149, AL050108, AL050138, AL137476, A58524, AF078844, A58523, AF119337, AF003737, AF113690, E03348, AF090934, AF017437, AF162270, AL137526, L19437, AL133093, X87582, U67958, AF113699, M30514, AF153205, AR059958, AL117585, L31396, I66342, AF185576, AF090901, Y07905, X93495, E02221, L31397, AL137292, AJ012755, AF054599, U72620, I26207, AF090943, AF061795, AF151685, U80742, AB019565, AL137556, AL080074, AF113013, AL133568, AL133113, AJ006417, AL122121, D83032, AL080060, AF100931, I33392, AL049382, AL117416, AL110225, AL137488, AL050092, X96540, AF111112, Y10080, AF126247, I03321, AL049938, Y11587, AL080159, AL133665, E15569, AL122118, AL080137, AL137527, AL133606, AL110280, A93016, A90832, U00763, I42402, U58996, L30117, AL137273, X65873, AL080158, X53587, AR038969, AF118090, AJ242859, AF113691, AL080086, AL133104, AL133067, I09360, AR000496, U39656, AL137538, U96683, Y14314, AF125949, AL133077, AL117432, AF081197, and AL122123.</p>				
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HHBEG72	534	761150	1 - 550	15 - 564	H49710, and AL047185.
HEMHA53	535	728297	1 - 593	15 - 607	AA010194.
HEMGX57	536	872083	1 - 594	15 - 608	AA485012, AL138096, AA743445, AC004542, AC005358, AC007056, AL021368, U93037, AB014608, AC004526, AC005209, AC004953, AL121595, AL021397, AP000692, AC005253, AC005387, AC004148, AC005089, AC005519, U91322, AC005730, AC004774, AC005539, AC003006, AL023653, AC000090, AC005326, AC005800, AC006960, Z83820, AC002302, AC007487, Z15025, AC004237, Y14768, AP000505, AL031276, Z95152, AF129756, AP000962, Z82176, AC003101, AC003669, AL109628, AC006050, AL117354, Z99571, AL031597, AC005940, AC005486, AL035530, AP000500, and AP000555.
HEMGT27	537	851065	1 - 542	15 - 556	AA213376, AA713538, AA713930, AC002395, AC010170, AC006515, AC000355, D87675, and AC005057.
HEMGL56	538	767669	1 - 327	15 - 341	AA122010, W40525, AA173833, AA622443, AA334425, AF042166, AF043045, and AL137574.
HEMFN30	539	692818	1 - 1033	15 - 1047	AA099585, AA099645, AW271704, H88677, H88726, AF086025, and AF190639.
HEMFF16	540	576539	1 - 128	15 - 142	
HEMEF34	541	596812	1 - 1243	15 - 1257	AA653240, AA812058, AA569667, AA644090, AA714224, AI755214, AL037714, AI754567, AI525532, AI754105, AA488903, AW103406, AW023111, AA535216, AA524616, AA829036, AI380617, AA701080, AI279417, AI366555, AI912401, AI358712, T05118, AW328331, AA704393, AI754170, AA290878, AL079734, AI284543, AI635440, AA601278, AW237905, AI289277, AI669421, AA019973, AA013168, AI250552, AA169245, AI792521, AL120141, AW303098, AI251284, AI251034, AI251203, AW271977, AL043351, AI049709, AA654778, AI793172, AI793209, AA054085, AA640685, AI275982, AI369580, AI792499, H07953, AA559241, AA747757, AI254770, AI114557, AL043105, AL135377, AI452836, AI613389, F00564, AI612142, AA578621, T74524, AA420546, AA572813, AC005089, Z95115, AC005225, AC007227, AC005899, AC003982, AC002302, AC007193, AL121603, AP000692, AC006023, AC004882, AC002565, U91323, Z98742, AC007225, AL139054, AC005015, AC004408, AC004851, Z97054, AL034420, AC005081, AC002073, AL009181, AF053356, AL033521, AC005529, AL049576, AC005193, AL031255, AC002364, AL049776, AL080243, AL031311, AC002350, AC005520, AC004821, AL022318, AC002400, Z84469, AC004813, U91321, AL022316, AP000193, AC004491, AC005280, AC015853, Z93023, AC005800, AC005332, AC016830, AC002316, Z83844, AC007055, AC005875, AC002115, AC002477, AL049856, AC002425, AC005207, AP000117, AC009247, AC006449, AC005519, AC005082, AC006530, AC003007, AL050318, AP000354, AC006285, AC000134, AC005071, U62317, AC005971, AD000092, AC004099, AF129756, AL049697, AC002544, U91326, AL021407, AC007036, AC004000, AL022326, AL132777, AL117694, AF196779, AL078581, AF045555, AC003684, AL035588, AC006538, AL133246, AL021397, AL133448, AC004771, AC004231, AP000689, AC006121, Z85986, AL022165, AC004596, AC010205, AC003036, AC005412, AC004148, AC009248, AC004883, U82828, AC005261, AC007051, AC007308, AC005011, AC006942, AL024498, L78833, AL031848, AL050321, AL049694, AC005409, AC016025, AC004019, AC002312, AC004967, AL022320, AC006312, AC005940, AC006241, Z84466, AJ251973,

HEMEA03	542	921922	1 - 403	15 - 417	AC007917, AL020997, AL023807, AC005632, AL031432, AC016831, AC002492, AC004922, AL096701, AC005399, Y18000, AC002347, AC006480, AC002996, AC007934, AC002511, AP000556, AC007406, AC006139, AL121825, AC005037, Z83838, AC003665, AL031289, AP000501, AC005291, AP000557, AC006430, AC007919, U95740, AC005823, AC007388, AC002470, AC004098, AF038458, Z93017, AL031291, AC007201, AC005231, AC004797, AC005041, AC005480, AC004508, AL031283, AL021391, AL008582, AL035400, AL121852, AL035587, AL050332, AC005914, AC007011, AC004750, AL021154, Z93096, AC007371, L44140, AP000552, AF003626, AP000347, AC002430, AP000248, AL049569, AL031670, AL008725, AC005837, AC005592, AC004876, AL122020, AP000704, Z83826, AC006441, AC005088, AP000114, AP000046, AC004383, AL121652, AL034555, AL049839, AC005488, AL021366, AC000052, AP000355, AP000514, AL133163, AP000247, AC004933, AL035684, AL109758, AL135744, AC005274, AC004815, AL035249, AC007536, AC007384, AL109827, AC000025, AC005695, AF109907, AL031588, AC005696, AL034379, U47924, AL034549, AC005726, AL121655, AL049712, AC006536, AC005484, AL049780, AC006130, AB023049, AC003037, AC007687, AC005736, AC004854, AC006026, AC006014, and Z99716. W90730.
HEMDX96	543	935963	1 - 833	15 - 847	AA463972, AA464108, AI080269, AA528133, W04732, AA912293, AA903826, W79633, AA557293, AI912574, AI906793, W25281, R47804, AI129889, AA365267, AI081962, W24623, AA404469, W19157, AI189367, AI159933, AI273685, AA301944, N70568, AI291841, AA911261, AI350318, AI541205, AI557426, AI541056, and AF111170.
HEMCV44	544	574321	1 - 418	15 - 432	
HEMCK53	545	728424	1 - 495	15 - 509	R10409, and R09783.
HEMCI59	546	739551	1 - 407	15 - 421	W03547, and AC002117.
HEMCI41	547	712614	1 - 938	15 - 952	AI797078, AA129381, AI701463, AI808119, AA129318, AI309212, AA970643, N47001, AI263617, AA633720, and AB028993.
HEMCC38	548	707453	1 - 372	15 - 386	H61491, and AA699633.
HEMBU26	549	684928	1 - 305	15 - 319	R32090.
HEMBT61	550	939957	1 - 449	15 - 463	N86549, AW369713, and AB002301.
HEMAL61	551	851106	1 - 520	15 - 534	
HEMAA63	552	745498	1 - 320	15 - 334	T85402.
HELHJ74	553	765696	1 - 516	15 - 530	AA058694, AA015929, AA012840, AA054133, and AC007279.
HELHD20	554	668881	1 - 421	15 - 435	AI567076, AW419262, AW303196, AW274349, AI281881, AA720702, AW327868, AI270117, AA533725, AW301350, AW193265, AA649642, AA446657, AA747276, AI963720, AI350211, AL046409, AW193432, AI613280, AI085719, AI471481, AA847499, AI198376, AA581903, AA973803, AA828704, AI619997, AI688846, AA649705, AI653886, AA525824, AI590958, AI610920, AI375710, W79504, AA623002, AI623696, AW275432, AI801600, AW072923, AI590689, AI061334, R77905, AW406162, AA652057, AA491814, F36273, AA357937, AA350859, AA714453, AI431303,

	555	769404	1 - 505	15 - 519	<p>AA494163, AA493708, AA715355, F25199, AA773886, AI133164, AW276817, AA825357, AW265170, T15977, AI783494, AA469451, AA502866, AI143242, AA535661, T07451, AI754658, AW249224, AI305766, AW338417, AW088846, AW410400, AW057877, AA177061, AI761471, F19012, AL042420, AI334435, AC005971, AF077058, AL096701, Z99716, AL049766, AC004931, AL031286, D83989, AC004033, AL034549, AC004955, AC004808, AC005969, AC002302, AL023799, AL031542, X55926, X54181, X54178, I51997, AL096703, AC005399, AL109654, U18394, Z86061, AC007537, U18391, U18392, X55925, U57005, U57006, AC007386, X54180, U57009, X54179, AL031668, AC004448, X54175, U18393, AC005730, U67801, AC005690, X55931, U57008, AC005722, AL035687, AL022318, AC000085, AC006324, AC005846, AC005291, AC007283, AC002452, X54176, AP000362, AC005553, U57007, AF196969, AC006210, AC002542, U18390, AC003104, AL133396, AC012384, AC004526, U18396, AC007450, AC002564, X55932, AF117829, AC006996, AC004453, AC005951, AC004690, AC006581, AC006367, AC007388, Z69714, AC005881, U67825, X54177, AL121871, AL034351, AB020862, AC004673, AC004745, AC006328, AC004552, Z94801, AC005019, AL035695, AL031073, AL049833, AL034547, AC004072, U02532, AC007934, AC010197, AF015153, AC005919, AC004948, AL022311, AL109653, AC007546, AC004227, U18400, AL050308, AL049539, AP000561, AC009891, AC007385, AL109963, AP000548, AC007225, AL133353, S77605, AL031643, AF015151, AF222684, AC004984, U73465, Z81364, AL121658, AF064866, Z84474, AL031577, AC005409, AJ011930, AL049835, AC011311, AC004945, AC009363, AC002038, Z92545, AL008721, AC004909, AC002301, AC006043, AC004492, Z93928, AC005342, AL133241, AC006241, AC007676, AC007344, AC005820, AC007285, AC006374, AC005610, AC004992, AC004796, AC004890, AC007436, AL049591, AC005387, AC005082, AC004626, AL031848, AL031681, AL031774, AF015157, AC008064, AC006057, Z82976, AL023574, AP000688, AC007358, AC005839, AF188024, AL133289, AC007731, AL136018, AC007227, AC005500, AC004782, S70707, AC005703, AC005183, AL031229, AC006333, Z68289, AC000094, AC004531, Z82201, AP000557, AC004021, AC006571, AC006478, AL109628, AF015149, AL031390, AL049647, AC007370, AC004993, Y18000, AL121578, AC004386, AL021069, AC004629, Z84721, AL008723, AL109801, U57004, AL049869, AC010072, AC004916, AC004864, AC007207, AF165926, AL035079, AC007262, AP000705, AL049759, AC005033, AC011604, AL031287, and AF015148.</p>
HELHC59	556	713019	1 - 640	15 - 654	<p>N72137, N24885, N25625, AI128843, AI126506, AI160533, AI200037, AW450603, N35103, N26904, AW020616, AI695490, AI802647, AA729493, AA605122, AW024969, AA806507, AA743134, AI217597, AI312534, AI219599, N25653, AA729125, AA568681, H86995, N26781, AI829009, AA648514, AA568193, AI032141, R73137, R26304, AW298649, AA768761, N20053, AW236299, AW453038, AW452862, AI141901, AA988539, AI361669, AI674252, AI039557, AI299683, AI984739, AI452444, W52017, AA543074, N34223, N28403, T25828, N36303, AI362330, AA296449, AW074182, AI805445, W52651, and AA653691.</p>
HELGY42	557	948302	1 - 510	15 - 524	<p>H23853, and H46507.</p>
HELGY02					<p>AI939550.</p>

HELGW31	558	610003	1 - 1645	15 - 1659	C14389, D80268, AW177440, AW177501, AW177511, AW352117, D81026, D59502, AI905856, AW178893, T03269, C14014, AA305578, AW179328, AW366296, AW360811, AW375405, AA514188, D58283, D59859, D80022, C14331, D80166, D80195, D80193, D59927, D59467, D51423, D59619, D80210, D51799, D80391, D80164, D59275, D80240, D80253, D80043, D59787, D80227, AW378532, D81030, D80212, D80196, D80188, D80219, AW176467, C15076, D80269, D80038, D59610, D57483, D80366, AA305409, C14429, D51022, D50979, D50995, D59889, AW178762, D80024, AW377671, D80378, AW178775, AW360844, AW360817, D80241, D51060, AW352158, AW375406, D80248, AW378534, AW179332, AW377672, AW179023, AW178905, D80134, D80045, D80132, D51097, AW352170, D58253, AW352171, D80522, AW377676, AW177731, AW178907, AW179019, AW179024, D80251, AA514186, C75259, D80133, AW178906, AW177505, AW179020, AW178909, AW177456, AW179329, AW178980, AW177733, AW378528, AW178908, AW178754, AW179018, AW179004, AW178914, AW178911, AW367967, AW352174, D80302, AW178774, AW177723, D80439, D80247, T48593, AI535850, AW178983, D51103, AW367950, C14975, AW178986, D45260, AI525913, Y17188, X82626, A84916, A67220, D89785, A62300, A62298, A78862, D34614, D26022, D88547, AJ132110, AR018138, X67155, A25909, AF058696, AR008278, Y12724, AR025207, AB028859, AB012117, A94995, A85396, D88507, AR066482, A44171, A85477, AR008443, I19525, A86792, I18367, X93549, I50126, I50132, I50128, I50133, AR066488, A82595, AR066490, AR016514, D50010, D13509, AR060138, A45456, A26615, AR052274, Y09669, AR060385, AB002449, AR066487, A43192, A43190, AR038669, A30438, AR008408, U79457, AF135125, AR060133, and AR008382.
HELGV36	559	597120	1 - 359	15 - 373	H79363, R79034, Z26324, and AC007199.
HELQQ55	560	732223	1 - 346	15 - 360	AA410214, W24694, and AI220186.
HELK56	561	925698	1 - 776	15 - 790	
HELGG21	562	671071	1 - 463	15 - 477	W01622.
HELGD47	563	851143	1 - 442	15 - 456	AA496758.
HELQ55	564	732224	1 - 449	15 - 463	R59270, F11339, and AB020864.
HELFN75	565	658681	1 - 621	15 - 635	
HELFI35	566	506277	1 - 307	15 - 321	
HELFA38	567	851146	1 - 391	15 - 405	AC005736, AC005412, AC004491, AP000689, AB003151, AC004796, AC004019, AC004967, AC004913, Z83822, AF185589, AL121655, AC006120, AL031594, AF047825, and AC005291.
HELEZ81	568	571340	1 - 322	15 - 336	AA355367, AA452887, AA581247, AA501794, AW303142, AI253987, AI077941, AA904275, AW302081, AA557790, AL079734, AA666295, AI802804, AI249688, AW151247, AA642809, AL049712, I34294, AL031258, AC005839, AC005512, AC005520, AP000694, AC006449, AC009516, AL021707, AC005944, AL035405, AC004148, AC004253, Z98051, AL050332, AC002544, Z93023, Z73420, AC006276, AB023049, AC004033, AC005261, AL080242, AF109907, AC005399, AP000305, Z85986, AC007216, AL096712, L47234, AL049760, AL022326, AC005777, AL133246, AL031686, AP000557, AC004812, AC002395, AC005578, AL031680, AC005920, AC002470, AP000152,

					<p>AF053356, AC006241, AC006509, AF165926, AC004876, AC007664, AC005695, AC002314, AC004655, AC005529, AL031431, AP000502, Z93017, Z83844, AC005900, AC005288, AC005256, AJ003147, AC004796, AF196779, AC002059, AC002133, AC004962, AL109827, AC002054, AC004991, AC005971, AC004491, AC004522, AC004099, AP000045, AC002316, AC009247, AC005800, AC016027, AL031281, AL031005, AL049570, AP000512, AP000047, AL035587, AL109623, AC006014, AC005255, AL034420, AC007201, AC002115, U91326, Z97630, AC004678, AL008726, AC016830, U47924, AL049869, AL109952, AC007546, AL031662, AC002126, AC004804, AC006236, AC007226, AC006538, AC004686, AL022315, AC007387, AL132712, AC002107, AF111168, AC005476, AL034423, AC004883, AC006480, U95742, AL122020, AL021154, AL021977, AC003101, AL031311, AP000252, AL022320, AL050318, AC004760, AC004966, AP000691, AP000563, AP000692, AF001548, AC005015, AC005581, AC004832, Z82176, AP000300, Z84480, AC004878, AL031735, AL133448, AC008040, AC004531, AF001549, AC005057, AF207550, AC006285, AB001523, AL050341, AC005940, AC004449, AC007565, AC007308, AC005231, AC005082, AL031427, AC005089, Z98941, AL049856, AF030453, AC005071, AC005048, AC008044, AC004851, AL121652, AC002300, AC005829, Z95331, and Z68870.</p>
HELET68	569	800029	1 - 446	15 - 460	R96611, AA019463, AA018536, AC006001, AJ250042, and AJ001119.
HELEO42	570	579016	1 - 556	15 - 570	
HELEH76	571	506674	1 - 418	15 - 432	<p>H00519, AI671775, AA689296, AW082267, AW340166, AI671779, AI298659, AA251240, AI189305, AI695034, AW085290, AI290925, AA977259, AA806531, AA836353, AA809326, AW086155, AA811618, AA731135, AF027156, and Z57575.</p>
HELEE83	572	577206	1 - 235	15 - 249	<p>AI813783, AW028943, AI872000, AA429481, AI146266, AW249720, AA496309, H71659, F31867, AW304536, AA583579, AW194077, W24312, AA758131, AI207476, AA297698, AA531596, AW003612, AI918419, AA654874, AA767884, AI358712, AA729512, AI299882, R74433, AI198718, AA745302, AA058312, AA558404, AA904211, F31951, AI866971, AA487300, C14330, T39217, AA225358, AA584183, AI310464, AA225890, AA341865, AA299422, AW381847, AW381904, F16409, AA713735, R93919, F26072, AA343810, AA937809, AA513884, T54464, AI365625, AA729253, AA808982, AI653999, AA516214, AI309979, AA525293, T39225, AW023111, AI915081, AW237905, AA584493, AI873627, AA179663, AW003595, AA634926, AA018777, AA508036, AA583568, AI198948, AI565084, AL037714, H67064, AA525407, AA644090, HI5295, AI053784, AA654482, AA515728, W52705, AA744423, AA320105, AL045476, AA298573, AI282629, AL045423, AA302982, F33505, AW162227, AW102811, R52008, AW275679, T05118, AW161459, J03764, AC004876, AC007225, AL133448, Z98884, AC003982, AL035405, U89337, AL049834, AL031657, U07561, AC004848, Z97056, AL022336, AC007011, AC005914, AC005244, AC004985, AL049692, AF039954, AC007686, M87889, AB018249, AC006050, AC004382, AF207550, AC000378, AC007546, AC007371, AL035659, AC005328, AC002504, AC006409, AC005030, AF041001, L78833, AC005480, AC006257, AC005340, AC005953, AL109801, AL031258, AF111168, Z99128, AP000032, AP000103, AC006312, AL031662, AL122020, AL049569, AC005484, AC002302, AC005206, U02052, AP000356,</p>

<p>AC006455, AL133245, AP000512, AC005668, AL034549, AP000270, AC004106, AC005667, AC000120, AL121652, AL031053, AC006443, AC006505, AP000045, AP000113, AC004851, X81870, D87675, AC004675, AC004988, AC002350, AF112441, AC002126, AC002492, AC008116, AC002404, AC006012, AC007298, AP000555, Z99755, Z86090, AF088219, AC003012, AC005786, AL032821, AP000008, AC006511, AL049849, AL049712, AC004129, AC005529, AL096791, AP000704, AC005621, AC005102, AC004150, AC004491, AC002476, AP000553, AC006965, AC006277, L35532, AC005972, AC006237, AC007308, AC003667, AL021578, AC006013, AC005011, AC004125, AC004024, AC005237, U78027, AL031767, AL022326, U11095, AP000343, AL133243, AL034423, U95741, AC005325, AF196970, AL049539, AC005632, AL035422, AC002425, AC004662, AC004066, AC004736, AC008064, AP000109, AP000041, AL121655, AC006084, AC004216, AC005015, AC005351, AF047825, AC005544, AC005086, AC006372, AC005523, AF121782, AC005921, AL022327, AL035412, AC007283, AL133233, AC005519, AP000690, AC005082, AL133035, AC006365, Z82206, Z75746, AC004801, AC005049, AC002381, I74786, AP000501, AC006261, AC007192, AC005291, AC002511, Z97832, AC002117, AC016025, AL031283, AC005527, AC007040, AC005231, AC006509, AL035699, AL022163, AC005363, AL049911, AC006368, AC002996, AF001550, AC002312, AC002195, AC006450, D00591, AC005410, AF064105, AC005993, AL023575, AC000024, AL121748, AC007685, AC009247, AC011311, AC007226, AC002300, AC000025, AL021707, AL022721, AC002112, AC005243, AF109907, AL049557, AC005261, AC007199, AC005500, AC006449, AC006205, AC004900, AL022165, AC005088, AC004760, AC004973, AC005393, U91321, AC005952, AC003038, AL031985, Z82217, U47654, AC004771, AL133485, Z82244, AL033527, AL049759, U95742, AC007216, AL050318, AC005778, Z93930, and AC005793.</p>					<p>AI291317, AA501614, AA937686, AA747472, AA614010, R63317, AW062724, AI053445, AI433247, AI832000, R79794, AA384039, T48872, T17269, AA434044, AL134369, AI673731, AL036283, AI538812, N62650, AA434172, AI859834, AA443727, AA122223, AI370475, AI079129, T32050, AA533408, AA227837, AI978792, AI347810, AA508873, AA857381, H29019, AI654529, H74314, AI872503, F23255, T03900, AW272763, AI053786, AI056415, AA223249, AL036805, AW193493, AI299050, AI049831, AA809189, AL135698, AA601680, AA326410, AW028908, AL120976, AI979005, AA557486, AA515224, AA715004, AA553448, AL042113, AA584489, AA046466, AA720732, AA524832, AL045077, N67816, AA342681, AW419118, AI859946, AI283090, AA507169, FI7700, AW337454, AI890385, AA577732, AI168205, AA564145, AI360514, AA528480, AI343143, AA121919, AI524540, AI343113, AI440324, AI457597, AW439480, AA437402, AA485485, AI610201, AI803827, AI865213, AI696901, AL033504, AL117337, AL021407, U51281, AC005701, AF205588, AC005592, AC001228, AP000193, AP000117, AL133355, AP000050, AC002119, AF107885, AC002524, AC008372, AC005212, Z49237, AB023051, AC006965, AC008928, AF091512, AL117328, AC006571, AC006257, AC006285, AC003030, AL031733, AP000512, AP000695, AC020663, AC004791, AF051976, AP000131, AP000209, AP000248, AC004472, AC007324, AC008101, AL049780, AC007055, U07000, AC005494, AC002057, AC005914, Z84487, AC009263, AC000004,</p>
<p>HELDT63</p>	<p>573</p>	<p>744864</p>	<p>1 - 697</p>	<p>15 - 711</p>	

					<p>AL050306, AC004841, AC005378, Z81002, AF045555, AL121578, AC004878, Z85986, AC006317, Z98051, AL022353, AC005523, AC005838, AP000023, AC005081, AC006450, AC006948, Z99716, AF148461, AC016025, AC006077, AC007014, AC008079, AC005755, AC005210, AC003667, AP000509, AL109758, AL096773, AF055278, AC006211, AC005911, AB026898, AL031296, AC006372, AC005512, AL008719, AC004858, AC005192, AF109907, AL080317, L32588, AF178081, AF008243, AP000018, AP000160, AC003043, AC002367, L78833, AC011604, AC004659, AC004967, AL022401, AL022329, AC005740, AC005365, AC009501, AC007934, AC003015, AC006143, AP000302, AC004796, AC005593, Z68280, AC006141, AC005823, AP000494, AC004024, AC008394, AC004974, AC005753, AC005768, Z99129, AC006166, AL022398, AC002511, AP000504, AC006048, AL078593, AC003104, Z95116, AC008149, AC004973, AL034417, AC002980, AC006254, AC005280, AL035410, AP000046, AP000114, Z93241, AC004765, AL031673, AC002316, AC004813, AL139054, AL021706, AL133448, AC006947, AC005599, AL031255, AC003682, AC004263, AJ003147, AP000701, AL096710, AL031230, AC005951, AL021939, AC006130, Z69364, AC002301, AC005037, AC004531, AC005757, AC002539, AC004876, AC004562, Z85987, AC005759, AL031584, AC004002, L81690, AC004797, AC007795, AP000115, AL009181, AC005726, AC005832, D84394, AL031278, U85195, AC009294, AC005071, AL035089, AC005971, U80017, AC004870, AE000658, AC008154, Z84469, U95740, AC002045, AC005399, AC018767, Z73963, AC006132, L05367, AC004552, AC004526, AC005225, AL035587, AC006552, AC002432, AF111168, AL008715, AL022238, AF129756, AC007676, AL034350, AL031121, Z95331, X96421, AC006296, AP000313, AL121603, AC005519, AC005243, AC006160, AF200465, AP000563, AF037062, AC005197, AP001043, Z93341, AL050333, AL022396, AL133304, AC006442, AC005772, AL035071, AC007637, and AC002418.</p>
HELDL15	574	660557	1 - 533	15 - 547	<p>AI989707, AI668636, AI668638, N80930, AI916749, N89573, AA687664, N89599, AI734212, AI734241, and AC005180.</p>
HELDL08	575	959919	1 - 363	15 - 377	<p>AA219475.</p>
HELDK22	576	567310	1 - 994	15 - 1008	<p>AI801505, AA601218, AI679294, AI679871, AI889579, AA598545, AA604843, AW105729, AL041895, AI050007, AW028950, AA604865, AI708005, AF129756, AC004805, AP000045, AF111168, U95742, AC004491, AC007216, AC005940, AC007240, AC005837, AL035681, AL035072, AP000557, AL096791, AL022336, L44140, AC002059, AC007182, AL121658, AC007226, AP000688, AC004099, AC006211, AP000555, AC002039, AC002425, AL023284, U91318, AP000553, AC004098, AC004815, L78810, AC002996, AC002301, AC005920, AC005531, AC005288, AC006241, AP000113, AC004526, AC004966, AC004841, AC004253, AC000052, AL080243, Z94056, AC005412, AC005057, AL049569, AC005377, AC006538, AC006312, AC005803, AC007055, AC005089, AC003029, AP000689, U62293, AC007666, AC005529, AL049776, AC005736, AC000134, U80017, AC004883, AC004531, AL023553, AL022165, Z93241, AC004983, AP000065, AL031295, AC005839, AJ010770, AP000010, AP000952, AC004686, AC004967, AL031670, AL022238, Z97054, AC009516, U47924, AL109628, AC004149, AC002314, AC004922, AC005255, AF030876, AC008372, Z85986, AL021397, AC007021, AL021546, AC002544, AF053356, AL049697, AC005562, AC005004, AC004084,</p>

					AF038458, AL031311, AC004933, AP000505, AC002350, AC006121, AC005519, AP001053, AC004216, L48038, Z97056, AC002477, AC003684, AL022320, AC005031, AC004895, U52111, AC005015, AC006480, AC020663, AC006530, AC007011, U95743, AC005231, AC005899, Z95115, AC006449, AC005387, AL049830, AC004132, AC002492, AC005921, AC004953, AC004659, AC004887, AC004973, AL049869, AL031584, AC005822, AL133245, AC005488, AF109907, AC006064, AC005520, AL121603, AC005722, AC007676, AL049795, AF107885, AL020997, AC006285, AC005071, AC006014, AC002470, AL031291, AC002077, AL096701, AL049843, AC003101, AC008055, AF196969, U91321, AL034379, AC005049, AC006001, AC000026, AC006115, AL121653, U91326, AL035684, AF134726, AC005102, AC002395, AC003035, AL109984, AC007227, AC005274, AF067844, AC007686, AC004382, AF196972, AC005300, AC005082, AP000501, AL121825, AC010206, AL050318, AJ246003, AP000152, AC004814, AC000003, AC008040, AP000556, AC003041, AC007637, AL031283, AC002476, AP000247, AC005081, AC005332, AC005696, AC006965, Z98884, Z95152, AC004167, AC007546, AF045555, AL021393, AC0000353, AC005740, AC016025, AC006947, AC016830, AC007277, AP000558, AF001552, AC016027, AC004019, AC005527, AL031985, AF205588, AC004752, AL078463, AL022316, Z82206, AP000300, AC004812, AC007376, AL035086, AC005037, AC005484, Z83844, AC009509, AC002375, Z93023, AL024498, and AL035450.
HELDH71	577	740198	1 - 629	15 - 643	H40372, AA190779, AI792065, AA315314, AI792074, HI5516, R14652, R60461, AA147113, AA173721, AW028676, HI1571, H65653, T85096, R96576, AA337744, R02157, AA191497, R73942, R09150, W24899, AC004537, and AF161419.
HELDG91	578	790371	1 - 757	15 - 771	AI808351, N32277, AA886875, AA256444, W81274, AI056648, W81237, AI168722, AA775321, H97616, AA256318, H26750, H26847, H97380, AI241162, and N44565.
HELW51	579	531073	1 - 248	15 - 262	AR025382.
HEL30	580	691024	1 - 359	15 - 373	H29208, AA595183, and AF102777.
HEL36	581	655045	1 - 498	15 - 512	AA037425, AI741209, R81422, and AW275774.
HELB11	582	967661	1 - 422	15 - 436	AA136444, H96161, H61998, W03286, and AC010209.
HELC83	583	781412	1 - 531	15 - 545	R13326, and R20026.
HELAZ48	584	864515	1 - 951	15 - 965	W19935, AA451818, AW402568, H96614, N25240, AW367995, Z44387, R20284, H06089, AA034188, AW247735, AI903997, R15130, F11576, R14728, AA317939, N99694, AW410153, AW409593, F05727, W16878, W21473, R15845, H46506, H20375, H50149, R73366, AA336250, AW383353, N33873, and AA379990.
HELAW26	585	684925	1 - 528	15 - 542	H49721, H78006, and R05888.
HELAQ36	586	707420	1 - 197	15 - 211	H59264.
HELAM32	587	699661	1 - 328	15 - 342	T79826, AW136576, W44672, AI863582, N77892, H62231, AW207812, AA722922, AI374730, AI632306, AW263176, AI770020, AI817074, N74527, AI948698, AA355234, AA676826, AI636019, AA063431, D25824, C21355, AW235414, AW451382, AW377510, AC016830, AC008101, AC008079, AC016027, and AC007324.

HELAH32	588	699665	1 - 490	15 - 504	W46180, AA284181, and AF086189.
HCMSY80	589	526182	1 - 264	15 - 278	
HCMSQ63	590	745584	1 - 450	15 - 464	AI679298, AI679875, AI925636, AI719454, AA235054, AI333087, AI095570, AA877427, and AL137734.
HCMSK41	591	940260	1 - 597	15 - 611	AA719296, and AA758153.
HAHSB27	592	501010	1 - 405	15 - 419	
HAHFS80	593	954432	1 - 550	15 - 564	F22045, F31427, F00312, AA383663, and AA247490.
HAHFE11	594	965293	1 - 402	15 - 416	AA888984, and AL008718.
HAHEP68	595	738501	1 - 473	15 - 487	W95964, AA279579, AA357601, H05847, AI026709, AA065168, W95676, AW451661, AW382980, AA065169, AI739083, AI239672, AA729486, AA768730, AW003068, and AC006504.
HAHCU22	596	848831	1 - 199	15 - 213	N56073, AW369804, R45746, AA758653, and AC006205.
HAHCR15	597	810326	1 - 619	15 - 633	W60983, AW382330, AA400064, N83192, AA248090, N30985, AA401371, C01567, and AB014569.
HAHCL94	598	794044	1 - 387	15 - 401	T86209.
HAHBC03	599	923542	1 - 528	15 - 542	AA293827, and AA402475.
HAHAD95	600	865104	1 - 323	15 - 337	AA311201.
HAFBG30	601	693363	1 - 459	15 - 473	AA156638, AW340037, AA576325, AI090498, AI652388, AA304579, AI280372, F35830, AI623386, AI652584, F26635, AI682162, and AC005740.
HAFAY37	602	928705	1 - 516	15 - 530	AI625551, AI018611, AI004171, AW270040, AI359447, N64334, AI928764, R91517, AW205692, AI093803, AW291368, AI056157, AA304165, AW388381, AA251845, AW193685, C00746, and AI768273.
HAFAJ63	603	845452	1 - 546	15 - 560	R64458, AI657485, H66475, AA203500, R69944, AA303679, AA393390, H92410, AI908514, AW406064, AA398719, H85493, AA152049, H59673, and R37909.
HAECA04	604	932993	1 - 309	15 - 323	L44310, AA302370, AC006084, and AC004820.
HAEAM82	605	781539	1 - 558	15 - 572	AA114163, AA573134, AW139049, AW204553, and AI909752.

TABLE 4

<u>Code</u>	<u>Description</u>	<u>Tissue</u>	<u>Organ</u>	<u>Cell Line</u>	<u>Disease</u>	<u>Vector</u>
AR022	a_Heart	a_Heart				
AR023	a_Liver	a_Liver				
AR024	a_mammary gland	a_mammary gland				
AR025	a_Prostate	a_Prostate				
AR026	a_small intestine	a_small intestine				
AR027	a_Stomach	a_Stomach				
AR028	Blood B cells	Blood B cells				
AR029	Blood B cells activated	Blood B cells activated				
AR030	Blood B cells resting	Blood B cells resting				
AR031	Blood T cells activated	Blood T cells activated				
AR032	Blood T cells resting	Blood T cells resting				
AR033	brain	brain				
AR034	breast	breast				
AR035	breast cancer	breast cancer				
AR036	Cell Line CAOV3	Cell Line CAOV3				
AR037	cell line PA-1	cell line PA-1				
AR038	cell line transformed	cell line transformed				
AR039	colon	colon				
AR040	colon (9808co65R)	colon (9808co65R)				
AR041	colon (9809co15)	colon (9809co15)				
AR042	colon cancer	colon cancer				
AR043	colon cancer (9808co64R)	colon cancer (9808co64R)				
AR044	colon cancer 9809co14	colon cancer 9809co14				
AR045	corn clone 5	corn clone 5				
AR046	corn clone 6	corn clone 6				
AR047	corn clone2	corn clone2				
AR048	corn clone3	corn clone3				
AR049	Corn Clone4	Corn Clone4				
AR050	Donor II B Cells 24hrs	Donor II B Cells 24hrs				
AR051	Donor II B Cells 72hrs	Donor II B Cells 72hrs				
AR052	Donor II B-Cells 24 hrs.	Donor II B-Cells 24 hrs.				
AR053	Donor II B-Cells 72hrs	Donor II B-Cells 72hrs				
AR054	Donor II Resting B Cells	Donor II Resting B Cells				
AR055	Heart	Heart				
AR056	Human Lung (clontech)	Human Lung (clontech)				
AR057	Human Mammary (clontech)	Human Mammary (clontech)				
AR058	Human Thymus	Human Thymus				

	(clontech)	(clontech)				
AR059	Jurkat (unstimulated)	Jurkat (unstimulated)				
AR060	Kidney	Kidney				
AR061	Liver	Liver				
AR062	Liver (Clontech)	Liver (Clontech)				
AR063	Lymphocytes chronic lymphocytic leukaemia	Lymphocytes chronic lymphocytic leukaemia				
AR064	Lymphocytes diffuse large B cell lymphoma	Lymphocytes diffuse large B cell lymphoma				
AR065	Lymphocytes follicular lymphoma	Lymphocytes follicular lymphoma				
AR066	normal breast	normal breast				
AR067	Normal Ovarian (4004901)	Normal Ovarian (4004901)				
AR068	Normal Ovary 9508G045	Normal Ovary 9508G045				
AR069	Normal Ovary 9701G208	Normal Ovary 9701G208				
AR070	Normal Ovary 9806G005	Normal Ovary 9806G005				
AR071	Ovarian Cancer	Ovarian Cancer				
AR072	Ovarian Cancer (9702G001)	Ovarian Cancer (9702G001)				
AR073	Ovarian Cancer (9707G029)	Ovarian Cancer (9707G029)				
AR074	Ovarian Cancer (9804G011)	Ovarian Cancer (9804G011)				
AR075	Ovarian Cancer (9806G019)	Ovarian Cancer (9806G019)				
AR076	Ovarian Cancer (9807G017)	Ovarian Cancer (9807G017)				
AR077	Ovarian Cancer (9809G001)	Ovarian Cancer (9809G001)				
AR078	ovarian cancer 15799	ovarian cancer 15799				
AR079	Ovarian Cancer 17717AID	Ovarian Cancer 17717AID				
AR080	Ovarian Cancer 4004664B1	Ovarian Cancer 4004664B1				
AR081	Ovarian Cancer 4005315A1	Ovarian Cancer 4005315A1				
AR082	ovarian cancer 94127303	ovarian cancer 94127303				
AR083	Ovarian Cancer 96069304	Ovarian Cancer 96069304				
AR084	Ovarian Cancer 9707G029	Ovarian Cancer 9707G029				
AR085	Ovarian Cancer 9807G045	Ovarian Cancer 9807G045				
AR086	ovarian cancer 9809G001	ovarian cancer				

		9809G001				
AR087	Ovarian Cancer 9905C032RC	Ovarian Cancer 9905C032RC				
AR088	Ovarian cancer 9907 C00 3rd	Ovarian cancer 9907 C00 3rd				
AR089	Prostate	Prostate				
AR090	Prostate (clontech)	Prostate (clontech)				
AR091	prostate cancer	prostate cancer				
AR092	prostate cancer #15176	prostate cancer #15176				
AR093	prostate cancer #15509	prostate cancer #15509				
AR094	prostate cancer #15673	prostate cancer #15673				
AR095	Small Intestine (Clontech)	Small Intestine (Clontech)				
AR096	Spleen	Spleen				
AR097	Thymus T cells activated	Thymus T cells activated				
AR098	Thymus T cells resting	Thymus T cells resting				
AR099	Tonsil	Tonsil				
AR100	Tonsil geminal center centroblast	Tonsil geminal center centroblast				
AR101	Tonsil germinal center B cell	Tonsil germinal center B cell				
AR102	Tonsil lymph node	Tonsil lymph node				
AR103	Tonsil memory B cell	Tonsil memory B cell				
AR104	Whole Brain	Whole Brain				
AR105	Xenograft ES-2	Xenograft ES-2				
AR106	Xenograft SW626	Xenograft SW626				
H0002	Human Adult Heart	Human Adult Heart	Heart			Uni-ZAP XR
H0019	Human Fetal Heart	Human Fetal Heart	Heart			pBluescript
H0050	Human Fetal Heart	Human Fetal Heart	Heart			Uni-ZAP XR
H0097	Human Adult Heart, subtracted	Human Adult Heart	Heart			pBluescript
H0105	Human Fetal Heart, subtracted	Human Fetal Heart	Heart			pBluescript
H0173	Human Cardiomyopathy, RNA remake	Human Cardiomyopathy	Heart		disease	Uni-ZAP XR
H0196	Human Cardiomyopathy, subtracted	Human Cardiomyopathy	Heart			Uni-ZAP XR
H0230	Human Cardiomyopathy, diff exp	Human Cardiomyopathy	Heart		disease	Uni-ZAP XR
H0233	Human Fetal Heart, Differential (Adult- Specific)	Human Fetal Heart	Heart			pBluescript
H0242	Human Fetal Heart, Differential (Fetal- Specific)	Human Fetal Heart	Heart			pBluescript
H0266	Human Microvascular Endothelial Cells, fract. A	HMEC	Vein	Cell Line		Lambda ZAP II

H0267	Human Microvascular Endothelial Cells, fract. B	HMEC	Vein	Cell Line		Lambda ZAP II
H0268	Human Umbilical Vein Endothelial Cells, fract. A	HUVE Cells	Umbilical vein	Cell Line		Lambda ZAP II
H0373	Human Heart	Human Adult Heart	Heart			pCMVSPORT 1
H0403	H. Umbilical Vein Endothelial Cells, IL4 induced	HUVE Cells	Umbilical vein	Cell Line		Uni-ZAP XR
H0412	Human umbilical vein endothelial cells, IL-4 induced	HUVE Cells	Umbilical vein	Cell Line		pSport I
H0413	Human Umbilical Vein Endothelial Cells, uninduced	HUVE Cells	Umbilical vein	Cell Line		pSport I
H0433	Human Umbilical Vein Endothelial cells, frac B, re-excision	HUVE Cells	Umbilical vein	Cell Line		pBluescript
H0437	H Umbilical Vein Endothelial Cells, frac A, re-excision	HUVE Cells	Umbilical vein	Cell Line		Lambda ZAP II
H0530	Human Dermal Endothelial Cells, untreated	Human Dermal Endothelial Cells; untreated				pSport I
H0531	Human Dermal Endothelial cells, treated	Human Dermal Endothelial cells, treated with VPF				pSport I
H0599	Human Adult Heart; re-excision	Human Adult Heart	Heart			Uni-ZAP XR
H0619	Fetal Heart	Human Fetal Heart	Heart			Uni-ZAP XR
H0645	Fetal Heart, re-excision	Human Fetal Heart	Heart			Uni-ZAP XR
S0005	Heart	Heart-left ventricle	Heart			pCDNA
S0045	Endothelial cells-control	Endothelial cell	endothelial cell-lung	Cell Line		Uni-ZAP XR
S0046	Endothelial-induced	Endothelial cell	endothelial cell-lung	Cell Line		Uni-ZAP XR
T0048	Human Aortic Endothelium	Human Aortic Endothelium				pBluescript SK-
T0049	Aorta endothelial cells + TNF-a	Aorta endothelial cells				pBluescript SK-
L0002	Atrium cDNA library Human heart					
L0060	Human thymus NSTH II					
L0070	Selected chromosome 21 cDNA library					
L0142	Human placenta cDNA (TFujiwara)	placenta				
L0157	Human fetal brain (TFujiwara)		brain			
L0362	Stratagene ovarian cancer (#937219)					Bluescript SK-
L0364	NCI_CGAP_GC5	germ cell tumor				Bluescript SK-
L0367	NCI_CGAP_Sch1	Schwannoma tumor				Bluescript SK-

L0375	NCI_CGAP_Kid6	kidney tumor	kidney			Bluescript SK-
L0378	NCI_CGAP_Lu1	lung tumor	lung			Bluescript SK-
L0438	normalized infant brain cDNA	total brain	brain			lafmid BA
L0439	Soares infant brain 1NIB		whole brain			Lafmid BA
L0455	Human retina cDNA randomly primed sublibrary	retina	eye			lambda gt10
L0459	Adult heart, Clontech					Lambda gt11
L0471	Human fetal heart, Lambda ZAP Express					Lambda ZAP Express
L0485	STRATAGENE Human skeletal muscle cDNA library, cat. #936215.	skeletal muscle	leg muscle			Lambda ZAPII
L0529	NCI_CGAP_Pr6	prostate				pAMP10
L0530	NCI_CGAP_Pr8	prostate				pAMP10
L0532	NCI_CGAP_Thy1	thyroid				pAMP10
L0534	Chromosome 7 Fetal Brain cDNA Library	brain	brain			pAMP10
L0547	NCI_CGAP_Pr16	tumor	prostate			pAMP10
L0581	Stratagene liver (#937224)		liver			pBluescript SK
L0588	Stratagene endothelial cell 937223					pBluescript SK-
L0589	Stratagene fetal retina 937202					pBluescript SK-
L0591	Stratagene HeLa cell s3 937216					pBluescript SK-
L0592	Stratagene hNT neuron (#937233)					pBluescript SK-
L0593	Stratagene neuroepithelium (#937231)					pBluescript SK-
L0595	Stratagene NT2 neuronal precursor 937230	neuroepithelial cells	brain			pBluescript SK-
L0596	Stratagene colon (#937204)		colon			pBluescript SK-
L0598	Morton Fetal Cochlea	cochlea	ear			pBluescript SK-
L0599	Stratagene lung (#937210)		lung			pBluescript SK-
L0601	Stratagene pancreas (#937208)		pancreas			pBluescript SK-
L0602	Pancreatic Islet	pancreatic islet	pancreas			pBluescript SK-
L0603	Stratagene placenta (#937225)		placenta			pBluescript SK-
L0604	Stratagene muscle 937209	muscle	skeletal muscle			pBluescript SK-
L0605	Stratagene fetal spleen (#937205)	fetal spleen	spleen			pBluescript SK-
L0608	Stratagene lung carcinoma 937218	lung carcinoma	lung	NCI-H69		pBluescript SK-
L0617	Chromosome 22 exon					pBluescript IKS +
L0622	HM1					pcDNAII (Invitrogen)

L0623	HM3	pectoral muscle (after mastectomy)			pcDNAII (Invitrogen)
L0637	NCI_CGAP_Brn53	three pooled meningiomas	brain		pCMV-SPORT6
L0638	NCI_CGAP_Brn35	tumor, 5 pooled (see description)	brain		pCMV-SPORT6
L0646	NCI_CGAP_Co14	moderately- differentiated adenocarcinoma	colon		pCMV-SPORT6
L0651	NCI_CGAP_Kid8	renal cell tumor	kidney		pCMV-SPORT6
L0657	NCI_CGAP_Ov23	tumor, 5 pooled (see description)	ovary		pCMV-SPORT6
L0659	NCI_CGAP_Pan1	adenocarcinoma	pancreas		pCMV-SPORT6
L0662	NCI_CGAP_Gas4	poorly differentiated adenocarcinoma with signet r	stomach		pCMV-SPORT6
L0663	NCI_CGAP_Ut2	moderately- differentiated endometrial adenocarcino	uterus		pCMV-SPORT6
L0665	NCI_CGAP_Ut4	serous papillary carcinoma, high grade, 2 pooled t	uterus		pCMV-SPORT6
L0666	NCI_CGAP_Ut1	well-differentiated endometrial adenocarcinoma, 7	uterus		pCMV-SPORT6
L0717	Gessler Wilms tumor				pSPORT1
L0731	Soares_pregnant_uterus_ NbHPU		uterus		pT7T3-Pac
L0740	Soares melanocyte 2NbHM	melanocyte			pT7T3D (Pharmacia) with a modified polylinker
L0742	Soares adult brain N2b5HB55Y		brain		pT7T3D (Pharmacia) with a modified polylinker
L0743	Soares breast 2NbHBst		breast		pT7T3D (Pharmacia) with a modified polylinker
L0744	Soares breast 3NbHBst		breast		pT7T3D (Pharmacia) with a modified polylinker
L0745	Soares retina N2b4HR	retina	eye		pT7T3D (Pharmacia) with a modified polylinker
L0746	Soares retina N2b5HR	retina	eye		pT7T3D (Pharmacia) with a modified polylinker
L0747	Soares_fetal_heart_NbHH		heart		pT7T3D

	19W					(Pharmacia) with a modified polylinker
L0748	Soares fetal liver spleen 1NFLS		Liver and Spleen			pT7T3D (Pharmacia) with a modified polylinker
L0749	Soares_fetal_liver_spleen _1NFLS_S1		Liver and Spleen			pT7T3D (Pharmacia) with a modified polylinker
L0750	Soares_fetal_lung_NbHL1 9W		lung			pT7T3D (Pharmacia) with a modified polylinker
L0751	Soares ovary tumor NbHOT	ovarian tumor	ovary			pT7T3D (Pharmacia) with a modified polylinker
L0752	Soares_parathyroid_tumor _NbHPA	parathyroid tumor	parathyroid gland			pT7T3D (Pharmacia) with a modified polylinker
L0753	Soares_pineal_gland_N3H PG		pineal gland			pT7T3D (Pharmacia) with a modified polylinker
L0754	Soares placenta Nb2HP		placenta			pT7T3D (Pharmacia) with a modified polylinker
L0755	Soares_placenta_8to9wee ks_2NbHP8to9W		placenta			pT7T3D (Pharmacia) with a modified polylinker
L0756	Soares_multiple_sclerosis _2NbHMSP	multiple sclerosis lesions				pT7T3D (Pharmacia) with a modified polylinker V_TYPE
L0757	Soares_senescent_fibrobla sts_NbHSF	senescent fibroblast				pT7T3D (Pharmacia) with a modified polylinker V_TYPE
L0758	Soares_testis_NHT					pT7T3D-Pac (Pharmacia) with a modified polylinker
L0759	Soares_total_fetus_Nb2H F8_9w					pT7T3D-Pac (Pharmacia) with a modified polylinker
L0764	NCI_CGAP_Co3	colon				pT7T3D-Pac

						(Pharmacia) with a modified polylinker
L0766	NCI_CGAP_GCB1	germinal center B cell				pT7T3D-Pac (Pharmacia) with a modified polylinker
L0769	NCI_CGAP_Brn25	anaplastic oligodendroglioma	brain			pT7T3D-Pac (Pharmacia) with a modified polylinker
L0772	NCI_CGAP_Co10	colon tumor RER+	colon			pT7T3D-Pac (Pharmacia) with a modified polylinker
L0774	NCI_CGAP_Kid3		kidney			pT7T3D-Pac (Pharmacia) with a modified polylinker
L0775	NCI_CGAP_Kid5	2 pooled tumors (clear cell type)	kidney			pT7T3D-Pac (Pharmacia) with a modified polylinker
L0776	NCI_CGAP_Lu5	carcinoid	lung			pT7T3D-Pac (Pharmacia) with a modified polylinker
L0777	Soares_NhHMPu_S1	Pooled human melanocyte, fetal heart, and pregnant	mixed (see below)			pT7T3D-Pac (Pharmacia) with a modified polylinker
L0779	Soares_NFL_T_GBC_S1		pooled			pT7T3D-Pac (Pharmacia) with a modified polylinker
L0780	Soares_NSF_F8_9W_OT _PA_P_S1		pooled			pT7T3D-Pac (Pharmacia) with a modified polylinker
L0783	NCI_CGAP_Pr22	normal prostate	prostate			pT7T3D-Pac (Pharmacia) with a modified polylinker
L0789	NCI_CGAP_Sub3					pT7T3D-Pac (Pharmacia) with a modified polylinker
L0790	NCI_CGAP_Sub4					pT7T3D-Pac (Pharmacia) with a modified polylinker
L0794	NCI_CGAP_GC6	pooled germ cell tumors				pT7T3D-Pac (Pharmacia) with a modified

						polylinker
L0803	NCI_CGAP_Kid11		kidney			pT7T3D-Pac (Pharmacia) with a modified polylinker
L0804	NCI_CGAP_Kid12	2 pooled tumors (clear cell type)	kidney			pT7T3D-Pac (Pharmacia) with a modified polylinker
L0805	NCI_CGAP_Lu24	carcinoid	lung			pT7T3D-Pac (Pharmacia) with a modified polylinker
L0809	NCI_CGAP_Pr28		prostate			pT7T3D-Pac (Pharmacia) with a modified polylinker

TABLE 5

OMIM Reference	Description
102200	Somatotrophinoma
102770	Myoadenylate deaminase deficiency
106100	Angioedema, hereditary
107970	Arrhythmogenic right ventricular dysplasia-1
108725	Atherosclerosis, susceptibility to
108962	Hypertension, salt-resistant
109400	Basal cell nevus syndrome
109543	Leukemia, chronic lymphocytic, B-cell
115650	Cataract, anterior polar-1
118210	Charcot-Marie-Tooth neuropathy-2A
120550	C1q deficiency, type A
120570	C1q deficiency, type B
120575	C1q deficiency, type C
120700	C3 deficiency
121011	Deafness, autosomal dominant 3, 601544
121011	Deafness, autosomal recessive 1, 220290
121800	Corneal dystrophy, crystalline, Schnyder
123270	[Creatine kinase, brain type, ectopic expression of]
129500	Ectodermal dysplasia, hidrotic
130500	Elliptocytosis-1
131100	Multiple endocrine neoplasia I
131100	Prolactinoma, hyperparathyroidism, carcinoid syndrome
131100	Carcinoid tumor of lung
132800	Basal cell carcinoma
132800	Epithelioma, self-healing, squamous 1, Ferguson-Smith type
133171	[Erythrocytosis, familial], 133100
133200	Erythrokeratoderma variabilis
133780	Vitreoretinopathy, exudative, familial
138140	Glucose transport defect, blood-brain barrier
138971	Kostmann neutropenia, 202700
143890	Hypercholesterolemia, familial
146150	Hypomelanosis of Ito
147050	Atopy
147670	Rabson-Mendenhall syndrome
147670	Diabetes mellitus, insulin-resistant, with acanthosis nigricans
147670	Leprechaunism
150250	Larsen syndrome, autosomal dominant
151440	Leukemia, T-cell acute lymphoblastoid
153700	Macular dystrophy, vitelliform type
155600	Malignant melanoma, cutaneous
161015	Mitochondrial complex I deficiency, 252010
164009	Leukemia, acute promyelocytic, NUMA/RARA type
164500	Spinocerebellar ataxia-7
164953	Liposarcoma

168360	Paraneoplastic sensory neuropathy
168461	Multiple myeloma, 254250
168461	Parathyroid adenomatosis 1
168461	Centrocytic lymphoma
168468	Metaphyseal chondrodysplasia, Murk Jansen type, 156400
171760	Hypophosphatasia, adult, 146300
171760	Hypophosphatasia, infantile, 241500
172411	Colorectal cancer, resistance to
176100	Porphyria cutanea tarda
176100	Porphyria, hepatoerythropoietic
177070	Spherocytosis, hereditary, Japanese type
177070	Hermansky-Pudlak syndrome, 203300
178300	Ptosis, hereditary congenital, 1
180297	Anemia, hemolytic, Rh-null, suppressor type, 268150
180721	Retinitis pigmentosa, digenic
180840	Susceptibility to IDDM
182280	Small-cell cancer of lung
182500	Cataract, congenital
182600	Spastic paraplegia-3A
185470	Myopathy due to succinate dehydrogenase deficiency
186855	Leukemia-2, T-cell acute lymphoblastic
188540	Hypothyroidism, nongoitrous
188826	Sorsby fundus dystrophy, 136900
191181	Cervical carcinoma
193235	Vitreoretinopathy, neovascular inflammatory
203800	Alstrom syndrome
209901	Bardet-Biedl syndrome 1
211420	Breast cancer, ductal
216550	Cohen syndrome
218000	Andermann syndrome
223900	Dysautonomia, familial
227220	[Eye color, brown]
230000	Fucosidosis
230350	Galactose epimerase deficiency
230450	Hemolytic anemia due to gamma-glutamylcysteine synthetase deficiency
231670	Glutaricaciduria, type I
232600	McArdle disease
238310	Hyperglycinemia, nonketotic, type II
243500	Isovalericacidemia
245200	Krabbe disease
248611	Maple syrup urine disease, type Ib
250100	Metachromatic leukodystrophy
250800	Methemoglobinemia, type I
250800	Methemoglobinemia, type II
251600	Microphthalmia, autosomal recessive
253700	Muscular dystrophy, limb-girdle, type 2C

253800	Walker-Warburg syndrome, 236670
253800	Fukuyama type congenital muscular dystrophy
255800	Schwartz-Jampel syndrome
259700	Osteopetrosis, recessive
259770	Osteoporosis-pseudoglioma syndrome
263200	Polycystic kidney disease, autosomal recessive
268900	[Sarcosinemia]
270100	Situs inversus viscerum
276900	Usher syndrome, type 1A
277730	Wernicke-Korsakoff syndrome, susceptibility to
278700	Xeroderma pigmentosum, group A
600045	Xeroderma pigmentosum, group E, subtype 2
600163	Long QT syndrome-3
600234	HMG-CoA synthase-2 deficiency
600258	Colorectal cancer, hereditary nonpolyposis, type 3
600276	Cerebral arteriopathy with subcortical infarcts and leukoencephalopathy, 125310
600319	Diabetes mellitus, insulin-dependent, 4
600528	CPT deficiency, hepatic, type I, 255120
600631	Enuresis, nocturnal, 1
600837	Hirschsprung disease, 142623
600839	Bartter syndrome, 241200
600957	Persistent Mullerian duct syndrome, type I, 261550
600971	Deafness, autosomal recessive 6
601226	Progressive external ophthalmoplegia, type 2
601414	Retinitis pigmentosa-18
601499	Rieger syndrome, type 2
601690	Platelet-activating factor acetylhydrolase deficiency
601691	Retinitis pigmentosa-19, 601718
601691	Stargardt disease-1, 248200
601691	Cone-rod dystrophy 3
601691	Fundus flavimaculatus with macular dystrophy, 248200
601718	Retinitis pigmentosa-19
601800	[Hair color, brown]
601843	Hypothyroidism, congenital, 274400
601884	[High bone mass]
601885	Cataract, zonular pulverulent-2
601916	Pancreatic cancer
601990	Neuroblastoma
602023	Bartter syndrome, type 3
602087	Arrhythmogenic right ventricular dysplasia-4
602088	Nephronophthisis, infantile
602091	Marfan syndrome, atypical
602094	Lipodystrophy, familial partial
602221	Stem-cell leukemia/lymphoma syndrome
602771	Muscular dystrophy, congenital, with early spine rigidity

Polynucleotide and Polypeptide Variants

[0099] The present invention is also directed to variants of the cardiovascular system associated polynucleotide sequence disclosed in SEQ ID NO:X or the complementary strand thereto, nucleotide sequences encoding the polypeptide of SEQ ID NO:Y, the nucleotide sequence of SEQ ID NO:X encoding the polypeptide sequence as defined in column 6 of Table 1A, nucleotide sequences encoding the polypeptide as defined in column 6 of Table 1A, the nucleotide sequence as defined in columns 8 and 9 of Table 2, nucleotide sequences encoding the polypeptide encoded by the nucleotide sequence as defined in columns 8 and 9 of Table 2, the nucleotide sequence as defined in column 6 of Table 1B, nucleotide sequences encoding the polypeptide encoded by the nucleotide sequence as defined in column 6 of Table 1B, the cDNA sequence contained in Clone ID NO:Z, and/or nucleotide sequences encoding a polypeptide encoded by the cDNA sequence contained in Clone ID NO:Z.

[00100] The present invention also encompasses variants of the polypeptide sequence disclosed in SEQ ID NO:Y, a polypeptide sequence as defined in column 6 of Table 1A, a polypeptide sequence encoded by the polynucleotide sequence in SEQ ID NO:X, a polypeptide sequence encoded by the nucleotide sequence as defined in columns 8 and 9 of Table 2, a polypeptide sequence encoded by the nucleotide sequence as defined in column 6 of Table 1B, a polypeptide sequence encoded by the complement of the polynucleotide sequence in SEQ ID NO:X, and/or a polypeptide sequence encoded by the cDNA sequence contained in Clone ID NO:Z.

[00101] "Variant" refers to a polynucleotide or polypeptide differing from the polynucleotide or polypeptide of the present invention, but retaining essential properties thereof. Generally, variants are overall closely similar, and, in many regions, identical to the polynucleotide or polypeptide of the present invention.

[00102] Thus, one aspect of the invention provides an isolated nucleic acid molecule comprising, or alternatively consisting of, a polynucleotide having a nucleotide sequence selected from the group consisting of: (a) a nucleotide sequence described in SEQ ID NO:X or contained in the cDNA sequence of Clone ID NO:Z; (b) a nucleotide sequence in SEQ ID NO:X or the cDNA in Clone ID NO:Z which encodes a mature cardiovascular system associated polypeptide; (c) a nucleotide sequence in SEQ ID NO:X or the cDNA sequence of Clone ID NO:Z, which

encodes a biologically active fragment of a cardiovascular system associated polypeptide; (d) a nucleotide sequence in SEQ ID NO:X or the cDNA sequence of Clone ID NO:Z, which encodes an antigenic fragment of a cardiovascular system associated polypeptide; (e) a nucleotide sequence encoding a cardiovascular system associated polypeptide having the complete amino acid sequence of SEQ ID NO:Y or the complete amino acid sequence encoded by the cDNA in Clone ID NO:Z; (f) a nucleotide sequence encoding a mature cardiovascular system associated polypeptide of the amino acid sequence of SEQ ID NO:Y or the amino acid sequence encoded by the cDNA in Clone ID NO:Z; (g) a nucleotide sequence encoding a biologically active fragment of a cardiovascular system associated polypeptide having the complete amino acid sequence of SEQ ID NO:Y or the complete amino acid sequence encoded by the cDNA in Clone ID NO:Z; (h) a nucleotide sequence encoding an antigenic fragment of a cardiovascular system associated polypeptide having the complete amino acid sequence of SEQ ID NO:Y or the complete amino acid sequence encoded by the cDNA in Clone ID NO:Z; and (i) a nucleotide sequence complementary to any of the nucleotide sequences in (a), (b), (c), (d), (e), (f), (g), or (h), above.

[00103] The present invention is also directed to nucleic acid molecules which comprise, or alternatively consist of, a nucleotide sequence which is at least 80%, 85%, 90%, 95%, 96%, 97%, 98%, 99% or 100%, identical to, for example, any of the nucleotide sequences in (a), (b), (c), (d), (e), (f), (g), (h), or (i) above, the nucleotide coding sequence in SEQ ID NO:X or the complementary strand thereto, the nucleotide coding sequence of the cDNA contained in Clone ID NO:Z or the complementary strand thereto, a nucleotide sequence encoding the polypeptide of SEQ ID NO:Y, a nucleotide sequence encoding a polypeptide sequence encoded by the nucleotide sequence in SEQ ID NO:X, a polypeptide sequence encoded by the complement of the polynucleotide sequence in SEQ ID NO:X, a nucleotide sequence encoding the polypeptide encoded by the cDNA contained in Clone ID NO:Z, the nucleotide coding sequence in SEQ ID NO:X as defined in columns 8 and 9 of Table 2 or the complementary strand thereto, a nucleotide sequence encoding the polypeptide encoded by the nucleotide sequence in SEQ ID NO:X as defined in columns 8 and 9 of Table 2 or the complementary strand thereto, the nucleotide coding sequence in SEQ ID NO:B as defined in column 6 of Table 1B or

the complementary strand thereto, a nucleotide sequence encoding the polypeptide encoded by the nucleotide sequence in SEQ ID NO:B as defined in column 6 of Table 1B or the complementary strand thereto, the nucleotide sequence in SEQ ID NO:X encoding the polypeptide sequence as defined in column 6 of Table 1A or the complementary strand thereto, nucleotide sequences encoding a polypeptide as defined in column 6 of Table 1A or the complementary strand thereto, and/or polynucleotide fragments of any of these nucleic acid molecules (e.g., those fragments described herein). Polynucleotides which hybridize to the complement of these nucleic acid molecules under stringent hybridization conditions or alternatively, under lower stringency conditions, are also encompassed by the invention, as are polypeptides encoded by these polynucleotides and nucleic acids.

[00104] In a preferred embodiment, the invention encompasses nucleic acid molecules which comprise, or alternatively, consist of a polynucleotide which hybridizes under stringent hybridization conditions, or alternatively, under lower stringency conditions, to a polynucleotide in (a), (b), (c), (d), (e), (f), (g), (h), or (i) above, as are polypeptides encoded by these polynucleotides. In another preferred embodiment, polynucleotides which hybridize to the complement of these nucleic acid molecules under stringent hybridization conditions or alternatively, under lower stringency conditions, are also encompassed by the invention, as are polypeptides encoded by these polynucleotides.

[00105] In another embodiment, the invention provides a purified protein comprising, or alternatively consisting of, a polypeptide having an amino acid sequence selected from the group consisting of: (a) the complete amino acid sequence of SEQ ID NO:Y or the complete amino acid sequence encoded by the cDNA in Clone ID NO:Z; (b) the amino acid sequence of a mature cardiovascular system associated polypeptide having the amino acid sequence of SEQ ID NO:Y or the amino acid sequence encoded by the cDNA in Clone ID NO:Z; (c) the amino acid sequence of a biologically active fragment of a cardiovascular system associated polypeptide having the complete amino acid sequence of SEQ ID NO:Y or the complete amino acid sequence encoded by the cDNA in Clone ID NO:Z; and (d) the amino acid sequence of an antigenic fragment of a cardiovascular system associated polypeptide having the complete amino acid sequence of SEQ ID NO:Y or the complete amino acid sequence encoded by the cDNA in Clone ID NO:Z.

[00106] The present invention is also directed to proteins which comprise, or alternatively consist of, an amino acid sequence which is at least 80%, 85%, 90%, 95%, 96%, 97%, 98%, 99% or 100%, identical to, for example, any of the amino acid sequences in (a), (b), (c), or (d), above, the amino acid sequence shown in SEQ ID NO:Y, the amino acid sequence encoded by the cDNA contained in Clone ID NO:Z, the amino acid sequence of the polypeptide encoded by the nucleotide sequence in SEQ ID NO:X as defined in columns 8 and 9 of Table 2, the amino acid sequence of the polypeptide encoded by the nucleotide sequence in SEQ ID NO:B as defined in column 6 of Table 1B, the amino acid sequence as defined in column 6 of Table 1A, an amino acid sequence encoded by the nucleotide sequence in SEQ ID NO:X, and an amino acid sequence encoded by the complement of the polynucleotide sequence in SEQ ID NO:X. Fragments of these polypeptides are also provided (e.g., those fragments described herein). Further proteins encoded by polynucleotides which hybridize to the complement of the nucleic acid molecules encoding these amino acid sequences under stringent hybridization conditions or alternatively, under lower stringency conditions, are also encompassed by the invention, as are the polynucleotides encoding these proteins.

[00107] By a nucleic acid having a nucleotide sequence at least, for example, 95% "identical" to a reference nucleotide sequence of the present invention, it is intended that the nucleotide sequence of the nucleic acid is identical to the reference sequence except that the nucleotide sequence may include up to five point mutations per each 100 nucleotides of the reference nucleotide sequence encoding the polypeptide. In other words, to obtain a nucleic acid having a nucleotide sequence at least 95% identical to a reference nucleotide sequence, up to 5% of the nucleotides in the reference sequence may be deleted or substituted with another nucleotide, or a number of nucleotides up to 5% of the total nucleotides in the reference sequence may be inserted into the reference sequence. The query sequence may be an entire sequence referred to in Table 1A or 2 as the ORF (open reading frame), or any fragment specified, as described herein.

[00108] As a practical matter, whether any particular nucleic acid molecule or polypeptide is at least 80%, 85%, 90%, 95%, 96%, 97%, 98% or 99% identical to a nucleotide sequence of the present invention can be determined conventionally using known computer programs. A preferred method for determining the best

overall match between a query sequence (a sequence of the present invention) and a subject sequence, also referred to as a global sequence alignment, can be determined using the FASTDB computer program based on the algorithm of Brutlag et al. (Comp. App. Biosci. 6:237-245 (1990)). In a sequence alignment the query and subject sequences are both DNA sequences. An RNA sequence can be compared by converting U's to T's. The result of said global sequence alignment is expressed as percent identity. Preferred parameters used in a FASTDB alignment of DNA sequences to calculate percent identity are: Matrix=Unitary, k-tuple=4, Mismatch Penalty=1, Joining Penalty=30, Randomization Group Length=0, Cutoff Score=1, Gap Penalty=5, Gap Size Penalty 0.05, Window Size=500 or the length of the subject nucleotide sequence, whichever is shorter.

[00109] If the subject sequence is shorter than the query sequence because of 5' or 3' deletions, not because of internal deletions, a manual correction must be made to the results. This is because the FASTDB program does not account for 5' and 3' truncations of the subject sequence when calculating percent identity. For subject sequences truncated at the 5' or 3' ends, relative to the query sequence, the percent identity is corrected by calculating the number of bases of the query sequence that are 5' and 3' of the subject sequence, which are not matched/aligned, as a percent of the total bases of the query sequence. Whether a nucleotide is matched/aligned is determined by results of the FASTDB sequence alignment. This percentage is then subtracted from the percent identity, calculated by the above FASTDB program using the specified parameters, to arrive at a final percent identity score. This corrected score is what is used for the purposes of the present invention. Only bases outside the 5' and 3' bases of the subject sequence, as displayed by the FASTDB alignment, which are not matched/aligned with the query sequence, are calculated for the purposes of manually adjusting the percent identity score.

[00110] For example, a 90 base subject sequence is aligned to a 100 base query sequence to determine percent identity. The deletions occur at the 5' end of the subject sequence and therefore, the FASTDB alignment does not show a matched/alignment of the first 10 bases at 5' end. The 10 unpaired bases represent 10% of the sequence (number of bases at the 5' and 3' ends not matched/total number of bases in the query sequence) so 10% is subtracted from the percent identity score calculated by the FASTDB program. If the remaining 90 bases were perfectly matched the final

percent identity would be 90%. In another example, a 90 base subject sequence is compared with a 100 base query sequence. This time the deletions are internal deletions so that there are no bases on the 5' or 3' of the subject sequence which are not matched/aligned with the query. In this case the percent identity calculated by FASTDB is not manually corrected. Once again, only bases 5' and 3' of the subject sequence which are not matched/aligned with the query sequence are manually corrected for. No other manual corrections are to be made for the purposes of the present invention.

[00111] By a polypeptide having an amino acid sequence at least, for example, 95% "identical" to a query amino acid sequence of the present invention, it is intended that the amino acid sequence of the subject polypeptide is identical to the query sequence except that the subject polypeptide sequence may include up to five amino acid alterations per each 100 amino acids of the query amino acid sequence. In other words, to obtain a polypeptide having an amino acid sequence at least 95% identical to a query amino acid sequence, up to 5% of the amino acid residues in the subject sequence may be inserted, deleted, (indels) or substituted with another amino acid. These alterations of the reference sequence may occur at the amino or carboxy terminal positions of the reference amino acid sequence or anywhere between those terminal positions, interspersed either individually among residues in the reference sequence or in one or more contiguous groups within the reference sequence.

[00112] As a practical matter, whether any particular polypeptide is at least 80%, 85%, 90%, 95%, 96%, 97%, 98% or 99% identical to, for instance, the amino acid sequence of a polypeptide referred to in Table 1A (e.g., an amino acid sequence identified in columns 5 or 6) or Table 2 (e.g., the amino acid sequence of the polypeptide encoded by the polynucleotide sequence defined in columns 8 and 9 of Table 2) or a fragment thereof, the amino acid sequence of the polypeptide encoded by the polynucleotide sequence in SEQ ID NO:B as defined in column 6 of Table 1B or a fragment thereof, the amino acid sequence of the polypeptide encoded by the nucleotide sequence in SEQ ID NO:X or a fragment thereof, or an amino acid sequence of the polypeptide encoded by cDNA contained in Clone ID NO:Z, or a fragment thereof, can be determined conventionally using known computer programs. A preferred method for determining the best overall match between a

query sequence (a sequence of the present invention) and a subject sequence, also referred to as a global sequence alignment, can be determined using the FASTDB computer program based on the algorithm of Brutlag et al. (Comp. App. Biosci.6:237-245 (1990)). In a sequence alignment the query and subject sequences are either both nucleotide sequences or both amino acid sequences. The result of said global sequence alignment is expressed as percent identity. Preferred parameters used in a FASTDB amino acid alignment are: Matrix=PAM 0, k-tuple=2, Mismatch Penalty=1, Joining Penalty=20, Randomization Group Length=0, Cutoff Score=1, Window Size=sequence length, Gap Penalty=5, Gap Size Penalty=0.05, Window Size=500 or the length of the subject amino acid sequence, whichever is shorter.

[00113] If the subject sequence is shorter than the query sequence due to N- or C-terminal deletions, not because of internal deletions, a manual correction must be made to the results. This is because the FASTDB program does not account for N- and C-terminal truncations of the subject sequence when calculating global percent identity. For subject sequences truncated at the N- and C-termini, relative to the query sequence, the percent identity is corrected by calculating the number of residues of the query sequence that are N- and C-terminal of the subject sequence, which are not matched/aligned with a corresponding subject residue, as a percent of the total bases of the query sequence. Whether a residue is matched/aligned is determined by results of the FASTDB sequence alignment. This percentage is then subtracted from the percent identity, calculated by the above FASTDB program using the specified parameters, to arrive at a final percent identity score. This final percent identity score is what is used for the purposes of the present invention. Only residues to the N- and C-termini of the subject sequence, which are not matched/aligned with the query sequence, are considered for the purposes of manually adjusting the percent identity score. That is, only query residue positions outside the farthest N- and C- terminal residues of the subject sequence.

[00114] For example, a 90 amino acid residue subject sequence is aligned with a 100 residue query sequence to determine percent identity. The deletion occurs at the N-terminus of the subject sequence and therefore, the FASTDB alignment does not show a matching/alignment of the first 10 residues at the N-terminus. The 10 unpaired residues represent 10% of the sequence (number of residues at the N- and

C- termini not matched/total number of residues in the query sequence) so 10% is subtracted from the percent identity score calculated by the FASTDB program. If the remaining 90 residues were perfectly matched the final percent identity would be 90%. In another example, a 90 residue subject sequence is compared with a 100 residue query sequence. This time the deletions are internal deletions so there are no residues at the N- or C-termini of the subject sequence which are not matched/aligned with the query. In this case the percent identity calculated by FASTDB is not manually corrected. Once again, only residue positions outside the N- and C-terminal ends of the subject sequence, as displayed in the FASTDB alignment, which are not matched/aligned with the query sequence are manually corrected for. No other manual corrections are to be made for the purposes of the present invention.

[00115] The polynucleotide variants of the invention may contain alterations in the coding regions, non-coding regions, or both. Especially preferred are polynucleotide variants containing alterations, which produce silent substitutions, additions, or deletions, but do not alter the properties or activities of the encoded polypeptide. Nucleotide variants produced by silent substitutions due to the degeneracy of the genetic code are preferred. Moreover, polypeptide variants in which less than 50, less than 40, less than 30, less than 20, less than 10, or 5-50, 5-25, 5-10, 1-5, or 1-2 amino acids are substituted, deleted, or added in any combination are also preferred. Polynucleotide variants can be produced for a variety of reasons, e.g., to optimize codon expression for a particular host (change codons in the human mRNA to those preferred by a bacterial host such as *E. coli*).

[00116] Naturally occurring variants are called "allelic variants," and refer to one of several alternate forms of a gene occupying a given locus on a chromosome of an organism. (Genes II, Lewin, B., ed., John Wiley & Sons, New York (1985).) These allelic variants can vary at either the polynucleotide and/or polypeptide level and are included in the present invention. Alternatively, non-naturally occurring variants may be produced by mutagenesis techniques or by direct synthesis.

[00117] Using known methods of protein engineering and recombinant DNA technology, variants may be generated to improve or alter the characteristics of the polypeptides of the present invention. For instance, one or more amino acids can be deleted from the N-terminus or C-terminus of the polypeptides of the present invention without

substantial loss of biological function. As an example, the authors of Ron et al., *J. Biol. Chem.* 268: 2984-2988 (1993), reported variant KGF proteins having heparin binding activity even after deleting 3, 8, or 27 amino-terminal amino acid residues. Similarly, Interferon gamma exhibited up to ten times higher activity after deleting 8-10 amino acid residues from the carboxy terminus of this protein. (Dobeli et al., *J. Biotechnology* 7:199-216 (1988).)

- [00118] Moreover, ample evidence demonstrates that variants often retain a biological activity similar to that of the naturally occurring protein. For example, Gayle and coworkers (*J. Biol. Chem.* 268:22105-22111 (1993)) conducted extensive mutational analysis of human cytokine IL-1a. They used random mutagenesis to generate over 3,500 individual IL-1a mutants that averaged 2.5 amino acid changes per variant over the entire length of the molecule. Multiple mutations were examined at every possible amino acid position. The investigators found that "[m]ost of the molecule could be altered with little effect on either [binding or biological activity]." In fact, only 23 unique amino acid sequences, out of more than 3,500 nucleotide sequences examined, produced a protein that significantly differed in activity from wild-type.
- [00119] Furthermore, even if deleting one or more amino acids from the N-terminus or C-terminus of a polypeptide results in modification or loss of one or more biological functions, other biological activities may still be retained. For example, the ability of a deletion variant to induce and/or to bind antibodies, which recognize the secreted form will likely be retained when less than the majority of the residues of the secreted form are removed from the N-terminus or C-terminus. Whether a particular polypeptide lacking N- or C-terminal residues of a protein retains such immunogenic activities can readily be determined by routine methods described herein and otherwise known in the art.
- [00120] Thus, the invention further includes polypeptide variants which show a functional activity (e.g., biological activity) of the polypeptides of the invention. Such variants include deletions, insertions, inversions, repeats, and substitutions selected according to general rules known in the art so as have little effect on activity.
- [00121] The present application is directed to nucleic acid molecules at least 80%, 85%, 90%, 95%, 96%, 97%, 98%, 99% or 100% identical to the nucleic acid sequences

disclosed herein, (e.g., encoding a polypeptide having the amino acid sequence of an N and/or C terminal deletion), irrespective of whether they encode a polypeptide having functional activity. This is because even where a particular nucleic acid molecule does not encode a polypeptide having functional activity, one of skill in the art would still know how to use the nucleic acid molecule, for instance, as a hybridization probe or a polymerase chain reaction (PCR) primer. Uses of the nucleic acid molecules of the present invention that do not encode a polypeptide having functional activity include, *inter alia*, (1) isolating a gene or allelic or splice variants thereof in a cDNA library; (2) in situ hybridization (e.g., "FISH") to metaphase chromosomal spreads to provide precise chromosomal location of the gene, as described in Verma et al., Human Chromosomes: A Manual of Basic Techniques, Pergamon Press, New York (1988); (3) Northern Blot analysis for detecting mRNA expression in specific tissues (e.g., normal cardiovascular system or diseased cardiovascular system tissues); and (4) *in situ* hybridization (e.g., histochemistry) for detecting mRNA expression in specific tissues (e.g., normal cardiovascular system or diseased cardiovascular system tissues).

[00122] Preferred, however, are nucleic acid molecules having sequences at least 80%, 85%, 90%, 95%, 96%, 97%, 98%, 99% or 100% identical to the nucleic acid sequences disclosed herein, which do, in fact, encode a polypeptide having functional activity. By a polypeptide having "functional activity" is meant, a polypeptide capable of displaying one or more known functional activities associated with a full-length (complete) protein of the invention. Such functional activities include, but are not limited to, biological activity, antigenicity [ability to bind (or compete with a polypeptide of the invention for binding) to an anti-polypeptide of the invention antibody], immunogenicity (ability to generate antibody which binds to a specific polypeptide of the invention), ability to form multimers with polypeptides of the invention, and ability to bind to a receptor or ligand for a polypeptide of the invention.

[00123] The functional activity of the polypeptides, and fragments, variants and derivatives of the invention, can be assayed by various methods.

[00124] For example, in one embodiment where one is assaying for the ability to bind or compete with full-length polypeptide of the present invention for binding to an anti-polypeptide of the invention antibody, various immunoassays known in the art can

be used, including but not limited to, competitive and non-competitive assay systems using techniques such as radioimmunoassays, ELISA (enzyme linked immunosorbent assay), "sandwich" immunoassays, immunoradiometric assays, gel diffusion precipitation reactions, immunodiffusion assays, in situ immunoassays (using colloidal gold, enzyme or radioisotope labels, for example), western blots, precipitation reactions, agglutination assays (e.g., gel agglutination assays, hemagglutination assays), complement fixation assays, immunofluorescence assays, protein A assays, and immunoelectrophoresis assays, etc. In one embodiment, antibody binding is detected by detecting a label on the primary antibody. In another embodiment, the primary antibody is detected by detecting binding of a secondary antibody or reagent to the primary antibody. In a further embodiment, the secondary antibody is labeled. Many means are known in the art for detecting binding in an immunoassay and are within the scope of the present invention.

[00125] In another embodiment, where a ligand is identified, or the ability of a polypeptide fragment, variant or derivative of the invention to multimerize is being evaluated, binding can be assayed, e.g., by means well-known in the art, such as, for example, reducing and non-reducing gel chromatography, protein affinity chromatography, and affinity blotting. See generally, Phizicky et al., *Microbiol. Rev.* 59:94-123 (1995). In another embodiment, the ability of physiological correlates of a polypeptide of the present invention to bind to a substrate(s) of the polypeptide of the invention can be routinely assayed using techniques known in the art.

[00126] In addition, assays described herein (see Examples) and otherwise known in the art may routinely be applied to measure the ability of polypeptides of the present invention and fragments, variants and derivatives thereof to elicit polypeptide related biological activity (either *in vitro* or *in vivo*). Other methods will be known to the skilled artisan and are within the scope of the invention.

[00127] Of course, due to the degeneracy of the genetic code, one of ordinary skill in the art will immediately recognize that a large number of the nucleic acid molecules having a sequence at least 80%, 85%, 90%, 95%, 96%, 97%, 98%, 99%, or 100% identical to, for example, the nucleic acid sequence of the cDNA contained in Clone ID NO:Z, a nucleic acid sequence referred to in Table 1A (e.g., SEQ ID NO:X), a nucleic acid sequence disclosed in Table 2 (e.g., the nucleic acid sequence

delineated in columns 8 and 9) or fragments thereof, will encode polypeptides "having functional activity." In fact, since degenerate variants of any of these nucleotide sequences all encode the same polypeptide, in many instances, this will be clear to the skilled artisan even without performing the above described comparison assay. It will be further recognized in the art that, for such nucleic acid molecules that are not degenerate variants, a reasonable number will also encode a polypeptide having functional activity. This is because the skilled artisan is fully aware of amino acid substitutions that are either less likely or not likely to significantly effect protein function (e.g., replacing one aliphatic amino acid with a second aliphatic amino acid), as further described below.

[00128] For example, guidance concerning how to make phenotypically silent amino acid substitutions is provided in Bowie et al., "Deciphering the Message in Protein Sequences: Tolerance to Amino Acid Substitutions," *Science* 247:1306-1310 (1990), wherein the authors indicate that there are two main strategies for studying the tolerance of an amino acid sequence to change.

[00129] The first strategy exploits the tolerance of amino acid substitutions by natural selection during the process of evolution. By comparing amino acid sequences in different species, conserved amino acids can be identified. These conserved amino acids are likely important for protein function. In contrast, the amino acid positions where substitutions have been tolerated by natural selection indicates that these positions are not critical for protein function. Thus, positions tolerating amino acid substitution could be modified while still maintaining biological activity of the protein.

[00130] The second strategy uses genetic engineering to introduce amino acid changes at specific positions of a cloned gene to identify regions critical for protein function. For example, site directed mutagenesis or alanine-scanning mutagenesis (introduction of single alanine mutations at every residue in the molecule) can be used. See Cunningham et al., *Science* 244:1081-1085 (1989). The resulting mutant molecules can then be tested for biological activity.

[00131] As the authors state, these two strategies have revealed that proteins are surprisingly tolerant of amino acid substitutions. The authors further indicate which amino acid changes are likely to be permissive at certain amino acid positions in the protein. For example, most buried (within the tertiary structure of the protein)

amino acid residues require nonpolar side chains, whereas few features of surface side chains are generally conserved. Moreover, tolerated conservative amino acid substitutions involve replacement of the aliphatic or hydrophobic amino acids Ala, Val, Leu and Ile; replacement of the hydroxyl residues Ser and Thr; replacement of the acidic residues Asp and Glu; replacement of the amide residues Asn and Gln, replacement of the basic residues Lys, Arg, and His; replacement of the aromatic residues Phe, Tyr, and Trp, and replacement of the small-sized amino acids Ala, Ser, Thr, Met, and Gly. Besides conservative amino acid substitutions, variants of the present invention include (i) substitutions with one or more of the non-conserved amino acid residues, where the substituted amino acid residues may or may not be one encoded by the genetic code, or (ii) substitutions with one or more of the amino acid residues having a substituent group, or (iii) fusion of the mature polypeptide with another compound, such as a compound to increase the stability and/or solubility of the polypeptide (for example, polyethylene glycol), or (iv) fusion of the polypeptide with additional amino acids, such as, for example, an IgG Fc fusion region peptide, serum albumin (preferably human serum albumin) or a fragment or variant thereof, or leader or secretory sequence, or a sequence facilitating purification. Such variant polypeptides are deemed to be within the scope of those skilled in the art from the teachings herein.

[00132] For example, polypeptide variants containing amino acid substitutions of charged amino acids with other charged or neutral amino acids may produce proteins with improved characteristics, such as less aggregation. Aggregation of pharmaceutical formulations both reduces activity and increases clearance due to the aggregate's immunogenic activity. See Pinckard et al., *Clin. Exp. Immunol.* 2:331-340 (1967); Robbins et al., *Diabetes* 36: 838-845 (1987); Cleland et al., *Crit. Rev. Therapeutic Drug Carrier Systems* 10:307-377 (1993).

[00133] A further embodiment of the invention relates to polypeptides which comprise the amino acid sequence of a polypeptide having an amino acid sequence which contains at least one amino acid substitution, but not more than 50 amino acid substitutions, even more preferably, not more than 40 amino acid substitutions, still more preferably, not more than 30 amino acid substitutions, and still even more preferably, not more than 20 amino acid substitutions from a polypeptide sequence disclosed herein. Of course it is highly preferable for a polypeptide to have an

amino acid sequence which comprises the amino acid sequence of a polypeptide of SEQ ID NO:Y, an amino acid sequence encoded by SEQ ID NO:X, an amino acid sequence encoded by the portion of SEQ ID NO:X as defined in columns 8 and 9 of Table 2, an amino acid sequence encoded by the complement of SEQ ID NO:X, and/or the amino acid sequence encoded by cDNA contained in Clone ID NO:Z which contains, in order of ever-increasing preference, at least one, but not more than 10, 9, 8, 7, 6, 5, 4, 3, 2 or 1 amino acid substitutions.

[00134] In specific embodiments, the polypeptides of the invention comprise, or alternatively, consist of, fragments or variants of a reference amino acid sequence selected from: (a) the amino acid sequence of SEQ ID NO:Y or fragments thereof (e.g., the mature form and/or other fragments described herein); (b) the amino acid sequence encoded by SEQ ID NO:X or fragments thereof; (c) the amino acid sequence encoded by the complement of SEQ ID NO:X or fragments thereof; (d) the amino acid sequence encoded by the portion of SEQ ID NO:X as defined in columns 8 and 9 of Table 2 or fragments thereof; and (e) the amino acid sequence encoded by cDNA contained in Clone ID NO:Z or fragments thereof; wherein the fragments or variants have 1-5, 5-10, 5-25, 5-50, 10-50 or 50-150, amino acid residue additions, substitutions, and/or deletions when compared to the reference amino acid sequence. In preferred embodiments, the amino acid substitutions are conservative. Polynucleotides encoding these polypeptides are also encompassed by the invention.

Polynucleotide and Polypeptide Fragments

[00135] The present invention is also directed to polynucleotide fragments of the polynucleotides (nucleic acids) of the invention. In the present invention, a "polynucleotide fragment" refers to a polynucleotide having a nucleic acid sequence which, for example: is a portion of the cDNA contained in Clone ID NO:Z or the complementary strand thereto; is a portion of the polynucleotide sequence encoding the polypeptide encoded by the cDNA contained in Clone ID NO:Z or the complementary strand thereto; is a portion of a polynucleotide sequence encoding the amino acid sequence encoded by the region of SEQ ID NO:X as defined in columns 8 and 9 of Table 2 or the complementary strand thereto; is a portion of the polynucleotide sequence of SEQ ID NO:X as defined in columns 8 and 9 of Table 2

or the complementary strand thereto; is a portion of the polynucleotide sequence in SEQ ID NO:X or the complementary strand thereto; is a polynucleotide sequence encoding a portion of the polypeptide of SEQ ID NO:Y; is a polynucleotide sequence encoding a portion of a polypeptide encoded by SEQ ID NO:X; is a polynucleotide sequence encoding a portion of a polypeptide encoded by the complement of the polynucleotide sequence in SEQ ID NO:X; is a portion of a polynucleotide sequence encoding the amino acid sequence encoded by the region of SEQ ID NO:B as defined in column 6 of Table 1B or the complementary strand thereto; or is a portion of the polynucleotide sequence of SEQ ID NO:B as defined in column 6 of Table 1B or the complementary strand thereto.

[00136] The nucleotide fragments of the invention are preferably at least about 15 nt, and more preferably at least about 20 nt, still more preferably at least about 30 nt, and even more preferably, at least about 40 nt, at least about 50 nt, at least about 75 nt, or at least about 150 nt in length. A fragment "at least 20 nt in length," for example, is intended to include 20 or more contiguous bases from the cDNA sequence contained in Clone ID NO:Z, or the nucleotide sequence shown in SEQ ID NO:X or the complementary stand thereto. In this context "about" includes the particularly recited value or a value larger or smaller by several (5, 4, 3, 2, or 1) nucleotides, at either terminus or at both termini. These nucleotide fragments have uses that include, but are not limited to, as diagnostic probes and primers as discussed herein. Of course, larger fragments (e.g., at least 160, 170, 180, 190, 200, 250, 500, 600, 1000, or 2000 nucleotides in length) are also encompassed by the invention.

[00137] Moreover, representative examples of polynucleotide fragments of the invention, comprise, or alternatively consist of, a sequence from about nucleotide number 1-50, 51-100, 101-150, 151-200, 201-250, 251-300, 301-350, 351-400, 401-450, 451-500, 501-550, 551-600, 651-700, 701-750, 751-800, 800-850, 851-900, 901-950, 951-1000, 1001-1050, 1051-1100, 1101-1150, 1151-1200, 1201-1250, 1251-1300, 1301-1350, 1351-1400, 1401-1450, 1451-1500, 1501-1550, 1551-1600, 1601-1650, 1651-1700, 1701-1750, 1751-1800, 1801-1850, 1851-1900, 1901-1950, 1951-2000, 2001-2050, 2051-2100, 2101-2150, 2151-2200, 2201-2250, 2251-2300, 2301-2350, 2351-2400, 2401-2450, 2451-2500, 2501-2550, 2551-2600, 2601-2650, 2651-2700, 2701-2750, 2751-2800, 2801-2850, 2851-2900, 2901-2950, 2951-3000, 3001-3050, 3051-3100, 3101-3150, 3151-3200, 3201-3250, 3251-3300, 3301-3350, 3351-3400, 3401-

3450, 3451-3500, 3501-3550, 3551-3600, 3601-3650, 3651-3700, 3701-3750, 3751-3800, 3801-3850, 3851-3900, 3901-3950, 3951-4000, 4001-4050, 4051-4100, 4101-4150, 4151-4200, 4201-4250, 4251-4300, 4301-4350, 4351-4400, 4401-4450, 4451-4500, 4501-4550, 4551-4600, 4601-4650, 4651-4700, 4701-4750, 4751-4800, 4801-4850, 4851-4900, 4901-4950, 4951-5000, 5001-5050, 5051-5100, 5101-5150, 5151-5200, 5201-5250, 5251-5300, 5301-5350, 5351-5400, 5401-5450, 5451-5500, 5501-5550, 5551-5600, 5601-5650, 5651-5700, 5701-5750, 5751-5800, 5801-5850, 5851-5900, 5901-5950, 5951-6000, 6001-6050, 6051-6100, 6101-6150, 6151-6200, 6201-6250, 6251-6300, 6301-6350, 6351-6400, 6401-6450, 6451-6500, 6501-6550, 6551-6600, 6601-6650, 6651-6700, 6701-6750, 6751-6800, 6801-6850, 6851-6900, 6901-6950, 6951-7000, 7001-7050, 7051-7100, 7101-7150, 7151-7200, 7201-7250, 7251-7300 or 7301 to the end of SEQ ID NO:X, or the complementary strand thereto. In this context "about" includes the particularly recited range or a range larger or smaller by several (5, 4, 3, 2, or 1) nucleotides, at either terminus or at both termini. Preferably, these fragments encode a polypeptide, which has a functional activity (e.g., biological activity). More preferably, these polynucleotides can be used as probes or primers as discussed herein. Polynucleotides which hybridize to one or more of these polynucleotides under stringent hybridization conditions or alternatively, under lower stringency conditions are also encompassed by the invention, as are polypeptides encoded by these polynucleotides.

[00138] Further representative examples of polynucleotide fragments of the invention, comprise, or alternatively consist of, a sequence from about nucleotide number 1-50, 51-100, 101-150, 151-200, 201-250, 251-300, 301-350, 351-400, 401-450, 451-500, 501-550, 551-600, 651-700, 701-750, 751-800, 800-850, 851-900, 901-950, 951-1000, 1001-1050, 1051-1100, 1101-1150, 1151-1200, 1201-1250, 1251-1300, 1301-1350, 1351-1400, 1401-1450, 1451-1500, 1501-1550, 1551-1600, 1601-1650, 1651-1700, 1701-1750, 1751-1800, 1801-1850, 1851-1900, 1901-1950, 1951-2000, 2001-2050, 2051-2100, 2101-2150, 2151-2200, 2201-2250, 2251-2300, 2301-2350, 2351-2400, 2401-2450, 2451-2500, 2501-2550, 2551-2600, 2601-2650, 2651-2700, 2701-2750, 2751-2800, 2801-2850, 2851-2900, 2901-2950, 2951-3000, 3001-3050, 3051-3100, 3101-3150, 3151-3200, 3201-3250, 3251-3300, 3301-3350, 3351-3400, 3401-3450, 3451-3500, 3501-3550, 3551-3600, 3601-3650, 3651-3700, 3701-3750, 3751-3800, 3801-3850, 3851-3900, 3901-3950, 3951-4000, 4001-4050, 4051-4100, 4101-

4150, 4151-4200, 4201-4250, 4251-4300, 4301-4350, 4351-4400, 4401-4450, 4451-4500, 4501-4550, 4551-4600, 4601-4650, 4651-4700, 4701-4750, 4751-4800, 4801-4850, 4851-4900, 4901-4950, 4951-5000, 5001-5050, 5051-5100, 5101-5150, 5151-5200, 5201-5250, 5251-5300, 5301-5350, 5351-5400, 5401-5450, 5451-5500, 5501-5550, 5551-5600, 5601-5650, 5651-5700, 5701-5750, 5751-5800, 5801-5850, 5851-5900, 5901-5950, 5951-6000, 6001-6050, 6051-6100, 6101-6150, 6151-6200, 6201-6250, 6251-6300, 6301-6350, 6351-6400, 6401-6450, 6451-6500, 6501-6550, 6551-6600, 6601-6650, 6651-6700, 6701-6750, 6751-6800, 6801-6850, 6851-6900, 6901-6950, 6951-7000, 7001-7050, 7051-7100, 7101-7150, 7151-7200, 7201-7250, 7251-7300 or 7301 to the end of the cDNA sequence contained in Clone ID NO:Z, or the complementary strand thereto. In this context "about" includes the particularly recited range or a range larger or smaller by several (5, 4, 3, 2, or 1) nucleotides, at either terminus or at both termini. Preferably, these fragments encode a polypeptide, which has a functional activity (e.g., biological activity). More preferably, these polynucleotides can be used as probes or primers as discussed herein. Polynucleotides which hybridize to one or more of these polynucleotides under stringent hybridization conditions or alternatively, under lower stringency conditions are also encompassed by the invention, as are polypeptides encoded by these polynucleotides.

[00139] Moreover, representative examples of polynucleotide fragments of the invention comprise, or alternatively consist of, a nucleic acid sequence comprising one, two, three, four, five, six, seven, eight, nine, ten, or more of the above described polynucleotide fragments of the invention in combination with a polynucleotide sequence delineated in Table 1B column 6. Additional, representative examples of polynucleotide fragments of the invention comprise, or alternatively consist of, a nucleic acid sequence comprising one, two, three, four, five, six, seven, eight, nine, ten, or more of the above described polynucleotide fragments of the invention in combination with a polynucleotide sequence that is the complementary strand of a sequence delineated in column 6 of Table 1B. In further embodiments, the above-described polynucleotide fragments of the invention comprise, or alternatively consist of, sequences delineated in Table 1B, column 6, and have a nucleic acid sequence which is different from that of the BAC fragment having the sequence disclosed in SEQ ID NO:B (see Table 1B, column 5). In additional embodiments,

the above-described polynucleotide fragments of the invention comprise, or alternatively consist of, sequences delineated in Table 1B, column 6, and have a nucleic acid sequence which is different from that published for the BAC clone identified as BAC ID NO:A (see Table 1B, column 4). In additional embodiments, the above-described polynucleotides of the invention comprise, or alternatively consist of, sequences delineated Table 1B, column 6, and have a nucleic acid sequence which is different from that contained in the BAC clone identified as BAC ID NO:A (see Table 1B, column 4). Polypeptides encoded by these polynucleotides, other polynucleotides that encode these polypeptides, and antibodies that bind these polypeptides are also encompassed by the invention. Additionally, fragments and variants of the above-described polynucleotides and polypeptides are also encompassed by the invention.

[00140] In additional specific embodiments, polynucleotides of the invention comprise, or alternatively consist of, one, two, three, four, five, six, seven, eight, nine, ten, or more fragments of the sequences delineated in column 6 of Table 1B, and the polynucleotide sequence of SEQ ID NO:X (e.g., as defined in Table 1B, column 2) or fragments or variants thereof. Polypeptides encoded by these polynucleotides, other polynucleotides that encode these polypeptides, and antibodies that bind these polypeptides are also encompassed by the invention.

[00141] In additional specific embodiments, polynucleotides of the invention comprise, or alternatively consist of, one, two, three, four, five, six, seven, eight, nine, ten, or more fragments of the sequences delineated in column 6 of Table 1B which correspond to the same Clone ID NO:Z (see Table 1B, column 1), and the polynucleotide sequence of SEQ ID NO:X (e.g., as defined in Table 1A or 1B) or fragments or variants thereof. Polypeptides encoded by these polynucleotides, other polynucleotides that encode these polypeptides, and antibodies that bind these polypeptides are also encompassed by the invention.

[00142] In further specific embodiments, polynucleotides of the invention comprise, or alternatively consist of, one, two, three, four, five, six, seven, eight, nine, ten, or more fragments of the sequences delineated in the same row of column 6 of Table 1B, and the polynucleotide sequence of SEQ ID NO:X (e.g., as defined in Table 1A or 1B) or fragments or variants thereof. Polypeptides encoded by these

polynucleotides, other polynucleotides that encode these polypeptides, and antibodies that bind these polypeptides are also encompassed by the invention.

[00143] In additional specific embodiments, polynucleotides of the invention comprise, or alternatively consist of a polynucleotide sequence in which the 3' 10 polynucleotides of one of the sequences delineated in column 6 of Table 1B and the 5' 10 polynucleotides of the sequence of SEQ ID NO:X are directly contiguous. Nucleic acids which hybridize to the complement of these 20 contiguous polynucleotides under stringent hybridization conditions or alternatively, under lower stringency conditions, are also encompassed by the invention. Polypeptides encoded by these polynucleotides and/or nucleic acids, other polynucleotides and/or nucleic acids that encode these polypeptides, and antibodies that bind these polypeptides are also encompassed by the invention. Additionally, fragments and variants of the above-described polynucleotides, nucleic acids, and polypeptides are also encompassed by the invention.

[00144] In additional specific embodiments, polynucleotides of the invention comprise, or alternatively consist of a polynucleotide sequence in which the 3' 10 polynucleotides of one of the sequences delineated in column 6 of Table 1B and the 5' 10 polynucleotides of a fragment or variant of the sequence of SEQ ID NO:X (e.g., as described herein) are directly contiguous. Nucleic acids which hybridize to the complement of these 20 contiguous polynucleotides under stringent hybridization conditions or alternatively, under lower stringency conditions, are also encompassed by the invention. Polypeptides encoded by these polynucleotides and/or nucleic acids, other polynucleotides and/or nucleic acids encoding these polypeptides, and antibodies that bind these polypeptides are also encompassed by the invention. Additionally, fragments and variants of the above-described polynucleotides, nucleic acids, and polypeptides are also encompassed by the invention.

[00145] In further specific embodiments, polynucleotides of the invention comprise, or alternatively consist of a polynucleotide sequence in which the 3' 10 polynucleotides of a fragment or variant of the sequence of SEQ ID NO:X and the 5' 10 polynucleotides of the sequence of one of the sequences delineated in column 6 of Table 1B are directly contiguous. Nucleic acids which hybridize to the complement of these 20 contiguous polynucleotides under stringent hybridization

conditions or alternatively, under lower stringency conditions, are also encompassed by the invention. Polypeptides encoded by these polynucleotides and/or nucleic acids, other polynucleotides and/or nucleic acids encoding these polypeptides, and antibodies that bind these polypeptides are also encompassed by the invention. Additionally, fragments and variants of the above-described polynucleotides, nucleic acids, and polypeptides are also encompassed by the invention.

[00146] In specific embodiments, polynucleotides of the invention comprise, or alternatively consist of a polynucleotide sequence in which the 3' 10 polynucleotides of one of the sequences delineated in column 6 of Table 1B and the 5' 10 polynucleotides of another sequence in column 6 are directly contiguous. In preferred embodiments, the 3' 10 polynucleotides of one of the sequences delineated in column 6 of Table 1B is directly contiguous with the 5' 10 polynucleotides of the next sequential exon delineated in Table 1B, column 6. Nucleic acids which hybridize to the complement of these 20 contiguous polynucleotides under stringent hybridization conditions or alternatively, under lower stringency conditions, are also encompassed by the invention. Polypeptides encoded by these polynucleotides and/or nucleic acids, other polynucleotides and/or nucleic acids encoding these polypeptides, and antibodies that bind these polypeptides are also encompassed by the invention. Additionally, fragments and variants of the above-described polynucleotides, nucleic acids, and polypeptides are also encompassed by the invention.

[00147] In the present invention, a "polypeptide fragment" refers to an amino acid sequence which is a portion of that contained in SEQ ID NO:Y, a portion of an amino acid sequence encoded by the portion of SEQ ID NO:X as defined in columns 8 and 9 of Table 2, a portion of an amino acid sequence encoded by the polynucleotide sequence of SEQ ID NO:X, a portion of an amino acid sequence encoded by the complement of the polynucleotide sequence in SEQ ID NO:X, and/or a portion of an amino acid sequence encoded by the cDNA contained in Clone ID NO:Z. Protein (polypeptide) fragments may be "free-standing," or comprised within a larger polypeptide of which the fragment forms a part or region, most preferably as a single continuous region. Representative examples of polypeptide fragments of the invention, include, for example, fragments comprising, or alternatively consisting of, from about amino acid number 1-20, 21-40, 41-60, 61-

80, 81-100, 102-120, 121-140, 141-160, 161-180, 181-200, 201-220, 221-240, 241-260, 261-280, 281-300, 301-320, 321-340, 341-360, 361-380, 381-400, 401-420, 421-440, 441-460, 461-480, 481-500, 501-520, 521-540, 541-560, 561-580, 581-600, 601-620, 621-640, 641-660, 661-680, 681-700, 701-720, 721-740, 741-760, 761-780, 781-800, 801-820, 821-840, 841-860, 861-880, 881-900, 901-920, 921-940, 941-960, 961-980, 981-1000, 1001-1020, 1021-1040, 1041-1060, 1061-1080, 1081-1100, 1101-1120, 1121-1140, 1141-1160, 1161-1180, 1181-1200, 1201-1220, 1221-1240, 1241-1260, 1261-1280, 1281-1300, 1301-1320, 1321-1340, 1341-1360, 1361-1380, 1381-1400, 1401-1420, 1421-1440, or 1441 to the end of the coding region. In a preferred embodiment, polypeptide fragments of the invention include, for example, fragments comprising, or alternatively consisting of, from about amino acid number 1-20, 21-40, 41-60, 61-80, 81-100, 102-120, 121-140, 141-160, 161-180, 181-200, 201-220, 221-240, 241-260, 261-280, 281-300, 301-320, 321-340, 341-360, 361-380, 381-400, 401-420, 421-440, 441-460, 461-480, 481-500, 501-520, 521-540, 541-560, 561-580, 581-600, 601-620, 621-640, 641-660, 661-680, 681-700, 701-720, 721-740, 741-760, 761-780, 781-800, 801-820, 821-840, 841-860, 861-880, 881-900, 901-920, 921-940, 941-960, 961-980, 981-1000, 1001-1020, 1021-1040, 1041-1060, 1061-1080, 1081-1100, 1101-1120, 1121-1140, 1141-1160, 1161-1180, 1181-1200, 1201-1220, 1221-1240, 1241-1260, 1261-1280, 1281-1300, 1301-1320, 1321-1340, 1341-1360, 1361-1380, 1381-1400, 1401-1420, 1421-1440, or 1441 to the end of the coding region of SEQ ID NO:Y. Moreover, polypeptide fragments of the invention may be at least about 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75, 80, 85, 90, 100, 110, 120, 130, 140, or 150 amino acids in length. In this context "about" includes the particularly recited ranges or values, or ranges or values larger or smaller by several (5, 4, 3, 2, or 1) amino acids, at either extreme or at both extremes. Polynucleotides encoding these polypeptide fragments are also encompassed by the invention.

[00148] Even if deletion of one or more amino acids from the N-terminus of a protein results in modification or loss of one or more biological functions of the protein, other functional activities (e.g., biological activities, ability to multimerize, ability to bind a ligand) may still be retained. For example, the ability of shortened muteins to induce and/or bind to antibodies which recognize the complete or mature forms of the polypeptides generally will be retained when less than the majority of the

residues of the complete or mature polypeptide are removed from the N-terminus. Whether a particular polypeptide lacking N-terminal residues of a complete polypeptide retains such immunologic activities can readily be determined by routine methods described herein and otherwise known in the art. It is not unlikely that a mutein with a large number of deleted N-terminal amino acid residues may retain some biological or immunogenic activities. In fact, peptides composed of as few as six amino acid residues may often evoke an immune response.

[00149] Accordingly, polypeptide fragments include the secreted protein as well as the mature form. Further preferred polypeptide fragments include the secreted protein or the mature form having a continuous series of deleted residues from the amino or the carboxy terminus, or both. For example, any number of amino acids, ranging from 1-60, can be deleted from the amino terminus of either the secreted polypeptide or the mature form. Similarly, any number of amino acids, ranging from 1-30, can be deleted from the carboxy terminus of the secreted protein or mature form. Furthermore, any combination of the above amino and carboxy terminus deletions is preferred. Similarly, polynucleotides encoding these polypeptide fragments are also preferred.

[00150] The present invention further provides polypeptides having one or more residues deleted from the amino terminus of the amino acid sequence of a polypeptide disclosed herein (e.g., a polypeptide of SEQ ID NO:Y, a polypeptide encoded by the polynucleotide sequence contained in SEQ ID NO:X or the complement thereof, a polypeptide encoded by the portion of SEQ ID NO:X as defined in columns 8 and 9 of Table 2, a polypeptide encoded by the portion of SEQ ID NO:B as defined in column 6 of Table 1B, and/or a polypeptide encoded by the cDNA contained in Clone ID NO:Z). In particular, N-terminal deletions may be described by the general formula m-q, where q is a whole integer representing the total number of amino acid residues in a polypeptide of the invention (e.g., the polypeptide disclosed in SEQ ID NO:Y, or the polypeptide encoded by the portion of SEQ ID NO:X as defined in columns 8 and 9 of Table 2), and m is defined as any integer ranging from 2 to q-6. Polynucleotides encoding these polypeptides are also encompassed by the invention.

[00151] The present invention further provides polypeptides having one or more residues from the carboxy terminus of the amino acid sequence of a polypeptide disclosed

herein (e.g., a polypeptide of SEQ ID NO:Y, a polypeptide encoded by the polynucleotide sequence contained in SEQ ID NO:X, a polypeptide encoded by the portion of SEQ ID NO:X as defined in columns 8 and 9 of Table 2, and/or a polypeptide encoded by the cDNA contained in Clone ID NO:Z). In particular, C-terminal deletions may be described by the general formula 1-n, where n is any whole integer ranging from 6 to q-1, and where n corresponds to the position of amino acid residue in a polypeptide of the invention. Polynucleotides encoding these polypeptides are also encompassed by the invention.

[00152] In addition, any of the above described N- or C-terminal deletions can be combined to produce a N- and C-terminal deleted polypeptide. The invention also provides polypeptides having one or more amino acids deleted from both the amino and the carboxyl termini, which may be described generally as having residues m-n of a polypeptide encoded by SEQ ID NO:X (e.g., including, but not limited to, the preferred polypeptide disclosed as SEQ ID NO:Y and the polypeptide encoded by the portion of SEQ ID NO:X as defined in columns 8 and 9 of Table 2), the cDNA contained in Clone ID NO:Z, and/or the complement thereof, where n and m are integers as described above. Polynucleotides encoding these polypeptides are also encompassed by the invention.

[00153] Also as mentioned above, even if deletion of one or more amino acids from the C-terminus of a protein results in modification or loss of one or more biological functions of the protein, other functional activities (e.g., biological activities, ability to multimerize, ability to bind a ligand) may still be retained. For example the ability of the shortened mutein to induce and/or bind to antibodies which recognize the complete or mature forms of the polypeptide generally will be retained when less than the majority of the residues of the complete or mature polypeptide are removed from the C-terminus. Whether a particular polypeptide lacking C-terminal residues of a complete polypeptide retains such immunologic activities can readily be determined by routine methods described herein and otherwise known in the art. It is not unlikely that a mutein with a large number of deleted C-terminal amino acid residues may retain some biological or immunogenic activities. In fact, peptides composed of as few as six amino acid residues may often evoke an immune response.

[00154] The present application is also directed to proteins containing polypeptides at

least 80%, 85%, 90%, 95%, 96%, 97%, 98% or 99% identical to a polypeptide sequence set forth herein. In preferred embodiments, the application is directed to proteins containing polypeptides at least 80%, 85%, 90%, 95%, 96%, 97%, 98% or 99% identical to polypeptides having the amino acid sequence of the specific N- and C-terminal deletions. Polynucleotides encoding these polypeptides are also encompassed by the invention.

[00155] Any polypeptide sequence encoded by, for example, the polynucleotide sequences set forth as SEQ ID NO:X or the complement thereof, (presented, for example, in Tables 1A and 2), the cDNA contained in Clone ID NO:Z, or the polynucleotide sequence as defined in column 6 of Table 1B, may be analyzed to determine certain preferred regions of the polypeptide. For example, the amino acid sequence of a polypeptide encoded by a polynucleotide sequence of SEQ ID NO:X (e.g., the polypeptide of SEQ ID NO:Y and the polypeptide encoded by the portion of SEQ ID NO:X as defined in columns 8 and 9 of Table 2) or the cDNA contained in Clone ID NO:Z may be analyzed using the default parameters of the DNASTAR computer algorithm (DNASTAR, Inc., 1228 S. Park St., Madison, WI 53715 USA; <http://www.dnastar.com/>).

[00156] Polypeptide regions that may be routinely obtained using the DNASTAR computer algorithm include, but are not limited to, Garnier-Robson alpha-regions, beta-regions, turn-regions, and coil-regions; Chou-Fasman alpha-regions, beta-regions, and turn-regions; Kyte-Doolittle hydrophilic regions and hydrophobic regions; Eisenberg alpha- and beta-amphipathic regions; Karplus-Schulz flexible regions; Emini surface-forming regions; and Jameson-Wolf regions of high antigenic index. Among highly preferred polynucleotides of the invention in this regard are those that encode polypeptides comprising regions that combine several structural features, such as several (e.g., 1, 2, 3 or 4) of the features set out above.

[00157] Additionally, Kyte-Doolittle hydrophilic regions and hydrophobic regions, Emini surface-forming regions, and Jameson-Wolf regions of high antigenic index (i.e., containing four or more contiguous amino acids having an antigenic index of greater than or equal to 1.5, as identified using the default parameters of the Jameson-Wolf program) can routinely be used to determine polypeptide regions that exhibit a high degree of potential for antigenicity. Regions of high antigenicity are determined from data by DNASTAR analysis by choosing values which represent

regions of the polypeptide which are likely to be exposed on the surface of the polypeptide in an environment in which antigen recognition may occur in the process of initiation of an immune response.

[00158] Preferred polypeptide fragments of the invention are fragments comprising, or alternatively, consisting of, an amino acid sequence that displays a functional activity (e.g. biological activity) of the polypeptide sequence of which the amino acid sequence is a fragment. By a polypeptide displaying a "functional activity" is meant a polypeptide capable of one or more known functional activities associated with a full-length protein, such as, for example, biological activity, antigenicity, immunogenicity, and/or multimerization, as described herein.

[00159] Other preferred polypeptide fragments are biologically active fragments. Biologically active fragments are those exhibiting activity similar, but not necessarily identical, to an activity of the polypeptide of the present invention. The biological activity of the fragments may include an improved desired activity, or a decreased undesirable activity.

[00160] In preferred embodiments, polypeptides of the invention comprise, or alternatively consist of, one, two, three, four, five or more of the antigenic fragments of the polypeptide of SEQ ID NO:Y, or portions thereof. Polynucleotides encoding these polypeptides are also encompassed by the invention.

[00161] The present invention encompasses polypeptides comprising, or alternatively consisting of, an epitope of: the polypeptide sequence shown in SEQ ID NO:Y; a polypeptide sequence encoded by SEQ ID NO:X or the complementary strand thereto; the polypeptide sequence encoded by the portion of SEQ ID NO:X as defined in columns 8 and 9 of Table 2; the polypeptide sequence encoded by the portion of SEQ ID NO:B as defined in column 6 of Table 1B or the complement thereto; the polypeptide sequence encoded by the cDNA contained in Clone ID NO:Z; or the polypeptide sequence encoded by a polynucleotide that hybridizes to the sequence of SEQ ID NO:X, the complement of the sequence of SEQ ID NO:X, the complement of a portion of SEQ ID NO:X as defined in columns 8 and 9 of Table 2, or the cDNA sequence contained in Clone ID NO:Z under stringent hybridization conditions or alternatively, under lower stringency hybridization as defined *supra*. The present invention further encompasses polynucleotide sequences encoding an epitope of a polypeptide sequence of the invention (such as, for

example, the sequence disclosed in SEQ ID NO:X, or a fragment thereof), polynucleotide sequences of the complementary strand of a polynucleotide sequence encoding an epitope of the invention, and polynucleotide sequences which hybridize to the complementary strand under stringent hybridization conditions or alternatively, under lower stringency hybridization conditions defined *supra*.

[00162] The term “epitopes,” as used herein, refers to portions of a polypeptide having antigenic or immunogenic activity in an animal, preferably a mammal, and most preferably in a human. In a preferred embodiment, the present invention encompasses a polypeptide comprising an epitope, as well as the polynucleotide encoding this polypeptide. An “immunogenic epitope,” as used herein, is defined as a portion of a protein that elicits an antibody response in an animal, as determined by any method known in the art, for example, by the methods for generating antibodies described *infra*. (See, for example, Geysen et al., Proc. Natl. Acad. Sci. USA 81:3998- 4002 (1983)). The term “antigenic epitope,” as used herein, is defined as a portion of a protein to which an antibody can immunospecifically bind its antigen as determined by any method well known in the art, for example, by the immunoassays described herein. Immunospecific binding excludes non-specific binding but does not necessarily exclude cross- reactivity with other antigens. Antigenic epitopes need not necessarily be immunogenic.

[00163] Fragments, which function as epitopes may be produced by any conventional means. (See, e.g., Houghten, R. A., Proc. Natl. Acad. Sci. USA 82:5131-5135 (1985) further described in U.S. Patent No. 4,631,211.)

[00164] In the present invention, antigenic epitopes preferably contain a sequence of at least 4, at least 5, at least 6, at least 7, more preferably at least 8, at least 9, at least 10, at least 11, at least 12, at least 13, at least 14, at least 15, at least 20, at least 25, at least 30, at least 40, at least 50, and, most preferably, between about 15 to about 30 amino acids. Preferred polypeptides comprising immunogenic or antigenic epitopes are at least 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75, 80, 85, 90, 95, or 100 amino acid residues in length. Additional non-exclusive preferred antigenic epitopes include the antigenic epitopes disclosed herein, as well as portions thereof. Antigenic epitopes are useful, for example, to raise antibodies, including monoclonal antibodies, that specifically bind the epitope. Preferred antigenic epitopes include the antigenic epitopes disclosed herein, as well as any

combination of two, three, four, five or more of these antigenic epitopes. Antigenic epitopes can be used as the target molecules in immunoassays. (See, for instance, Wilson et al., Cell 37:767-778 (1984); Sutcliffe et al., Science 219:660-666 (1983)).

[00165] Non-limiting examples of epitopes of polypeptides that can be used to generate antibodies of the invention include a polypeptide comprising, or alternatively consisting of, at least one, two, three, four, five, six or more of the portion(s) of SEQ ID NO:Y specified in column 6 of Table 1A. These polypeptide fragments have been determined to bear antigenic epitopes of the proteins of the invention by the analysis of the Jameson-Wolf antigenic index, which is included in the DNASTar suite of computer programs. By "comprise" it is intended that a polypeptide contains at least one, two, three, four, five, six or more of the portion(s) of SEQ ID NO:Y shown in column 6 of Table 1A, but it may contain additional flanking residues on either the amino or carboxyl termini of the recited portion. Such additional flanking sequences are preferably sequences naturally found adjacent to the portion; i.e., contiguous sequence shown in SEQ ID NO:Y. The flanking sequence may, however, be sequences from a heterologous polypeptide, such as from another protein described herein or from a heterologous polypeptide not described herein. In particular embodiments, epitope portions of a polypeptide of the invention comprise one, two, three, or more of the portions of SEQ ID NO:Y shown in column 6 of Table 1A. Polynucleotides encoding these polypeptides are also encompassed by the invention.

[00166] Similarly, immunogenic epitopes can be used, for example, to induce antibodies according to methods well known in the art. See, for instance, Sutcliffe et al., *supra*; Wilson et al., *supra*; Chow et al., Proc. Natl. Acad. Sci. USA 82:910-914; and Bittle et al., J. Gen. Virol. 66:2347-2354 (1985). Preferred immunogenic epitopes include the immunogenic epitopes disclosed herein, as well as any combination of two, three, four, five or more of these immunogenic epitopes. The polypeptides comprising one or more immunogenic epitopes may be presented for eliciting an antibody response together with a carrier protein, such as an albumin, to an animal system (such as rabbit or mouse), or, if the polypeptide is of sufficient length (at least about 25 amino acids), the polypeptide may be presented without a carrier. However, immunogenic epitopes comprising as few as 8 to 10 amino acids have

been shown to be sufficient to raise antibodies capable of binding to, at the very least, linear epitopes in a denatured polypeptide (e.g., in Western blotting).

[00167] Epitope-bearing polypeptides of the present invention may be used to induce antibodies according to methods well known in the art including, but not limited to, *in vivo* immunization, *in vitro* immunization, and phage display methods. See, e.g., Sutcliffe et al., *supra*; Wilson et al., *supra*, and Bittle et al., *J. Gen. Virol.*, 66:2347-2354 (1985). If *in vivo* immunization is used, animals may be immunized with free peptide; however, anti-peptide antibody titer may be boosted by coupling the peptide to a macromolecular carrier, such as keyhole limpet hemacyanin (KLH) or tetanus toxoid. For instance, peptides containing cysteine residues may be coupled to a carrier using a linker such as maleimidobenzoyl- N-hydroxysuccinimide ester (MBS), while other peptides may be coupled to carriers using a more general linking agent such as glutaraldehyde. Animals such as rabbits, rats and mice are immunized with either free or carrier- coupled peptides, for instance, by intraperitoneal and/or intradermal injection of emulsions containing about 100 µg of peptide or carrier protein and Freund's adjuvant or any other adjuvant known for stimulating an immune response. Several booster injections may be needed, for instance, at intervals of about two weeks, to provide a useful titer of anti-peptide antibody which can be detected, for example, by ELISA assay using free peptide adsorbed to a solid surface. The titer of anti-peptide antibodies in serum from an immunized animal may be increased by selection of anti-peptide antibodies, for instance, by adsorption to the peptide on a solid support and elution of the selected antibodies according to methods well known in the art.

[00168] As one of skill in the art will appreciate, and as discussed above, the polypeptides of the present invention (e.g., those comprising an immunogenic or antigenic epitope) can be fused to heterologous polypeptide sequences. For example, polypeptides of the present invention (including fragments or variants thereof), may be fused with the constant domain of immunoglobulins (IgA, IgE, IgG, IgM), or portions thereof (CH1, CH2, CH3, or any combination thereof and portions thereof, resulting in chimeric polypeptides. By way of another non-limiting example, polypeptides and/or antibodies of the present invention (including fragments or variants thereof) may be fused with albumin (including but not limited to recombinant human serum albumin or fragments or variants thereof (see, e.g.,

U.S. Patent No. 5,876,969, issued March 2, 1999, EP Patent 0 413 622, and U.S. Patent No. 5,766,883, issued June 16, 1998, herein incorporated by reference in their entirety)). In a preferred embodiment, polypeptides and/or antibodies of the present invention (including fragments or variants thereof) are fused with the mature form of human serum albumin (i.e., amino acids 1 – 585 of human serum albumin as shown in Figures 1 and 2 of EP Patent 0 322 094) which is herein incorporated by reference in its entirety. In another preferred embodiment, polypeptides and/or antibodies of the present invention (including fragments or variants thereof) are fused with polypeptide fragments comprising, or alternatively consisting of, amino acid residues 1-z of human serum albumin, where z is an integer from 369 to 419, as described in U.S. Patent 5,766,883 herein incorporated by reference in its entirety. Polypeptides and/or antibodies of the present invention (including fragments or variants thereof) may be fused to either the N- or C-terminal end of the heterologous protein (e.g., immunoglobulin Fc polypeptide or human serum albumin polypeptide). Polynucleotides encoding fusion proteins of the invention are also encompassed by the invention.

[00169] Such fusion proteins as those described above may facilitate purification and may increase half-life in vivo. This has been shown for chimeric proteins consisting of the first two domains of the human CD4-polypeptide and various domains of the constant regions of the heavy or light chains of mammalian immunoglobulins. See, e.g., EP 394,827; Traunecker et al., *Nature*, 331:84-86 (1988). Enhanced delivery of an antigen across the epithelial barrier to the immune system has been demonstrated for antigens (e.g., insulin) conjugated to an FcRn binding partner such as IgG or Fc fragments (see, e.g., PCT Publications WO 96/22024 and WO 99/04813). IgG Fusion proteins that have a disulfide-linked dimeric structure due to the IgG portion disulfide bonds have also been found to be more efficient in binding and neutralizing other molecules than monomeric polypeptides or fragments thereof alone. See, e.g., Fountoulakis et al., *J. Biochem.*, 270:3958-3964 (1995). Nucleic acids encoding the above epitopes can also be recombined with a gene of interest as an epitope tag (e.g., the hemagglutinin (HA) tag or flag tag) to aid in detection and purification of the expressed polypeptide. For example, a system described by Janknecht et al. allows for the ready purification of non-denatured fusion proteins expressed in human cell lines (Janknecht et al., 1991, *Proc. Natl. Acad. Sci. USA*

88:8972- 897). In this system, the gene of interest is subcloned into a vaccinia recombination plasmid such that the open reading frame of the gene is translationally fused to an amino-terminal tag consisting of six histidine residues. The tag serves as a matrix binding domain for the fusion protein. Extracts from cells infected with the recombinant vaccinia virus are loaded onto Ni²⁺ nitriloacetic acid-agarose column and histidine-tagged proteins can be selectively eluted with imidazole-containing buffers.

Fusion Proteins

[00170] Any polypeptide of the present invention can be used to generate fusion proteins. For example, the polypeptide of the present invention, when fused to a second protein, can be used as an antigenic tag. Antibodies raised against the polypeptide of the present invention can be used to indirectly detect the second protein by binding to the polypeptide. Moreover, because secreted proteins target cellular locations based on trafficking signals, polypeptides of the present invention which are shown to be secreted can be used as targeting molecules once fused to other proteins.

[00171] Examples of domains that can be fused to polypeptides of the present invention include not only heterologous signal sequences, but also other heterologous functional regions. The fusion does not necessarily need to be direct, but may occur through linker sequences.

[00172] In certain preferred embodiments, proteins of the invention are fusion proteins comprising an amino acid sequence that is an N and/or C- terminal deletion of a polypeptide of the invention. In preferred embodiments, the invention is directed to a fusion protein comprising an amino acid sequence that is at least 80%, 85%, 90%, 95%, 96%, 97%, 98% or 99% identical to a polypeptide sequence of the invention. Polynucleotides encoding these proteins are also encompassed by the invention.

[00173] Moreover, fusion proteins may also be engineered to improve characteristics of the polypeptide of the present invention. For instance, a region of additional amino acids, particularly charged amino acids, may be added to the N-terminus of the polypeptide to improve stability and persistence during purification from the host cell or subsequent handling and storage. Also, peptide moieties may be added to the polypeptide to facilitate purification. Such regions may be removed prior to final

preparation of the polypeptide. The addition of peptide moieties to facilitate handling of polypeptides are familiar and routine techniques in the art.

[00174] As one of skill in the art will appreciate that, as discussed above, polypeptides of the present invention, and epitope-bearing fragments thereof, can be combined with heterologous polypeptide sequences. For example, the polypeptides of the present invention may be fused with heterologous polypeptide sequences, for example, the polypeptides of the present invention may be fused with the constant domain of immunoglobulins (IgA, IgE, IgG, IgM) or portions thereof (CH1, CH2, CH3, and any combination thereof, including both entire domains and portions thereof), or albumin (including, but not limited to, native or recombinant human albumin or fragments or variants thereof (see, e.g., U.S. Patent No. 5,876,969, issued March 2, 1999, EP Patent 0 413 622, and U.S. Patent No. 5,766,883, issued June 16, 1998, herein incorporated by reference in their entirety)), resulting in chimeric polypeptides. For example, EP-A-O 464 533 (Canadian counterpart 2045869) discloses fusion proteins comprising various portions of constant region of immunoglobulin molecules together with another human protein or part thereof. In many cases, the Fc part in a fusion protein is beneficial in therapy and diagnosis, and thus can result in, for example, improved pharmacokinetic properties (EP-A 0232 262). Alternatively, deleting the Fc part after the fusion protein has been expressed, detected, and purified, would be desired. For example, the Fc portion may hinder therapy and diagnosis if the fusion protein is used as an antigen for immunizations. In drug discovery, for example, human proteins, such as hIL-5, have been fused with Fc portions for the purpose of high-throughput screening assays to identify antagonists of hIL-5. See, D. Bennett et al., *J. Molecular Recognition* 8:52-58 (1995); K. Johanson et al., *J. Biol. Chem.* 270:9459-9471 (1995).

[00175] Moreover, the polypeptides of the present invention can be fused to marker sequences, such as a polypeptide, which facilitates purification of the fused polypeptide. In preferred embodiments, the marker amino acid sequence is a hexa-histidine peptide, such as the tag provided in a pQE vector (QIAGEN, Inc., 9259 Eton Avenue, Chatsworth, CA, 91311), among others, many of which are commercially available. As described in Gentz et al., *Proc. Natl. Acad. Sci. USA* 86:821-824 (1989), for instance, hexa-histidine provides for convenient purification

of the fusion protein. Another peptide tag useful for purification, the "HA" tag, corresponds to an epitope derived from the influenza hemagglutinin protein (Wilson et al., Cell 37:767 (1984).)

[00176] Additional fusion proteins of the invention may be generated through the techniques of gene-shuffling, motif-shuffling, exon-shuffling, and/or codon-shuffling (collectively referred to as "DNA shuffling"), briefly described below, and further described herein. DNA shuffling may be employed to modulate the activities of polypeptides of the invention, such methods can be used to generate polypeptides with altered activity, as well as agonists and antagonists of the polypeptides. See, generally, U.S. Patent Nos. 5,605,793; 5,811,238; 5,830,721; 5,834,252; and 5,837,458, and Patten et al., Curr. Opinion Biotechnol. 8:724-33 (1997); Harayama, Trends Biotechnol. 16(2):76-82 (1998); Hansson et al., J. Mol. Biol. 287:265-76 (1999); and Lorenzo and Blasco, Biotechniques 24(2):308-13 (1998); each of these patents and publications are hereby incorporated by reference in its entirety). In a preferred embodiment, one or more components, motifs, sections, parts, domains, fragments, etc., of a polynucleotide encoding a polypeptide of the invention may be recombined with one or more components, motifs, sections, parts, domains, fragments, etc., of one or more heterologous molecules encoding a heterologous polypeptide.

[00177] Thus, any of these above fusions can be engineered using the polynucleotides or the polypeptides of the present invention.

Recombinant and Synthetic Production of Polypeptides of the Invention

[00178] The present invention also relates to vectors containing the polynucleotide of the present invention, host cells, and the production of polypeptides by synthetic and recombinant techniques. The vector may be, for example, a phage, plasmid, viral, or retroviral vector. Retroviral vectors may be replication competent or replication defective. In the latter case, viral propagation generally will occur only in complementing host cells.

[00179] The polynucleotides of the invention may be joined to a vector containing a selectable marker for propagation in a host. Generally, a plasmid vector is introduced in a precipitate, such as a calcium phosphate precipitate, or in a complex

with a charged lipid. If the vector is a virus, it may be packaged *in vitro* using an appropriate packaging cell line and then transduced into host cells.

[00180] The polynucleotide insert should be operatively linked to an appropriate promoter, such as the phage lambda PL promoter, the *E. coli lac*, *trp*, *phoA* and *tac* promoters, the SV40 early and late promoters and promoters of retroviral LTRs, to name a few. Other suitable promoters will be known to the skilled artisan. The expression constructs will further contain sites for transcription initiation, termination, and, in the transcribed region, a ribosome binding site for translation. The coding portion of the transcripts expressed by the constructs will preferably include a translation initiating codon at the beginning and a termination codon (UAA, UGA or UAG) appropriately positioned at the end of the polypeptide to be translated.

[00181] As indicated, the expression vectors will preferably include at least one selectable marker. Such markers include dihydrofolate reductase, G418 or neomycin resistance, glutamine synthase, for eukaryotic cell culture and tetracycline, kanamycin or ampicillin resistance genes for culturing in *E. coli* and other bacteria. Representative examples of appropriate hosts include, but are not limited to, bacterial cells, such as *E. coli*, *Streptomyces* and *Salmonella typhimurium* cells; fungal cells, such as yeast cells (e.g., *Saccharomyces cerevisiae* or *Pichia pastoris* (ATCC Accession No. 201178)); insect cells such as *Drosophila* S2 and *Spodoptera* Sf9 cells; animal cells such as CHO, COS, 293, NSO and Bowes melanoma cells; and plant cells. Appropriate culture mediums and conditions for the above-described host cells are known in the art.

[00182] Among vectors preferred for use in bacteria include pQE70, pQE60 and pQE-9, available from QIAGEN, Inc.; pBluescript vectors, Phagescript vectors, pNH8A, pNH16a, pNH18A, pNH46A, available from Stratagene Cloning Systems, Inc.; and ptrc99a, pKK223-3, pKK233-3, pDR540, pRIT5 available from Pharmacia Biotech, Inc. Among preferred eukaryotic vectors are pWLNEO, pSV2CAT, pOG44, pXT1 and pSG available from Stratagene; and pSVK3, pBPV, pMSG and pSVL available from Pharmacia. Preferred expression vectors for use in yeast systems include, but are not limited to pYES2, pYD1, pTEF1/Zeo, pYES2/GS, pPICZ, pGAPZ, pGAPZalph, pPIC9, pPIC3.5, pHIL-D2, pHIL-S1, pPIC3.5K, pPIC9K, and

PAO815 (all available from Invitrogen, Carlsbad, CA). Other suitable vectors will be readily apparent to the skilled artisan.

[00183] Vectors which use glutamine synthase (GS) or DHFR as the selectable markers can be amplified in the presence of the drugs methionine sulphoximine or methotrexate, respectively. An advantage of glutamine synthase based vectors is the availability of cell lines (e.g., the murine myeloma cell line, NS0) which are glutamine synthase negative. Glutamine synthase expression systems can also function in glutamine synthase expressing cells (e.g., Chinese Hamster Ovary (CHO) cells) by providing additional inhibitor to prevent the functioning of the endogenous gene. A glutamine synthase expression system and components thereof are detailed in PCT publications: WO87/04462; WO86/05807; WO89/01036; WO89/10404; and WO91/06657 which are hereby incorporated in their entireties by reference herein. Additionally, glutamine synthase expression vectors can be obtained from Lonza Biologics, Inc. (Portsmouth, NH). Expression and production of monoclonal antibodies using a GS expression system in murine myeloma cells is described in Bebbington *et al.*, *Bio/technology* 10:169(1992) and in Biblia and Robinson *Biotechnol. Prog.* 11:1 (1995) which are herein incorporated by reference.

[00184] The present invention also relates to host cells containing the above-described vector constructs described herein, and additionally encompasses host cells containing nucleotide sequences of the invention that are operably associated with one or more heterologous control regions (e.g., promoter and/or enhancer) using techniques known of in the art. The host cell can be a higher eukaryotic cell, such as a mammalian cell (e.g., a human derived cell), or a lower eukaryotic cell, such as a yeast cell, or the host cell can be a prokaryotic cell, such as a bacterial cell. A host strain may be chosen, which modulates the expression of the inserted gene sequences, or modifies and processes the gene product in the specific fashion desired. Expression from certain promoters can be elevated in the presence of certain inducers; thus expression of the genetically engineered polypeptide may be controlled. Furthermore, different host cells have characteristics and specific mechanisms for the translational and post-translational processing and modification (e.g., phosphorylation, cleavage) of proteins. Appropriate cell lines can be chosen to ensure the desired modifications and processing of the foreign protein expressed.

- [00185] Introduction of the nucleic acids and nucleic acid constructs of the invention into the host cell can be effected by calcium phosphate transfection, DEAE-dextran mediated transfection, cationic lipid-mediated transfection, electroporation, transduction, infection, or other methods. Such methods are described in many standard laboratory manuals, such as Davis et al., *Basic Methods In Molecular Biology* (1986). It is specifically contemplated that the polypeptides of the present invention may in fact be expressed by a host cell lacking a recombinant vector.
- [00186] In addition to encompassing host cells containing the vector constructs discussed herein, the invention also encompasses primary, secondary, and immortalized host cells of vertebrate origin, particularly mammalian origin, that have been engineered to delete or replace endogenous genetic material (e.g., cardiovascular system antigen coding sequence), and/or to include genetic material (e.g., heterologous polynucleotide sequences) that is operably associated with cardiovascular system associated polynucleotides of the invention, and which activates, alters, and/or amplifies endogenous cardiovascular system associated polynucleotides. For example, techniques known in the art may be used to operably associate heterologous control regions (e.g., promoter and/or enhancer) and endogenous cardiovascular system associated polynucleotide sequences via homologous recombination (see, e.g., US Patent Number 5,641,670, issued June 24, 1997; International Publication Number WO 96/29411; International Publication Number WO 94/12650; Koller *et al.*, *Proc. Natl. Acad. Sci. USA* 86:8932-8935 (1989); and Zijlstra *et al.*, *Nature* 342:435-438 (1989), the disclosures of each of which are incorporated by reference in their entireties).
- [00187] Polypeptides of the present invention can also be recovered from: products purified from natural sources, including bodily fluids, tissues and cells, whether directly isolated or cultured; products of chemical synthetic procedures; and products produced by recombinant techniques from a prokaryotic or eukaryotic host, including, for example, bacterial, yeast, higher plant, insect, and mammalian cells. Depending upon the host employed in a recombinant production procedure, the polypeptides of the present invention may be glycosylated or may be non-glycosylated. In addition, polypeptides of the invention may also include an initial modified methionine residue, in some cases as a result of host-mediated processes. Thus, it is well known in the art that the N-terminal methionine encoded by the

translation initiation codon generally is removed with high efficiency from any protein after translation in all eukaryotic cells. While the N-terminal methionine on most proteins also is efficiently removed in most prokaryotes, for some proteins, this prokaryotic removal process is inefficient, depending on the nature of the amino acid to which the N-terminal methionine is covalently linked.

[00188] In one embodiment, the yeast *Pichia pastoris* is used to express polypeptides of the invention in a eukaryotic system. *Pichia pastoris* is a methylotrophic yeast which can metabolize methanol as its sole carbon source. A main step in the methanol metabolization pathway is the oxidation of methanol to formaldehyde using O₂. This reaction is catalyzed by the enzyme alcohol oxidase. In order to metabolize methanol as its sole carbon source, *Pichia pastoris* must generate high levels of alcohol oxidase due, in part, to the relatively low affinity of alcohol oxidase for O₂. Consequently, in a growth medium depending on methanol as a main carbon source, the promoter region of one of the two alcohol oxidase genes (*AOX1*) is highly active. In the presence of methanol, alcohol oxidase produced from the *AOX1* gene comprises up to approximately 30% of the total soluble protein in *Pichia pastoris*. See, Ellis, S.B., *et al.*, *Mol. Cell. Biol.* 5:1111-21 (1985); Koutz, P.J., *et al.*, *Yeast* 5:167-77 (1989); Tschopp, J.F., *et al.*, *Nucl. Acids Res.* 15:3859-76 (1987). Thus, a heterologous coding sequence, such as, for example, a polynucleotide of the present invention, under the transcriptional regulation of all or part of the *AOX1* regulatory sequence is expressed at exceptionally high levels in *Pichia* yeast grown in the presence of methanol.

[00189] In one example, the plasmid vector pPIC9K is used to express DNA encoding a polypeptide of the invention, as set forth herein, in a *Pichea* yeast system essentially as described in "*Pichia* Protocols: Methods in Molecular Biology," D.R. Higgins and J. Cregg, eds. The Humana Press, Totowa, NJ, 1998. This expression vector allows expression and secretion of a polypeptide of the invention by virtue of the strong *AOX1* promoter linked to the *Pichia pastoris* alkaline phosphatase (PHO) secretory signal peptide (i.e., leader) located upstream of a multiple cloning site.

[00190] Many other yeast vectors could be used in place of pPIC9K, such as, pYES2, pYD1, pTEF1/Zeo, pYES2/GS, pPICZ, pGAPZ, pGAPZalpha, pPIC9, pPIC3.5,

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NOM DU FICHER / FILE NAME :

NOTE POUR LE TOME / VOLUME NOTE:

What Is Claimed Is:

1. An isolated nucleic acid molecule comprising a polynucleotide having a nucleotide sequence at least 95% identical to a sequence selected from the group consisting of:

(a) a polynucleotide fragment of SEQ ID NO:X or a polynucleotide fragment of the cDNA sequence contained in Clone ID NO:Z, which is hybridizable to SEQ ID NO:X;

(b) a polynucleotide encoding a polypeptide fragment of SEQ ID NO:Y or a polypeptide fragment encoded by the cDNA sequence contained in cDNA Clone ID NO:Z, which is hybridizable to SEQ ID NO:X;

(c) a polynucleotide encoding a polypeptide fragment of a polypeptide encoded by SEQ ID NO:X or a polypeptide fragment encoded by the cDNA sequence contained in cDNA Clone ID NO:Z, which is hybridizable to SEQ ID NO:X;

(d) a polynucleotide encoding a polypeptide domain of SEQ ID NO:Y or a polypeptide domain encoded by the cDNA sequence contained in cDNA Clone ID NO:Z, which is hybridizable to SEQ ID NO:X;

(e) a polynucleotide encoding a polypeptide epitope of SEQ ID NO:Y or a polypeptide epitope encoded by the cDNA sequence contained in cDNA Clone ID NO:Z, which is hybridizable to SEQ ID NO:X;

(f) a polynucleotide encoding a polypeptide of SEQ ID NO:Y or the cDNA sequence contained in cDNA Clone ID NO:Z, which is hybridizable to SEQ ID NO:X, having biological activity;

(g) a polynucleotide which is a variant of SEQ ID NO:X;

(h) a polynucleotide which is an allelic variant of SEQ ID NO:X;

(i) a polynucleotide which encodes a species homologue of the SEQ ID NO:Y;

(j) a polynucleotide capable of hybridizing under stringent conditions to any one of the polynucleotides specified in (a)-(i), wherein said polynucleotide does not hybridize under stringent conditions to a nucleic acid molecule having a nucleotide sequence of only A residues or of only T residues.

2. The isolated nucleic acid molecule of claim 1, wherein the polynucleotide fragment comprises a nucleotide sequence encoding a protein.

3. The isolated nucleic acid molecule of claim 1, wherein the polynucleotide fragment comprises a nucleotide sequence encoding the sequence identified as SEQ ID NO:Y or the polypeptide encoded by the cDNA sequence contained in cDNA Clone ID NO:Z, which is hybridizable to SEQ ID NO:X.

4. The isolated nucleic acid molecule of claim 1, wherein the polynucleotide fragment comprises the entire nucleotide sequence of SEQ ID NO:X or the cDNA sequence contained in cDNA Clone ID NO:Z, which is hybridizable to SEQ ID NO:X.

5. The isolated nucleic acid molecule of claim 2, wherein the nucleotide sequence comprises sequential nucleotide deletions from either the C-terminus or the N-terminus.

6. The isolated nucleic acid molecule of claim 3, wherein the nucleotide sequence comprises sequential nucleotide deletions from either the C-terminus or the N-terminus.

7. A recombinant vector comprising the isolated nucleic acid molecule of claim 1.

8. A method of making a recombinant host cell comprising the isolated nucleic acid molecule of claim 1.

9. A recombinant host cell produced by the method of claim 8.

10. The recombinant host cell of claim 9 comprising vector sequences.

11. An isolated polypeptide comprising an amino acid sequence at least 90% identical to a sequence selected from the group consisting of:

(a) a polypeptide fragment of SEQ ID NO:Y or the encoded sequence contained in cDNA Clone ID NO:Z;

(b) a polypeptide fragment of SEQ ID NO:Y or the encoded sequence contained in cDNA Clone ID NO:Z, having biological activity;

(c) a polypeptide domain of SEQ ID NO:Y or the encoded sequence contained in cDNA Clone ID NO:Z;

(d) a polypeptide epitope of SEQ ID NO:Y or the encoded sequence contained in cDNA Clone ID NO:Z;

(e) a full length protein of SEQ ID NO:Y or the encoded sequence contained in cDNA Clone ID NO:Z;

(f) a variant of SEQ ID NO:Y;

(g) an allelic variant of SEQ ID NO:Y; or

(h) a species homologue of the SEQ ID NO:Y.

12. The isolated polypeptide of claim 11, wherein the full length protein comprises sequential amino acid deletions from either the C-terminus or the N-terminus.

13. An isolated antibody that binds specifically to the isolated polypeptide of claim 11.

14. A recombinant host cell that expresses the isolated polypeptide of claim 11.

15. A method of making an isolated polypeptide comprising:

(a) culturing the recombinant host cell of claim 14 under conditions such that said polypeptide is expressed; and

(b) recovering said polypeptide.

16. The polypeptide produced by claim 15.

17. A method for preventing, treating, or ameliorating a medical condition, comprising administering to a mammalian subject a therapeutically effective amount of the polynucleotide of claim 1.

18. A method of diagnosing a pathological condition or a susceptibility to a pathological condition in a subject comprising:

(a) determining the presence or absence of a mutation in the polynucleotide of claim 1; and

(b) diagnosing a pathological condition or a susceptibility to a pathological condition based on the presence or absence of said mutation.

19. A method of diagnosing a pathological condition or a susceptibility to a pathological condition in a subject comprising:

(a) determining the presence or amount of expression of the polypeptide of claim 11 in a biological sample; and

(b) diagnosing a pathological condition or a susceptibility to a pathological condition based on the presence or amount of expression of the polypeptide.

20. A method for identifying a binding partner to the polypeptide of claim 11 comprising:

(a) contacting the polypeptide of claim 11 with a binding partner; and

(b) determining whether the binding partner effects an activity of the polypeptide.

21. The gene corresponding to the cDNA sequence of SEQ ID NO:Y.

22. A method of identifying an activity in a biological assay, wherein the method comprises:

(a) expressing SEQ ID NO:X in a cell;

(b) isolating the supernatant;

a) (c) detecting an activity in a biological assay; and

(d) identifying the protein in the supernatant having the activity.

23. The product produced by the method of claim 20.

24. A method for preventing, treating, or ameliorating a medical condition, comprising administering to a mammalian subject a therapeutically effective amount of the polypeptide of claim 11.