



US 20150012286A1

(19) **United States**

(12) **Patent Application Publication**  
**Ledley**

(10) **Pub. No.: US 2015/0012286 A1**

(43) **Pub. Date: Jan. 8, 2015**

(54) **INSTRUMENTS AND METHODS FOR  
OBTAINING INFORMED CONSENT TO  
GENETIC TESTS**

(52) **U.S. Cl.**  
CPC ..... *G06F 19/322* (2013.01)  
USPC ..... *705/2*

(71) Applicant: **National Biomedical Research  
Foundation**, Bethesda, MD (US)

(57) **ABSTRACT**

(72) Inventor: **Fred D. Ledley**, Needham, MA (US)

(21) Appl. No.: **14/304,746**

(22) Filed: **Jun. 13, 2014**

**Related U.S. Application Data**

(63) Continuation of application No. 13/888,027, filed on May 6, 2013, now abandoned, which is a continuation of application No. 10/134,424, filed on Apr. 25, 2002, now Pat. No. 8,438,042.

(60) Provisional application No. 60/310,804, filed on Aug. 8, 2001.

**Publication Classification**

(51) **Int. Cl.**  
*G06F 19/00* (2006.01)

This invention provides an instrument for obtaining consent for a genetic test that comprises three or more integrated elements including an information element for conveying information to an individual concerning a genetic test, and instruction element for use by a practitioner in instructing individuals on the genetic test and use of the instrument, a collection element for collecting an individual's medical and family history, a assessment element for assessing the individual's retention and understanding of information concerning a genetic test, a certification element for certifying the individual's consent to said tests, as well as housekeeping elements useful for recording a medical record, labeling a sample, and billing. Also provided is a method for obtaining informed consent for a genetic test using an integrated instrument. The instruments and methods disclosed have utility in obtaining informed consent for genetic tests.

## INSTRUMENTS AND METHODS FOR OBTAINING INFORMED CONSENT TO GENETIC TESTS

### FIELD OF THE INVENTION

[0001] This invention provides novel instruments and methods for obtaining informed consent for genetic tests.

### BACKGROUND OF THE INVENTION

[0002] The human genome project has been undertaken with the expectation that the sequences of genes that comprise the genome are determinants of individual development, health, and disease. Variation in gene sequences, variations in the level, location, or timing of expression of a gene, and variation in the physical, chemical, or dynamic characteristics of the products expressed from a gene are known to underlie many aspects of human individuality including physical and mental characteristics, growth, longevity, health, and disease. An objective of genomic research is the discovery, development and implementation of genetic tests that can be used to determine how the genes of an individual predispose that individual to various clinical outcomes. Genetic tests are expected to have a central role in routine health, wellness, and disease management, enabling predisposition testing and interventions to prevent disease, providing early diagnosis, and optimizing pharmacological interventions with drugs that are likely to be safe and effective for an individual.

[0003] The utilization of genetic tests and the interpretation of genetic tests results are more complex than conventional diagnostic testing. The number of genetic tests that will be available from human genomic research is very large compared to the number of conventional diagnostic tests. The genome project is expected to reveal 30,000-100,000 genes and >10,000,000 discrete genetic variations that may be developed into genetic tests with utility in predicting specific health outcomes. Few individuals or healthcare practitioners are familiar with the many genes different already known to be associated with specific health outcomes. Few have the ability to remain current with the rapidly emerging literature in this field. The effective and ethical use of genetic tests requires that individuals have sufficient information about the tests to decide whether to have the test done and to make efficacious use of the test result. This requires that individuals have access to information concerning the potential benefits of genetic testing, the procedures involved in genetic testing, and the potential risks to health and privacy. Because of the unique nature of genetic testing, good medical practice and statutory requirements in some states require that an informed consent be obtained from an individual before a sample is obtained and a genetic test is performed. To provide a valid informed consent, an individual must have been given and must retain and understand sufficient information concerning the test, the DNA sample, the potential use of genetic information that may be obtained from the sample, and the potential benefits and risks associated with the test to make an informed decision regarding the test.

[0004] Genetic testing is typically initiated by health care practitioners (including primary or subspecialty physicians or practitioners specialized in genetics, such as MD, PhD, or MA/MS trained geneticists or genetic counselors), and informed consent is obtained by the practitioner during a meeting with the individual. During this meeting, the practi-

tioner must provide the individual with information sufficient for the individual to make an informed choice and to certify their consent to the testing procedure. After certification, samples are typically obtained by the health care practitioner or a designated blood drawing facility and tests are then performed by certified laboratories. The test result is reported from the laboratory to the practitioner and/or to the individual. Many practitioners do not have sufficient training in genetics, knowledge relating to individual genetic tests, or time to adequately provide individuals with the information required to provide a legally binding informed consent.

[0005] The process of obtaining informed consent is described in many textbooks, articles, reports, and recommendations. In current practice, information about genetic tests is collected by practitioners and individuals from a variety of sources including textbooks of medicine or genetics, as well as articles in medical journals, courses for continuing medical education, government agencies, disease advocacy groups, biotechnology companies, academic research groups, the Internet, and articles in the lay press. This information, as well as information about the process of obtaining a genetic test, and the use of genetic test results is discussed with the individual in an ad hoc manner. Many sources of information are written at a level appropriate for healthcare practitioners. Few are appropriate for individuals in the general public. Moreover, information gleaned from multiple sources is often conflicting and incomplete. Few sources of information are validated in clinical studies to demonstrate that the content and mode of presentation results in comprehension and retention by the individual.

[0006] Documents by which an individual can certify their consent to a genetic test are known in the art. Such documents focus primarily on legal issues related to genetic testing such as the technical and predictive limitations of genetic testing, potential errors in diagnosis and interpretation, the disposition of the DNA sample, and the reporting of test results. Informed consent documents are typically generic, i.e., they address issues that are relevant to many different genetic tests and clinical outcomes rather than being specific to particular genetic test, genetic tests for related genes, or a specific clinical outcome.

[0007] Because of the complexity of genetic information, the widespread lack of professional training in genetics and procedures for delivering genetic services, and the lack of validated resources for providing genetic services, surveys suggest that <10% of practitioners feel that they are capable of adequately providing such services. Moreover, despite laws in some states that require informed consent be obtained before genetic tests are performed, data demonstrates that many genetic tests are performed without any informed consent being obtained or with inadequate informed consent.

### SUMMARY OF THE INVENTION

[0008] The inventor has determined that an instrument for obtaining informed consent comprising integrated elements with information for the individual, instruction for the practitioner, and materials for certifying an individual's consent and, optionally, elements for processing the genetic record, sample collection, and billing has utility in assisting practitioners to obtain meaningful and legally binding informed consent. This instrument may be validated to establish that it is effective in establishing understanding, comprehension, and effective use of the test and test result. The instrument described in this invention provides an individual with infor-

mation about a genetic test for one gene, more than one gene, related genes, genes associated with a clinical outcome or for a gene screen and assists the provider in obtaining a valid informed consent and performing other procedures associated with genetic testing.

**[0009]** The instrument comprises an information element, an instruction element and a certification element. The elements are integrated. The information element contains information sufficient for an individual to provide a valid informed consent. This element is integrated with an instructional element for the practitioner that contains more detailed reference information on the gene, gene test, or clinical outcome that is the subject of the test as well as stepwise directions on how to instruct the individual in the information in the information element and materials designed to support such instruction. The integrated instrument contains both informational materials required by the practitioner and the individual as well as worksheets, checklists, forms, illustrative materials and other materials required to carry out these steps in an integrated manner. The information element contains basic information for individuals about the genetic test including text and illustrative materials in the primary language of the individual and at a level of comprehension appropriate for the general population. It is generally considered that materials intended for comprehension by the general population should not exceed an 8-10<sup>th</sup> grade level. The information element is designed to provide individuals with information that is accurate, timely, and useful and considered by experts to be sufficient for an individual to make an informed decision to proceed with a genetic test. The information element may contain illustrative materials as well as supplemental information about genetics, genetic tests, or a clinical outcome, or references or links to more advanced information available in printed materials or references or links to more advanced information available in printed materials or electronic medium.

**[0010]** The instruction element directs the practitioner how to present information to individuals and how to obtain informed consent using the instrument. This element includes stepwise instructions on the use of the instrument and each of the elements comprising the instrument, reference information at the level of the practitioner on medical genetics, the genetic test, and related clinical outcomes, and answers to questions that are frequently asked by individuals during the consent process. The instruction element preferably contains a checklist to document that the practitioner has followed each of the steps required for use of the instrument. The instruction element may contain illustrative materials for use by the practitioner in presenting information to the individual, for example, props, diagrams, worksheets, objects, exercises, questions, or games that can be used to improve the individuals retention and comprehension of the information. The instruction element may also include a worksheet to assist the practitioner in calculating an individual's genetic risk of a clinical outcome based on genetic test results as well as information from the individual's medical history or family history.

**[0011]** The instruction element advantageously reduces the impact of the practitioner's subjectivity. It is well known that, for example, validated instruments for neuro-psychological testing require the practitioner to adhere strictly to the instruction set in order to achieve valid testing results. In this invention, the instruction element provides the means for standardization of the procedures employed by the practitioner in obtaining informed consent, and enables consent to be obtained in a

validated manner. In addition, it is generally recognized that information presented to individuals and the practices of the practitioner should be non-directive. The standardized and validated information element and instruction elements minimize unintentional bias and improve the quality and ethics of the consent and the consent process.

**[0012]** The instrument of this invention also includes a certification element. The certification element comprises a legal document in which the individual consents to the genetic test before any required witnesses, who certify that the individual has consented to the genetic test.

**[0013]** Optionally included in the instruments of the invention are various other elements, to with, an assessment element, a collection element, a labeling element, a billing element, a recording element, a training element, a quality control element and an indemnification element. One or any more than one of these elements may be included with the information, the instruction and the certification elements that comprise the instrument of the invention. Preferred elements to be included comprise the assessment element or the collection element, or both. Any optional element included in the instrument is integrated with one or more of the three essential elements.

**[0014]** The assessment element assesses the individual's retention and understanding of information contained in the information element and instruction element. The assessment element comprises questions about the genetic test, the risks and benefits of the test, clinical practice guidelines, recommendations, and possible clinical actions in response to the test results. The assessment element is integrated with the information element, in that the questions in the assessment element concern content from the information element, as well as the instruction element, which provides correct answers to each of the questions and procedures for responding to incorrect questions. The assessment element is intended to determine whether the individual satisfies the minimum standards of retention and understanding sufficient to provide a valid informed consent. The assessment also serves as an internal form of quality control on the ability of the practitioner to practice this method.

**[0015]** The integrated collection element assists the provider in obtaining information from an individual concerning their personal medical history and family history that is useful in deciding whether or not to have a genetic test performed and quantitatively determine the individual's genetic risk. This element is integrated with the information element which describes, for example, how an individual's family history impact their risk of a clinical outcome, as well as the instruction element which provides the practitioner with the ability to collect the personal medical history and family history and analyze this information to make a preliminary assessment of risk.

**[0016]** The other optional elements provide "housekeeping" functions. The labeling element and the billing element further assists the practitioner in processing the sample for genetic testing, establishing a genetic record, and obtaining payment for the test. The recording element ensures that a record of the informed consent process and the certification is established. The training element trains practitioners in the use of the instrument, the quality control element assesses the performance of the user against performance standards, and the indemnification element provides an indemnification

form for practitioners who use the instrument to obtain consent against claims that adequate informed consent was not properly obtained.

**[0017]** The method described in this invention involves the use of an integrated instrument to obtain valid informed consent. This method comprises, briefly, the steps of transmitting to the individual information on the genetic test and on the process of testing, instructing the individual with respect to the genetic test and the testing process and obtaining the individual's certified consent to the test using an integrated instrument. The method may optionally include the steps of collecting a personal medical history and family history using an integrated collection element, assessing the individual's retention or comprehension of this information using an integrated assessment element, labeling the sample with information required for proper sample handling using an integrated labeling element, and recording information concerning the informed consent process, the test to be performed, and the individual's medical and family history in a medical record using an integrated recording element. The method preferably includes the two steps of collecting and/or assessing. It may include any one or more of the remaining steps of labeling, billing training, providing quality control, indemnification and recording using integrated elements. Preferably these steps are performed using integrated elements.

**[0018]** One or more of the elements of the instrument may be posted to make it generally available to individuals or practitioners, by placing it on a web site, and providing it as a resource in printed or electronic medium accessible to individuals or practitioners, or incorporating it in policies, practices, guidelines, recommendations, training materials, or lessons and using integrated elements for one or more of the steps of informing, instructing, assessing, collecting, certifying, labeling, and recording. Preferably the information element and/or the instruction element is posted.

## DETAILED DESCRIPTION OF THE INVENTION

### A. Definitions and General Information

**[0019]** "Genetic test", "gene test", "test", or "genetic testing" mean the analysis of DNA, RNA, protein, or other biological materials in a sample from an individual to determine, without limitation, the sequence or structure of one, or more than one, gene, the presence or absence of one, or more than one, genetic marker, variance, variation, mutation, polymorphism, or micro satellite sequence associated with a gene, the presence of one, or more than one, viral sequence, viral-like sequence, or repetitive sequence, a haplotype or genotype spanning one, or more than one, gene, the number of copies of one, or more than one, gene, the amount or characteristics of RNA or protein expressed from one, or more than one, gene, the biological function of one, or more than one, gene, the arrangement of genes within the genome, the chromosome number, or integrity, modification, or structure of DNA and chromosomes. Many gene tests are useful in medicine for determining and individual's risk of a clinical outcome including diagnosing genetic disease, determining an individual's propensity to multifactorial diseases, and/or predicting an individual's response to therapeutic drugs. Genetic tests have been developed for many inherited diseases including, for example, Huntington's Disease, Cystic Fibrosis, and Phenylketonuria. Genetic tests have also been developed for genes that predispose to common, multifactorial diseases

including, for example, atherosclerosis, heart failure, stroke, anemia, cancer, clotting disorders, dementia, endocrine diseases, osteoporosis, and pulmonary diseases. Genetic tests have also been described which predict the pharmacokinetic and pharmacodynamic characteristics of many drugs including, for example, drugs for the treatment of elevated cholesterol, drugs to treat cancer, drugs to reduce hypertension, and drugs to treat dementia. The term genetic test includes any test which determines the structure, characteristics, amount, or activity of certain chemical entities that reflect the structure or function of one gene or more than one gene.

**[0020]** A common form of a genetic test involves the sequencing of one or more genes to determine whether the sequence corresponds to a sequence known to encode a gene product associated with normal biological or clinical activity or having a variant sequence that encodes a gene product that correlates with an abnormal function, disease, or clinical outcome. Gene sequences can be determined from gels, using automated sequencing, gene chips, hybridization to selected or random nucleotide sequences, mass spectroscopy or other methods well known in the art. Methods for selectively determining the sequence of one, or more than one, specific bases within a gene or the sequence of a region of a gene known to be a marker for specific health outcomes or to be associated with specific clinical outcomes are also well known in the art. A genetic test may identify a single variance within a gene or multiple variances within a gene. A genetic test may also identify one or more variances in more than one gene.

**[0021]** One form of a genetic test is a "gene screen" which identifies a large number of variances within one gene or many different genes, potentially every gene in the genome. A gene screen may identify variances in genes that are related through a common pathway, process, or clinical outcome and/or genes that are not related. Such tests raise particularly difficult issues for obtaining informed consent. A specific embodiment of this invention is an instrument for obtaining informed consent for a gene screen. Another common form of genetic test well known in the art quantifies the amount or structure of mRNA for one gene or many different genes in a sample. Other forms of genetic tests involve identification and analysis of specific proteins, or structurally variant forms of proteins by mass spectroscopy, electrophoresis, or by binding to natural or synthetic substrates or antibodies using methods well known in the art.

**[0022]** "Sample" means an aliquot of material from an individual, for example, blood, tissue, hair, skin cells, mucosal cells, or cells from other parts of the body, secretions such as saliva, mucous, urine, feces or other bodily tissues, or fluids, useful for genetic testing. Sample also means DNA, RNA, protein or other chemical entities useful for genetic testing that are extracted or purified from such materials. The term refers to, without limitation, any substance or chemical entity derived directly or indirectly from an individual that contains DNA, RNA, protein, or other materials suitable for performing a genetic test. A sample may contain sufficient material to perform one genetic test or a series of genetic tests over time. The term "label" is generally known in the art and refers to information that is attached to or otherwise associated with a sample or sample collection device which may contain information concerning the handling and disposition of the sample, the test to be performed, and identifying information concerning the individual.

**[0023]** "Sample collection device" is generally known in the art and includes any device for obtaining samples for

genetic tests and placing them in a format that can be delivered to the site where the sample can be extracted and the test can be performed. Examples of sample collection devices for genetic testing are known in the art. Sample collection devices may incorporate, for example, filter paper or tubes which hold the sample for transport to a laboratory, extraction of DNA or other components of the sample, storage of the sample, DNA banking, or performing one or more steps of the genetic test. It will be recognized that several difference devices may be used in the course of obtaining and processing a sample and performing a genetic test and storing the sample, and that multiple labels may be required to transmit information through the course of the sample handling and testing procedures. Samples can be collected using routine procedures for blood drawing and commonly employ tubes designed to enable the separation of nucleated cells, plasma or serum. Specialized devices are also known in the art including several devices that are approved by the FDA for sample collection. An exemplary device is the OraSure Oral Specimen Collection Device from Orasure Technologies, Inc. which is an FDA-approved device that can be used for the collection of DNA from the oral mucosa for clinical applications. Another exemplary device is S&S 903 Specimen Collection Paper from Schleicher & Schuell, GmbH which is also a FDA listed device widely used for sample collection, including genetic studies. S&S 903 Specimen Collection Paper, is used widely for newborn screening and has also been used for genetic studies. S&S 903 Specimen Collection Paper has also been incorporated into single and multi-part forms and forms and customized printing is available from the manufacturer with biologically inactive inks and glues that enable the paper to incorporate information or codes for patient identification, processing, and lot traceability. The 903 device can be used to collect blood or body fluids such as urine, tears, or saliva which are spotted and dried onto the 903 paper. In this form the sample is stable and can be mailed to centralized labs for analysis, sample extraction, or DNA banking.

**[0024]** A gene test may be performed using a “diagnostic product” that provides one or more than one of the reagents and materials required to form said test and may include a sample collection device. A diagnostic product typically comprises a kit containing reagents and materials that have been subjected to quality control and premeasured so that the test can be performed effectively by a technician, automated laboratory, or even an individual. Diagnostic products may be reviewed and approved by the Food and Drug Administration as In Vitro Diagnostics. Most genetic testing today is not performed using approved diagnostics, but rather performed under FDA “home brew” guidelines using analyte specific reagents. The term diagnostic product as used herein includes analyte specific reagents, sample collection devices, or other reagents or materials used to perform genetic tests.

**[0025]** “Banking” or “DNA banking” means the storage of a sample intended for future genetic testing. Since the gene sequences of aggregate somatic cells do not change over time (unless the cells are clonal and/or malignant), a sample obtained for one genetic test can be banked and additional tests can be performed at a later time. Informed consent is commonly required for DNA banking. Such consent must describe the potential uses of the sample and the final disposition of the sample. Potential uses may include retesting for quality control, genomic research, or additional tests for the benefit of the individual that may be requested by the indi-

vidual or practitioner. Such consent should also state whether a sample will be stored indefinitely or destroyed. Preferably the informed consent for a genetic test includes informed consent for banking, the permitted uses of the banked sample in the future, and the disposition of the banked sample.

**[0026]** “Chemical entity” means proteins, protein derivatives (such as glycoproteins, lipoproteins, or phosphoproteins), lipids, carbohydrates, small-molecule organic compounds, and inorganic compounds measured in tissue or body fluids whose structure, activity, characteristics, amount, location, or activity reflects the structure or function of one or more genes. It is recognized that tests on chemical entities often enable direct inferences to be made concerning the structure or activity of one or more genes. For example, electrophoresis of hemoglobin extracted from red blood cells can reveal a change in the hemoglobin molecule caused by the sickle cell mutation in the hemoglobin gene; an increase in the amount of phenylalanine in the blood or urine can reveal the presence of mutations in the gene for phenylalanine hydroxylase; the concentration of salts in sweat can reveal the presence of mutations in the CFTR gene, the ability of a specific monoclonal antibody to hybridize to a tumor cell may determine whether a genetic rearrangement has taken place; and a measure of Thiopurine Methyltransferase enzyme activity may reveal the presence of mutations in the TPMT gene. One skilled in the art will recognize that it is frequently more convenient and cost effective to determine the structure or activity of a protein or to measure metabolites in blood or urine than to perform an analysis directly on DNA or RNA. Such tests can be used interchangeably with tests that directly analyze DNA or RNA in the present invention. Many tests can reveal evidence indicating variations in gene sequences, expression or function including, for example, tests for proteins in serum, blood cells, tissues, assays for the expression of specific genes measured at the RNA or protein level, and assays for metabolites that are characteristic of specific gene functions or dysfunctions. It will be recognized that tests for chemical entities other than DNA or RNA may not be explicitly included in guidelines or statutes mandating informed consent. Nevertheless, the information that can be gained from such tests is often equivalent to that obtained through the analysis of DNA and RNA and presents similar benefits and risks to the individual. This invention specifically relates to tests performed on any chemical entity as a genetic test.

**[0027]** A “gene” is a linear sequence of nucleotides that encode or control a biological function. Genes typically direct the expression of RNA or protein which may be directly responsible for carrying out the function encoded by the gene, or the RNA or protein may be subject to modifications to carry out such functions. The gene may include, without limitation, introns, exons, promoters, or other sequences as well as chemical modifications of the nucleic acids which are involved in determining a biological function associated with that gene including the activity, amount, structure, or location of a chemical entity. Those skilled in the art will also recognize that the term gene is also used to refer to a specific series of nucleotides including characteristic variations that are associated with a clinical outcome. For example, a CFTR gene with variations that cause cystic fibrosis is often referred to as a “cystic fibrosis gene”, a BRCA1 gene with variations that cause breast cancer is often referred to as a “breast cancer gene”, and a phenylalanine hydroxylase gene with mutations that cause phenylketonuria is referred to as a “PKU gene.”

**[0028]** It is recognized by the skilled artisan that the sequence of nucleotides in the gene which encode its function may vary in different individuals, and that variances or mutations within the sequences of nucleotides of the gene may change its function. The terms “mutation”, “variation”, “polymorphism”, or “variance” refer to sequences within a gene which may differ among individuals. The term mutation is typically used to describe those variations that alter a characteristic activity of a gene or a gene product such as changes in the structure, activity, expression, availability, modification, processing, specificity, or function. Mutation more specifically describes those variations that impair activity of a gene or a gene product or are associated with an adverse clinical outcome. The terms “genetic marker”, “polymorphism”, or “single nucleotide polymorphism (SNP)”, are typically used to refer to specific sequences within a gene that can differ among individuals that are useful as markers to identify specific genes. Use of these terms implies that the specific variation in sequence does not alter the function of the gene, however, such sequences could be associated with characteristic activity of the gene or gene product or a specific clinical outcome. When a genetic variation is associated with a specific clinical outcome, the variation, and the gene that contains that variation, are said to “cause” or be “linked” or “associated” with that clinical outcome. Those skilled in the art recognize that a sequence variance which has detrimental effects in one circumstance, can have no effect, or even have beneficial effects in other circumstances, that sequence variances that have biological effects can also be used as markers, and that markers may be very closely linked with specific clinical outcomes even if they are not causative. Specific embodiments of this invention relate to sequence variations that are associated with a specific clinical outcome either because the sequence variation alters the biological function of a gene in a way that causes the clinical outcome, or because the sequence variation is a marker that is linked or associated with a clinical outcome. The skilled artisan will recognize that it is often not known whether a specific variance is a mutation or a polymorphism, that the terms “variance”, “variation”, “mutation”, “genetic marker”, “polymorphism”, and “SNP” each refer to differences in gene sequences, or positions in the genome where differences in the sequence are found between different individual, and that these terms are often used interchangeably in describing gene sequences that may be the object of a genetic test.

**[0029]** Relationships among genes are recognized based on similarities in structure and function, activities that contribute to common biological pathways, or activities contributing to a common pathological process or clinical outcome. “Gene family” means genes that share common structural or functional characteristics or activities. Some genes within a gene family may exhibit structural similarities due to comparable function (analogy) or evolution (homology) and may contain sequence identities, common motifs, or common functional elements, and may often be located in contiguous or closely linked regions of the chromosomes. It is recognized that genes within a family often carry out analogous biological functions, and that mutations in closely related genes can lead to similar clinical outcomes. “Pathway” refers to a sequential or intersecting set of biological functions. Several genes and gene products are typically involved in pathways for complex biological function such as the synthesis of biological compounds, the construction of cellular or somatic structures, or the regulation of a process within the body. It is recognized

that genes that contribute to a common pathway often work in a coordinated fashion, and that variances in any gene along the pathway could alter the characteristic structure, level, or expression of other genes as well as the end product. A disease, disorder or clinical outcome can often involve multiple genes as well as different variances in one or more than one gene. Genes are said to be “related” if they comprise a gene family or are involved in a common pathway, process, or clinical outcome.

**[0030]** The present invention relates to obtaining informed consent for genetic tests for one or more than one variances in one gene or in more than one gene. A preferred aspect of this invention relates to obtaining informed consent for genetic tests for more than one gene where such genes are related members of a gene family, a pathway, process, or clinical outcome. Obtaining informed consent for such tests may require proportionally more information on the part of the practitioner and understanding on the part of the individual for the consent to be valid. In specific embodiments of this invention, the genetic tests is for two genes where such genes are related members of a gene family, a pathway, process or clinical outcome, three such genes, five such genes, more than 5 such genes, more than 10 such genes, or more than 100 such genes. In a specific embodiment of this invention the genetic test is a gene that includes two or more than two genes that may not be related, more than 10 genes, more than 100 genes, more than 1000 genes, or more than 10,000 genes.

**[0031]** “Disease” and “disorder” refer to recognized morbid or pathological events and are commonly catalogued in textbooks of medicine and standard classifications of disease such as the International Classification of Disease (ICD). “Clinical outcome” means any observable clinical event or observation including, for example, disease, disorder, health, morbidity, or mortality; growth, development, aging or longevity; the onset, progression, course, remission, relapse, symptoms, signs, or pathology of a disease or disorder; cognitive function, behavior, psychosis, or dementia; as well as drug response, or drug toxicity or the response to any intervention involving drugs, nutrition, lifestyle change, education, or surgery as well as the application of non-allopathic therapies such as, without limitation, traditional, herbal, or folk medicines, nutraceuticals, osteopathy, or chiropractic medicine. The present invention relates preferably to genetic tests useful in the field of medicine for predicting a clinical outcome or determining the genetic risk of a clinical outcome.

**[0032]** The present invention is applicable to any clinical outcome known in the art for which genetic tests may identify a risk factor for that clinical outcome. A skilled artisan would recognize that the present invention is not limited to diseases that are traditionally identified as being genetic in origin but also to clinical outcomes that are “multifactorial”, i.e. associated with combinations of genetic and environmental factors. This includes, for example, clinical outcomes such as heart disease, hypertension, heart failure, coronary vascular disease, cerebral vascular disease, stroke, peripheral vascular disease, arthritis, rheumatoid arthritis, Lupus Erythematosus (SLE), psoriasis, asthma, reactive airway disease, COPD, osteoarthritis, osteoporosis, hearing loss, cataracts, renal failure, nephritis, hepatic failure, hepatitis, pancreatitis, diabetes, infection, cancer, drug toxicity, drug resistance, drug dependence, neurological diseases, dementia, Alzheimer’s disease, psychosis, neuroses, and metabolic diseases.

**[0033]** It is often important to perform genetic tests for multiple variations that may occur in one gene, or more than

one gene, to determine an individual's risk of a multifactorial clinical outcome. For example, a mutation in one gene may predispose an individual to a high risk of a clinical outcome, which may be increased or decreased by variations occurring in another related gene. Many multifactorial diseases are also "polygenic", meaning that they are associated with variations in more than one gene. The process of obtaining informed consent for genetic tests related to a multifactorial or polygenic clinical outcome is particularly difficult since it requires the practitioner to instruct the individual in the action of multiple genes singularly and together as well as non-genetic or environmental factors that contribute to such a clinical outcome and how such non-genetic or environmental factors may be modified to alter the course or incidence of the clinical outcome. It is recognized that genetic tests are often most useful for multifactorial clinical outcomes since the identification of genetic risk factors for a clinical outcome may enable modification of complementary non-genetic or environmental risk factors that may alter the course or incidence of that clinical outcome. In specific embodiments of this invention relate to tests for genes associated with multifactorial or polygenic clinical outcomes where such outcome is associated with one gene, two genes where such genes are related members of a gene family, a pathway, process or clinical outcome, three such genes, five such genes, more than five such genes, more than ten such genes, or more than 100 such genes. A specific embodiment of this invention is an instrument for obtaining informed consent for genetic tests one gene, two genes where such genes are related members of a gene family, a pathway, process or clinical outcome, three such genes, five such genes, more than five such genes, more than ten such genes, or more than 100 such genes. In a specific embodiment of this invention is an instrument for obtaining informed consent for a genetic test that is a gene screen for two or more than two genes that may not be related, specifically more than 10 genes, more than 100 genes, more than 1000 genes, or more than 10,000 genes.

**[0034]** Those skilled in the art recognize that often all of the genes and variations that are related to a clinical outcome may not yet be known. Genetic tests for variations in known genes are often useful in identifying risk factors for clinical outcomes. As the number of genes that are known within the human genome increases as a result of genomic research, and as further genomic research ascribes specific functions to these genes in health and disease and identifies variances within these genes that are associated with clinical outcomes, it will be desirable to perform additional genetic tests to further refine the assessment of risk. If DNA banking is performed when the initial sample is obtained, it is often possible to use this sample for such additional tests. A specific embodiment of this invention is an instrument for obtaining informed consent for a genetic test for more than one gene, related genes, a clinical outcome, or a gene screen which authorizes DNA banking and additional genetic tests for related genes at a future time. In specific embodiments, informed consent is obtained for such tests with notification or assent of the individual.

**[0035]** "Genetic risk" is a quantitative and/or statistical measure of the likelihood that an individual will have a clinical outcome as a result of variations in one or more than one gene. The risk may be expressed, for example, as the fold increase in risk of a particular clinical outcome, the likelihood or probability that an individual will experience a particular clinical outcome, or an odds ratio. Various methods for deter-

mining these measures are known by those of ordinary skill in the art and are commonly described in medical journals in conjunction with the discovery of genes that are considered risk factors for specific disease and in textbooks of medicine and genetics. Risk is often described as a statistical range which describes the probability of an individual experiencing a clinical outcome, for example risks being <10%, 10-25%, 25-50%, 50-75%, 75-90% or >90%. Risk may also be determined as a fold increase in risk, for example and individual may have a <2, 2-5, 5-10, or >10 fold increased likelihood of a clinical outcome if they have a certain genetic variation. A gene or sequence variation in a gene is a "risk factor" for a specific clinical outcome, condition and/or disease if the gene or variation is associated with a change in the risk or likelihood of that outcome.

**[0036]** "Genetic risk", susceptibility", "predisposition", and "risk" are often used interchangeably to describe the likelihood of a individual exhibiting a disease, disorder, or clinical outcome. It is recognized that a risk factor may refer equally to variations that increase the risk of a specific outcome or to variances that reduce the risk of that outcome. The determination of genetic risk often makes use of data from a medical and family history in addition to data describing the test result. The presence or absence of a specific variation or gene may have greater predictive value based on the family history of a specific clinical outcome and specific pattern of inheritance in that family.

**[0037]** The methods used to determine genetic risk as well as the statistical significance, sensitivity, specificity, and the predictive value of such information is described to the individual as part of the process of obtaining informed consent. The predictive value of a specific test may be described as the relative contribution of a specific variance or gene to a clinical outcome or to the fraction of individuals with a clinical outcome in which such outcome is attributable to a specific variance or gene. Studies suggest that the perceived accuracy of a test is particularly important to individuals who are considering whether or not to have a test performed. A description of factors including the technical specifications for the test (e.g. false positives and false negatives associated with the laboratory procedure), the statistical significance, specificity, and sensitivity of the association between a variance or gene and a clinical outcome, and the predictive value of the test result all contribute to the perceived accuracy of the test. While such information is available to those skilled in the art in reports describing the association of a specific variance or gene with a clinical outcome, it is difficult for many practitioners who are not skilled in genetics to ascertain such information and describe this information to individuals. A specific embodiment of this invention is an instrument for obtaining informed consent containing an integrated instruction element which describes the calculations for determining an individual risk based on the results of said tests, statistical processes (including the significance, sensitivity, and predictive value of the test results), personal medical history, and family history. In a specific embodiment the instrument contains stepwise instructions or a worksheet for the practitioner to determine an individual's risk.

**[0038]** The term "medical history" is well known in the art. The term "family history" or "family medical history" refers to information on the health of an individual's relatives, diseases they may have suffered, and the cause of death attributed to deceased family members. An individual who undergoes a genetic test is often referred to as a "proband". A family

history is most commonly obtained by asking an individual about their relatives and is commonly presented as a family tree illustrating the family relationships and notes about their medical history. A family history may be obtained using computer programs such as TreeBuilder™ or Cyrillic™. Certain tests may have limited predictive value in the absence of a family history of a specific clinical outcome. Other tests may have greater predictive value if the family history is known. When genetic tests are performed for the purpose of reproductive counseling, the family history will also contain information about an individual's reproductive partner, for example a spouse, partner, or egg or sperm donor, and their related family members.

**[0039]** The term "family members" includes family members of the proband as well as family members of a reproductive partner. As part of the informed consent process, it is often important to collect an individual's medical history and family history to help the individual assess the potential predictive value of the test. A specific embodiment of this invention is an instrument for obtaining informed consent for one, or more than one, genetic test which includes collection of information on an individual's medical history or family history. A specific embodiment of this invention is an instrument for obtaining informed consent for one, or more than one, genetic test, containing an integrated collection element which directs the practitioner how to determine an individual's risk based on the individual medical history, family history, and results of said test. In a specific embodiment the instrument contains stepwise instructions or a worksheet for the practitioner to determine an individual's risk based on the medical history or family history. A specific embodiment of this invention is a computer program for collecting an individual's medical history or family history integrated with an instrument for obtaining informed consent.

**[0040]** Several medical organizations such as the National Institutes of Health, the American College of Human Genetics, and others promulgate "recommendations" on the use of genetic tests that are often based on the prevalence of a clinical outcome in a specific population or demographic group or a family history of a clinical outcome. Such recommendations are often based on the predictive value of the test and its potential effects on an individual's quality of life, the prevalence of disease in a population or demographic group and its potential impact on health care economics (pharmacoeconomics). Such recommendations do not prohibit the use of genetic tests by an individual, though they may have a role in decisions concerning reimbursement for such tests. An important part of the process of obtaining informed consent is to instruct an individual concerning recommendations that are relevant to the test being considered and an assessment of whether the individual meets the criteria for the test and whether such recommendations are relevant to the individual's concerns. A specific embodiment of this invention is an instrument for obtaining informed consent for a genetic test or more than one genetic test which describes recommendations concerning such tests and guides the practitioner in an assessment of the recommended course of action for the individual. A specific embodiment of this invention is an instrument that guides the practitioner to instruct individuals concerning recommendations concerning genetic testing.

**[0041]** An exemplary purpose for performing a genetic test on an individual is to establish a measure of an individual's risk of a specific clinical outcome using a genetic test to determine the sequence of one gene, more than one gene,

related or unrelated genes, or a gene screen in the sample, the presence or absence of one, or more than one, sequence variation genetic marker, variance, variation, mutation, polymorphism, or micro satellite sequence associated with one gene or more than one genes, the presence of one, or more than one, viral sequence, viral-like sequence, or repetitive sequence, a haplotype or genotype spanning one gene, or more than one gene, related genes, the number of copies of one or more than one gene, the amount or characteristics of RNA or protein expressed from one, or more than one, gene, the biological function of one, or more than one, gene, the arrangement of genes within the genome, the chromosome number, or integrity of chromosomes.

**[0042]** This invention preferably concerns genetic tests useful in medicine that identify associations with a clinical outcome such as a health, genetic disease, multifactorial diseases, or an individual's response to therapeutic drugs. Such associations are generally established through clinical trials which collect data both on the clinical outcome and genetic variations in a sample obtained from the individual. It is often necessary to perform multiple clinical trials to achieve a consensus on the significance of a specific variation on an individual's genetic risk of a specific clinical outcome. Methods for performing such studies are known to those skilled in the art, and the results of such studies are commonly reported in publications in the medical literature and presentations at scientific meetings.

**[0043]** Initial reports of genetic tests may involve studies on small populations which demonstrate the statistical association of a gene or sequence variation with a clinical outcome. Such studies may suggest that a test has potential utility. These data must then be supplemented by additional studies which confirm and refine the accuracy of this observation and establish the utility of the test in quantitatively determining the genetic risk of a clinical outcome. Sometimes it is necessary to perform many studies or perform meta-analyses which combine the data from several different trials to establish that a test is useful in determining the genetic risk of a clinical outcome. Studies performed as part of the research and development of a genetic test are commonly described in reports in scientific and medical journals, presentations at scientific meetings, and, sometimes, in filings made to regulatory authorities to obtain authorization for manufacture or sale of a diagnostic product designed for use in performing a genetic test. Once a genetic test has been validated through multiple clinical studies, information about such tests will be found in textbooks of medicine, genetics or clinical pathology, in materials for medical education and continuing medical education. Once a diagnostic product is approved by the FDA or offered by a certified testing laboratory, additional information is often available from the manufacturers of a diagnostic product or laboratories that perform the test on a commercial basis. More than 500 validated tests for variations in specific genes have been described and are performed by certified laboratories. Information on tests that are commonly performed in clinical practice is available to those skilled in the art, for example through the Internet locations [genetest.org](http://genetest.org) and [geneclinics.org](http://geneclinics.org), textbooks such as Scriver et al., *The Molecular Basis of Inherited Disease*, McGraw Hill, databases available through the internet location [nhgri.nih.gov](http://nhgri.nih.gov), the National Center for Biological Information (NCBI) linked to the human genome project, and through academic journals of medicine and related sciences indexed through MEDLINE. New genetic tests are being discovered at a rapid

rate due to continuing progress of the human genome project and associated clinical research. Those skilled in the art recognize that it is difficult to remain current on the many reports describing basic genetic research and clinical trials on genetic tests and their application to determine the genetic risk of many different clinical outcomes. Information from such reports is important both to the practitioner who must describe the test to the individual, and to the individual who must decide whether or not to have the test performed. Moreover, it is often difficult to describe medical studies in simple language that is generally understandable by individuals. A specific embodiment of this invention is an instrument for obtaining informed consent for one genetic test or more than one genetic test with an integrated instruction element which provides the practitioner with a current summary of information from reports concerning such test or tests as well as illustrative materials which facilitate the instruction of an individual concerning such tests at an appropriate level of comprehension. In a further embodiment this information is incorporated in an information element for individuals with text and illustrative materials at a level appropriate for individuals.

**[0044]** The invention provides instruments and methods for obtaining informed consent comprising validated elements with information concerning the genetic test, elements for instructing an individual concerning the genetic test, elements for collection of personal medical history and family history, elements for assessing the individual's retention and comprehension of information, and elements for certification of informed consent. These methods and instruments enable practitioners and individuals to obtain a meaningful and legal informed consent.

**[0045]** "Informed consent" or "consent" mean the process by which individuals receive information about a genetic test, are informed of the potential benefits and risks associated with performing a genetic test, and provide legally binding permission for such a test to be performed on their provided sample. The terms informed consent or consent also mean the legally binding consent provided by an individual or a document, the "informed consent document", executed by an individual which certifies their consent for a genetic test to be performed. "Assent" means the process by which an individual indicates their acceptance of a genetic test without providing a legally binding consent. For example, minors generally are considered incapable of providing a legally binding consent, but may provide assent. Standards of medical care and some state laws require that an individual provide an informed consent for a genetic test to be performed.

**[0046]** The elements of a document for certifying individual's consent and guidelines for what constitute an informed consent process and legally binding informed consent document are known in the art. Informed consent for genetic testing often resembles the consents obtained for human subject research as described in the Code of Federal Regulations in sections 46.116 and 46.117. These guidelines are formally applicable only to tests that are performed for research purposes and are not formally applicable to the consents required for validated genetic tests that are performed for the purpose of determining and individuals risk of a clinical outcome. Nevertheless, many informed consents used for genetic testing retain the elements of an informed consent for research purposes, in part because many genetic tests are not yet fully validated and may be considered by some to be research even though they are performed primarily for diagnostic purposes.

Also, informed consent standards for research have been retained for genetic testing because many institutions seek consent to use samples and banked DNA that are obtained for diagnostic purposes for research purposes as well. An embodiment of this invention is an instrument which provides for an informed consent for genetic in compliance with Code of Federal Regulations in sections 46.116 and 46.117. An exemplary use of such consents would be for genetic tests performed for research purposes.

**[0047]** Other informed consents for genetic testing resemble the legal consents used for medical procedures such as surgery. The principles underlying such consents are primarily matters of state law and legal doctrine arising from common law (judicial decisions) as it applies to decisions about medical treatment and procedures. The operable standard under this doctrine is that the practitioner must disclose information that is or would be material to the patient in making his or her decision and information that a reasonable practitioner in similar circumstances would disclose. Some states in addition to the common law standard have carved out specific rules (statutes) proscribing the process for informed consent in regard to specific tests or procedures as well as the content of the disclosures that must be made to the patient facing those procedures. In some states genetic testing is treated this exceptional way and there are specific statutes on genetic testing. The statutes in most states are silent on the issue of informed consent for genetic testing, leaving the common law standard as the one that must usually be met. In the absence of a legal standard governing informed consent for genetic testing, the burden is increasingly placed on institutions and individual practitioners to provide sufficient information and instruction and collect relevant information sufficient to make the consent valid. As described herein, this may include, for example, information about the genetics, the genetic tests that will be performed, the use of genetic results, the risks and benefits of performing a test, recommendations concerning use of the genetic test, determinations of genetic risk, the use of sample, and procedures for records and protecting privacy. The preferred embodiment of this invention is an instrument which provides for an informed consent which assures compliance with statutes concerning informed consent for genetic tests. An exemplary use of such consent is to obtain consent for a test performed using a diagnostic product, preferably a diagnostic product approved by the FDA. Another exemplary use of such consent is to obtain consent for a test performed by a certified reference laboratory operating under CLIA regulations as a "home brew". A preferred embodiment of this invention is an instrument that provides for an informed consent for a genetic test that is not research.

**[0048]** The inadequacy of current informed consent practices has been noted in many reports in the medical literature. Major problems include the inability of many practitioners to provide sufficient information and instruction for the individual to make a truly informed decision. Another problem is the difficulty of communicating technically difficult information at a level appropriate for most individuals. Another problem is the poor retention of information and understanding of information required to provide an informed consent by individuals.

**[0049]** "Individual" means any person who may provide consent for a genetic test or have a genetic test performed. This includes individuals who may provide consent for genetic tests performed on their own samples, individuals with legal authority to authorize genetic testing for others, for

example parents who may provide consent for genetic tests of a minor, and individuals who have tests performed as a consequence of such consent.

**[0050]** “Practitioner”, “provider”, or “health care provider” are used interchangeably and include, for example, practitioners specialized in genetics with MD, PhD or MS degrees, genetic counselors, practitioners of primary care, specialties or subspecialties including physicians, nurses, physicians assistants, pharmacists, social workers, psychologists, as well as other ancillary healthcare professionals or nonprofessional personnel or their designees and the medical practices, hospitals, managed care organizations, or institutions for whom they are agents. The term may also include specialists trained in alternative healthcare practices including, for example, osteopaths or chiropraths. The terms refer to any provider of health services who may legally assist an individual in procuring a genetic test. The term practitioner may also relate to automated systems established by, or at the direction of, a practitioner that may be used to obtain informed consent from an individual. In such instance the term includes computer hardware and software or Internet sites that carry out such functions. In certain instances the practitioner is a virtual embodiment of the electronic medium and the instruction element is a computer program that guides the individual through the process of informed consent in an interactive manner. In some instances the virtual provider may be represented by a program or figure with synthetic voice and voice recognition systems.

**[0051]** “Record” or “recording” refers to a system, document, or file containing medical data about an individual. The record may contain an individual’s identity and the results of genetic tests and also information about personal and developmental history, medical history, family history, clinical laboratory data, images, findings on physical exam, and previous illnesses and therapies as well as reference or links to other records. Those skilled in the art will recognize that it is important to protect the privacy of genetic records. Genetic privacy laws in many locales mandate extensive protections for the privacy of genetic information. Methods for protecting the privacy of records are known in the art and include maintaining records in a secure environment, eliminating identifiable information that can be used to associate an individual with their record in favor of codes. Patient numbers and passwords are exemplary codes. A specific embodiment of this invention is an instrument for obtaining informed consent for a genetic test or one or more genetic tests which incorporates procedures for creating a record containing genetic information and for protecting the privacy of said record. Those skilled in the art recognize that individuals need to be informed about policies and procedures used to maintain a record containing the results of a genetic test and any other medical information or identifiable information as part of the process of providing informed consent for a genetic test. Individuals must be informed what steps will be taken to protect privacy, who will be authorized to access this information, and whether the information may be used for research purposes. A specific embodiment of this invention is an instrument for obtaining informed consent for a genetic test or one or more genetic tests which describes procedures with regards to a record containing genetic information and protections for individual privacy.

**[0052]** A “test result” or “genetic test result” means the end result of a genetic test including, for example, the sequence of one or more genes within a sample, the presence or absence of

one or more genetic markers, variances, variations, mutations, polymorphisms, or micro satellite sequences, the presence of one or more viral sequences, viral-like sequence, or repetitive sequence, a haplotype or genotype spanning one or more genes, the number of copies of one or more genes, the amount or characteristics of RNA or protein expressed from one or more genes the biological function of one or more genes, the arrangement of one or more genes within the genome, the chromosome number, or integrity of chromosomes together with known associations of such findings with a specific clinical outcome. Genetic test results may also include inferences or statistical data from clinical trials which establish the association of test results with a clinical outcome to provide an assessment of genetic risk and may include a determination of genetic risk based on the genetic test, medical history, family history, and clinical data.

**[0053]** “Genetic counseling” or “counseling” means the process of providing information to an individual concerning a genetic test or clinical outcome associated with a genetic risk. It includes the process of providing information to an individual concerning the use of a genetic test or genetic test result. Counseling is recognized by those skilled in the art to be an essential step in providing an individual with an accurate assessment of their genetic risk and providing an individual with assistance in the use of this information in making decisions regarding healthcare, lifestyle, family planning, reproductive counseling or other activities. Counseling is generally performed by a practitioner who has specialized training in genetics or in specific diseases. Counseling generally occurs in a practitioner’s office and involves one or two sessions with a practitioner. Counseling can be performed before a test is performed as part of the process of obtaining informed consent and can also be performed after obtaining the test results to aid the individual in understanding their genetic risk and making effective use of this information.

**[0054]** The process of genetic counseling is described in many articles and textbooks. The process commonly includes collecting a personal medical history or family history from an individual, discussing the benefits and risks of a genetic test, communicating the results of a genetic test, and explaining the medical significance of the genetic test results, elaborating on various health related choices the individual may make on the basis of the genetic test results, and discussing the consequences of genetic test results to family members, reproductive partners, or other individuals designated physician. It is generally considered important for genetic counseling to be “non-directive”, meaning that information is provided to an individual without value judgments or implied direction concerning the decision to perform a genetic test and the use of the test results. This is particularly important when genetic tests can be used for reproductive decisions, particularly decisions relating to pregnancy termination. When genetic testing is performed for common diseases, counseling frequently is concerned with the various treatment options or lifestyle choices.

**[0055]** A critical aspect of genetic counseling is the ability to communicate complex information about a clinical outcome, genetic tests, genetic risk, and genetic test results in a way that it is known to be understandable to most individuals. Genetic information is very complex, and it is often difficult to communicate this information to individuals who commonly have little technical background or understanding of genetics. Such communications are preferably at the 8<sup>th</sup> grade level of written comprehension. In current practice, genetic

testing is initiated by healthcare practitioners. In some instances a prescription from a practitioner is required for a certified laboratory to perform a test. A specific embodiment of this invention is an instrument for obtaining informed consent for a genetic test or one or more genetic tests which also provides a mechanism by which the practitioner can prescribe a genetic test.

**[0056]** A major limitation of current practice is that many healthcare practitioners, particularly primary healthcare practitioners who are in the best position to use genetic tests to assess an individual's genetic risk or predisposition to diseases before they occur, are not sufficiently familiar with the current literature on genetic tests to provide individuals with information or instruction, collect adequate family histories, or obtain a meaningful and legal informed consent. Genetic counseling can be obtained through a referral to a healthcare practitioner specially trained specially in genetics. The genetics professional commonly meets with the individual one or two times, and the responsibility for ongoing medical care will continue to reside with the referring practitioner. It not practical to refer all individuals to practitioners specially trained in genomics. It is anticipated that by 2006, 10-40 million tests will be performed annually. At the present time there are <3,000 individuals with specialized training in genetics. The instruments described in this invention have utility in providing practitioners with the information and instructions required to provide counseling to individuals sufficient to obtain an informed consent.

**[0057]** Information about genetic risk is available from sources other than healthcare practitioners. Patient support groups specializing in certain disorders or classes of disorders are often an important source of information for individuals. General information is also available on the Internet or world wide web, for example at Internet locations such as genetests.org, geneclinics.org, nih.gov, rarediseases.org, genetichealth.com, dna.com and genesage. While many individuals seek information from such sources, the quality and relevance of the information varies widely and this information is not integrated with the counseling provided by the practitioner or the informed consent process.

**[0058]** Samples are generally obtained by the health care practitioner, a central blood drawing service of a hospital or health care clinic, or a satellite facility of a diagnostic testing service. Samples can also be obtained by an individual, for example by using an OraSure device. Samples are commonly sent to genetic testing services, often referred to as reference laboratories for genetic tests, such as Genzyme Genetics, Quest Diagnostics, LabCorp, or Specialty Laboratories, certain clinical laboratories or hospital based, or academic research laboratories. Such laboratories are commonly regulated by Clinical Laboratory Improvement Act (CLIA) which sets standards for the performance and reporting of test results. Genetic tests are not currently regulated by the FDA though, in the future, may be developed as FDA approved diagnostic tests or kits for use by diagnostic laboratories or even home use. Genetic tests available from a certified reference laboratory or available as diagnostic kits are generally referred to as validated, meaning they have been subject to clinical evaluations and have demonstrated clinical utility. Such tests are differentiated from those that are not yet validated and are performed on a research basis. A preferred embodiment of this invention relates to validated tests that are not covered by guidelines governing clinical research. A separate embodiment of this invention relates to tests that are

designed as research where the guidelines for informed consent must comply with sections 46.116 and 46.117.

**[0059]** "Validated" is known in the art and refers to the process by which a method or an instrument is established in a reproducible fashion and subjected to testing to establish its utility and validity. For example, a clinical procedure or laboratory test is validated if it is performed in a reproducible manner and is shown through research to have clinical value. Methods or instruments are validated through an iterative process of developing the text and materials that comprise the instrument, and then testing these texts or materials in a clinical study to determine whether they are understandable. Texts or materials which are poorly understood by study subjects are then revised and retested until a desired level of comprehension is achieved in the study population. Larger studies can then be performed to demonstrate the efficacy of the entire instrument in achieving a desired level of retention and comprehension in a broad population representing different ethnic, demographic, or socioeconomic groups. Methods for validating an instrument are known in the art and involve testing the instrument on a sufficiently large number of people to perform a statistical analysis on the data. A set of performance specifications are established concerning the retention and understanding of information concerning the genetic test by the individual, the proper handling of the sample and genetic information, and the satisfaction of both the individual and the practitioner in the adequacy of the process. Statistical analysis is performed to demonstrate that the instrument adequately meets the performance specifications. In a specific embodiment, the instruments described in this invention are validated through clinical studies that demonstrate their utility in providing information and counseling to individuals and obtaining a valid informed consent. Use of a validated instrument often involves training in the use of the instrument quality controls designed to maintain consistency in the use of the method or instrument, as well as quality assessment and process improvements designed to maintain the quality of the method or instrument, and work towards improvements in efficacy or efficiency.

**[0060]** "Training" means curriculum and materials for instructing practitioners in the use of the instruments and methods described herein. This may involve specialized materials for use in medical education, continuing medical education, or group or individualized instruction of practitioners in the use of the instrument by those skilled in the use of these instruments.

**[0061]** "Quality control" and "quality assessment" refer to the ongoing process of measuring whether performance specifications are being achieved through use of the instrument. Quality control is achieved by integrating elements into the instrument that assess whether the performance specifications are met and by implementing procedures for review of these elements on an ongoing basis. Such review may involve analyzing a random sample of results, results in selected regions or populations based on the particular test being performed, the specialty of the practitioner, or the health, language, ethnic origin, or socioeconomic status of the individual.

**[0062]** Validated instruments are known in the art, for example, for neurocognitive testing. For examples tests such as the Wechsler Individual Achievement Test (WIAT), Wechsler Adult Intelligence Scale (WAIS), Boehm Test of Basic Concepts, California Verbal Learning (CVLY-II), Kaplan Baycrest Neurocognitive Assessment, Wechsler Adult Intel-

ligence Scale (WAIS-III), Wechsler Intelligence Scale for Children (WISC-III), Bayley Scales of Infant Development (II) and many other tests have been developed to test individuals for neurological, developmental, and psychological performance and achievement. Once developed these tests are subjected to clinical evaluation to validate the reliability of the instrument. Practitioners who administer these tests do so by purchasing packages with the exam that are provided to the individual taking the test, an instruction set that provides stepwise guidance on performing the test, and a scoring sheet to score the individuals answers and compute established performance parameters. Other validated instruments are used to assess clinical depression such as the Beck Depression Inventory (BDI), Depression Scale (DEPS), Duke Anxiety Depression Scale (DADS), Hopkins System Checklist (HSCL), Primary Care Evaluation of Mental Disorders (PHQ), and the Symptom Driven Diagnostic System-Primary Care (SDDS-PC).

**[0063]** “Integrated” means elements that are linked in their content, components, structure, sale, operation, or use. An instrument is integrated if it comprises two or more than two integrated elements. Elements are integrated if there is cross-reference between the elements, coordinated text or illustrative materials between the elements, or explicitly complementary functions in the design, content, composition, materials, function, or intended use of the elements. An example is an instruction element that guides the practitioner through the process of providing information in an information element to an individual, collecting a medical history or a family history using a collection element, assessing the individual’s retention and comprehension of the information using an assessment element and certifying their consent using a certification element. Other examples of integration include providing the practitioner with text or illustrative materials in an instruction element that match or complement the information provided directly to the individual in an information element, providing the practitioner with instructions, in an instruction element, for assessing, using an assessment element, an individual’s retention and understanding of the information in the information element, and providing the practitioner with materials for obtaining and labeling a sample or sample collection device, creating a genetic record, or billing along with instruction in the use of such materials.

**[0064]** A checklist is a useful component of an integrated instrument. “Checklist” means a form in printed or electronic medium that lists key steps involved in obtaining an informed consent using the instrument which is designed such that the practitioner can confirm when each step has been performed and/or completed. The checklist can be used by the practitioner in practicing the method of obtaining informed consent using the instrument, can be incorporated in a medical record to document the method that was used, and can be used for quality control of the method and instrument. For example, the checklist may list contain entries related to the description of the genes involved in a clinical outcome, the genetic test, the nature of a specific clinical outcome, the role of genetic tests and test results in managing a clinical outcome, how genetic tests are performed, the nature and purpose of informed consent, how samples are obtained and handled, what happens to the sample after the test is performed, whether the sample can be used for other purposes, whether the sample will be available for additional tests in the future, who will perform the test, who receives the test results, what information will be placed in a medical or genetic record, how

this information may be used, policies for protecting the privacy, as well as other information included in the information element or instruction element. A specific embodiment of the method is use of a checklist for obtaining informed consent using an integrated instrument.

**[0065]** Worksheets are also useful components of an integrated instrument. “Worksheet” means a form in printed or electronic medium which is used for the collection or processing of data. Worksheets are typically designed to prompt the user to collect and record certain data, for example by filling in the blanks on the form or providing answers to specific questions. Worksheets can also guide the user through a series of calculations by arranging data entries in a convenient layout, providing additional data or data tables necessary for the calculation, and indicating the mathematical functions to be used. Worksheets are recognized to be useful in obtaining a medical history, review of systems, and family history by providing a list of specific symptoms, signs, diseases, or clinical outcomes that should be addressed. Worksheets can be used to calculate genetic risk based on a family history or a genetic test result by providing a format for systematizing the data, the calculations that need to be performed, and statistical tables.

**[0066]** The invention provides for the integration of elements for obtaining informed consent including two, or more than two, or the following: an information element, with information for individuals concerning genetic tests, an instruction element for practitioners to assist in providing information to the individual, obtaining an informed consent, obtaining a sample, and establishing a record, a collection instrument for obtaining an individuals medical history and family medical history, an assessment element to assess the individual’s retention and comprehension of information, a certification element for certifying an individual informed consent, as well as elements for obtaining and labeling the sample, creating a genetic record, and billing. A specific embodiment of this invention is the integration of the elements required to obtain a valid informed consent into an instrument that may be used by a practitioner to obtain informed consent from an individual.

**[0067]** Integration is achieved by development of elements designed to be used in a coordinated fashion. For example, it may first be determined by experts what information an individual should receive and what information they should retain and understand in order to provide a valid informed consent. An information element for the individual may then be developed along with an element for assessment that would ascertain whether an individual retained and understood this information. An instruction element may then be developed as a teaching guide for the practitioner through the process of obtaining consent. These elements may then be subjected to validation to determine whether use of the instruction element and information element, in fact, provides most individuals with the requisite information to provide consent. Several iterations may be required in the development of these integrated elements to achieve the performance specifications. Integration is also achieved by providing the practitioner with all of the elements required to complete the process of achieving informed consent, create a medical record, and processing a genetic test. Integration may also be achieved by providing different elements required to obtain informed consent and process a sample together, for example in the form of a booklet or package that contains several elements. Integration may also be achieved in the design of the elements such that

entries made in one element are systematically incorporated in another element, for example through the use of carbon copies. Such integration has utility both in improving the efficiency and quality of the informed consent process.

**[0068]** “Electronic medium” are known in the art and the term refers, without limitation, to software and hardware capable of carrying out the unique methods and embodiments described herein including the computer code, concept, content, components, design, construction, appearance, look, feel, animation, text, graphics, organization, storage systems, presentation systems, and function of the medium. In an embodiment of this invention, the electronic medium are interactive such that the individual or the practitioner may direct or query the system. In an embodiment of the present invention, such electronic medium contains synthetic speech and speech recognition capabilities.

**[0069]** The terms “printed medium” or “printed materials” are generally known in the art and refer, without limitation, to text or illustrative materials on paper in bound or unbound form, boards, labels, transparencies, photographs, or objects as well as the concept, content, components, design, construction, appearance, look, feel, figures, graphics, and organization of the materials. In a preferred embodiment of this invention the instrument comprises elements in printed medium that can be separated.

**[0070]** “Carbon copy” refers to the imprinting of entries made by a practitioner or individual on multiple pages of the instrument simultaneously, for example through the use of carbon paper or other paper or materials designed for that purpose. Carbon copy also refers to the copying of information entered into one element through electronic means to other integrated elements within the instrument, for example by copying into another element in electronic medium or through the printing into a printed medium. In a preferred embodiment of this invention, the printed materials are constructed such that a carbon copy of information entries in one element are copied on other integrated elements.

**[0071]** “Text” is known in the art and means written materials whether in printed or electronic form including associated images, diagrams, or pictures. “Illustrative materials” means materials designed to assist the instruction of the individual and promote understanding and retention of the information. Illustrative materials may include, without limitation, diagrams, pictures, photographs, poster, displays, exercises, models, objects, games, props, or worksheets. Illustrative materials may be in the form of printed medium or electronic medium and may include various objects. For example, diagrams showing different patterns of inheritance may aid the understanding of the role of inheritance of a particular gene or the inheritance of clinical outcome. Photographs or models may aid the understanding of a clinical outcome. Exercises, games, or worksheets may aid the comprehension and retention of information. An “object” may be used to illustrate principles of genetics, for example the use of dice to illustrate principles of chance and probability.

**[0072]** This invention comprises printed materials with text and illustrative materials for carrying out the unique methods and embodiments described herein. Preferably, the invention is in the form of a booklet with printed materials comprising each of the elements bound in such a way that the elements are integrated. For example, a checklist within the instruction element can be used by the practitioner and then incorporated in the recording element, answers to questions in the assessment element or the certification on the certification element

can be marked by the individual and incorporated in the recording element, and information in the labeling element and billing element can be incorporated in the recording element. Preferably this is achieved through the design of the instrument such that a carbon copy of entries in one or more elements is also made in the recording element when the initial entry is made in the other elements of the booklet. Preferably also the invention is in the form of a booklet with printed materials comprising two or more elements bound in such a way that the elements can be separated. For example, the information element may be separated and provided to the individual, various illustrative materials may be separated for use in instruction of the individual, the recording element can be separated for incorporation in an individual’s general medical record, the label element may be separated and affixed to a sample collection device, and the billing element may be separated for processing by a billing office. This is achieved through the design of the instrument using methods known in the art such that pages are bound together with certain pages perforated so as to enable easy separation of selected pages from the other pages of the instrument, or certain pages are affixed by adhesives which provide for clean separation of one or more pages from the instrument. For example, the information element may comprise a booklet that can be provided to the individual and retained for their information. For example, elements for assessment, certification, records, labeling, and billing, may comprise separate pages that can be separated from the instrument, and illustrative materials may be separated for display on a board. In one embodiment, the pages or printing of different elements within the instrument are color coded for efficient separation. In alternative embodiment, the different elements are distinguished by size of the page for efficient separation. The instrument may be a kit containing different printed materials including text, illustrative materials or objects in a single package that can be separated for use by the individual and practitioner.

**[0073]** Alternatively, this invention comprises electronic medium capable of carrying out the unique methods and embodiments described herein. This is achieved through the design and development of computer programs wherein the different elements are presented to the individual or practitioner as different pages on a computer screen, windows, or pages printed by the computer program. Preferably, the elements are integrated through the use of a menu or, more preferably, links between the elements. The elements are also preferably linked by the copying of information entered into one element into one or more integrated elements. For example, the information element may be linked to the assessment element so that the individual can answer questions about the information which is provided and return to review the information if necessary. The instrument may be accessible via the Internet or loaded on a specific computer. Methods are well known to those in the art for constructing such functioning systems using HTML or JAVA.

**[0074]** The instrument may contain elements comprising printed materials and elements comprising electronic medium. For example, the information element may be an audio tape, video tape or interactive computer system, while the elements for certification, labeling, or records are printed materials. Alternatively, the information element may be a pamphlet, while other elements of the instrument are in electronic medium. Preferably, the electronic medium is designed such that certain elements can be printed from the program.

For example, the information element may be printed for the individual's records and the recording element, labeling element, or billing element can be printed for use by the practitioner.

**[0075]** The elements of the invention may be in any language, for example, English, Spanish, French, German, Italian, Russian, Japanese, Chinese, or Hebrew. Preferred are elements which use the primary language of the individual. When the primary language of the individual is different than the primary language of the practitioner, certain elements may be in the language of the individual and other elements in the language of the practitioner. For example, the information element, collection element, assessment element, and certification element may be in the primary language of the individual, while the instruction element, assessment element, recording element, billing element are in the primary language of the practitioner. In further embodiments, the instrument integrates translations for the practitioner of elements that are in the primary language of the individual within the element. One or more of the elements of the instrument or components thereof may be in Braille or in oral form (e.g. audiotape, videotape, or electronic systems with synthetic or recorded voices) for those who are visually impaired or otherwise unable to read printed materials.

#### B. Detailed Description of the Elements

**[0076]** This invention describes integrated instruments and methods with utility in obtaining informed consent for genetic tests. The instruments described in this invention comprise the following integrated elements:

**[0077]** (a) an information element for an individual concerning a genetic test for one gene, more than one gene, related genes, a clinical outcome or a gene screen;

**[0078]** (b) an instruction element for the practitioner useful in providing instruction to the individual and guidance in the use of the instrument and obtaining informed consent; and

**[0079]** (c) a certification element, which can be used to certify the individual's consent for the test.

**[0080]** The instrument of the invention may optionally include any one or more than one of the following additional elements:

**[0081]** a collection instrument for collection of information concerning the individual's personal medical history or their family medical history;

**[0082]** an assessment element for assessment of the individuals retention or comprehension of the information;

**[0083]** a labeling element for labeling a sample or sample collection device or diagnostic used for genetic testing with the identity of the individual;

**[0084]** a billing element for payment by the individual or through a reimbursement agency

**[0085]** a recording element that can constitute or be incorporated in an individual's medical record;

**[0086]** a training element for training the instructor in the use of the instrument;

**[0087]** a quality control element for monitoring performance of the practitioner and the performance of the instrument; and

**[0088]** an indemnification element that can constitute an agreement to indemnify the practitioner.

**[0089]** In a preferred embodiment the instrument comprises in an integrated manner the information, instruction, certification and assessment elements. In an alternative pre-

ferred embodiment the instrument comprises in an integrated manner the information, instruction, certification and collection elements. In another preferred embodiment, the instrument comprises in an integrated manner the information, instruction, certification, collection and assessment elements. In yet another preferred embodiment, the instrument comprises in an integrated manner the information, instruction, certification, collection and assessment elements and at least one of the elements selected from the group consisting of a labeling element, a billing element, a recording element, a training element, a quality control element, and an indemnification element. Alternatively, the instruments described in this invention comprises the information, instruction and certification elements and two, or more than two, or the following: a collection element, an assessment element, a labeling element, a billing element, a recording element, a training element, a quality control element, and an indemnification element. More specifically, the instruments described in this invention may comprise the information, instruction and certification elements and two, three, four, five, six, seven, or eight of the other elements described herein.

**[0090]** The elements comprising the invention may be integrated individually in a pair wise manner or in groups within the instrument, or, in alternative embodiments of the invention, the instruments may be comprised selectively of such integrated elements. For example, the information element may be integrated with one or more of the following elements: an instruction element, a collection element, an assessment element, a certification element, a labeling element, a billing element, a recording element, and a training element. Specifically, the information element may be integrated with the instruction element, a certification element, or an assessment element or all three of said elements. Alternatively, the information element may be integrated with the instruction element, a certification element, or a training element or all three of said elements.

**[0091]** In another example, the instruction element may be integrated with one or more than one of the following elements: an information element, a collection element, an assessment element, a certification element, a labeling element, a billing element, a recording element, and a training element. Specifically, the instruction element may be integrated with a certification or assessment elements. The information and instruction elements may be integrated with one or more than one of the following elements: an assessment element, a collection element, a certification element, a labeling element, a billing element, a recording element, and a training element. Alternatively, the instruction element may be integrated with an assessment element and one or more than one of the following elements: an information element, a collection element, a certification element, a labeling element, a billing element, a recording element, and a training element. Alternatively, the instruction element may be integrated with a certification element and one or more than one of the following elements: an information element, a collection element, an assessment element, a labeling element, a billing element, a recording element, or a training element. Specifically, the instrument may contain an instruction element integrated with a training element. Alternatively, the instrument may contain an instruction element integrated with a training element and one or more than one of the following elements: an information element, a collection element, a certification element, an assessment element, a labeling element, a billing element, or a recording element. Spe-

cifically, the instrument may contain an instruction element integrated with information and assessment elements. Alternatively, the instrument may contain an instruction element integrated with information, assessment, and certification elements. Alternatively, the instrument may contain an instruction element integrated with certification and training elements.

**[0092]** In another example, the instrument may contain a certification element integrated with one or more than one of the following elements: an information element, an instruction element, a collection element, an assessment element, a labeling element, a billing element, a recording element, or a training element. Specifically, the instrument may contain a certification element integrated with an assessment element. Alternatively, the instrument may contain a certification element integrated with an assessment element and one or more than one of the following elements: an instruction element, an information element, a collection element, a certification element, a labeling element, a billing element, a recording element, and a training element. Specifically, the certification element may be integrated with a recording element. Alternatively, the certification element and recording element may be integrated with one or more of the following elements: an information element, an instruction element, a collection element, a labeling element, a billing element, and a training element.

**[0093]** In another example, the instrument may contain a training element integrated with one or more of the following elements: an information element, an instruction element, a collection element, an assessment element, a certification element, a labeling element, a billing element, and a recording element. Specifically, the instrument may contain a training element integrated with an instruction element.

**[0094]** The instrument may be used to obtain informed consent for a genetic test for one gene. Alternatively, the instrument may be used to obtain informed consent for a genetic test for more than one gene, related genes or for genes associated with a clinical outcome. The instrument may also be used to obtain informed consent for a gene screen test.

**[0095]** The information element comprises text and illustrative materials intended to provide an individual with sufficient knowledge about a genetic test, the potential medical consequences of a genetic test, and the procedures involved in genetic testing to provide a meaningful and legal informed consent. The information element is integrated with one or more other elements of the instrument. The type of information required for an individual to provide a valid informed consent is known in the art and disclosed in various textbooks and publications in scientific journals as well as in courses and presentations by individuals recognized to be opinion leaders in the field. The information element provides such information in the form of text and illustrative materials. The text and illustrative materials include information about a specific clinical outcome, the genes that constitute risk factors for that clinical outcome, the significance of different genes that constitute risk factors for that clinical outcome, the potential actions that could be taken to prevent or treat the clinical outcome based on genetic test results, how genetic tests are performed, the purpose of informed consent, the process of obtaining informed consent, how samples are obtained and handled, the significance and process of DNA banking, what happens to the sample after the test is performed, what happens to banked DNA, whether the sample can be used for other purposes, whether the same will be

available for additional tests in the future, who will perform the test, who will receive the test results, what information will be placed in a medical or genetic record, how this information may be used, policies for protecting the privacy and confidentiality of test results, the availability, nature and role of genetic counseling, factors which should be considered in deciding whether to have a genetic test including the benefits and risks of a genetic test, potential uses of test results in health and wellness management and lifestyle decisions, the recommendation of professional organizations. The information element may also describe in the form of text and illustrative materials the liabilities of various parties that may be involved in providing information, handling the sample, performing the test results, or providing the individual with guidance on the use of the test results. The information element may also have background information about genetics to aid understanding of genetic testing in general, references (for example, books, publications, web sites) to more detailed information, and contacts (for example, the names, telephone numbers or web addresses of organizations or individuals) who the individual can contact if they wish further information. In a specific preferred embodiment, the information element is validated.

**[0096]** The text and illustrative materials are designed for individuals with an 8<sup>th</sup> grade education or level of reading comprehension. Methods for assessing the grade level of language used in such an element are known in the art. Optionally, the integrated instrument may contain information elements at different grade levels or links or references to advanced information for individuals who have the interest and ability to comprehend such information and the practitioner will select an information element with an appropriate level of complexity for the individual. For example, text and illustrative materials may be provided for individuals at the 8<sup>th</sup> grade level, 12<sup>th</sup> grade level, college students, college graduates, or postgraduate level. Information can be provided in any language, preferably the primary language of the individual. Alternatively, information can be provided orally by an audiotape, videotape, or computer for individuals who may be illiterate.

**[0097]** In a specific embodiment, the text and illustrative materials comprise printed material. Preferably the text and illustrative materials can be physically separated from the other elements and provided to the individual for their review or study. In an alternative embodiment, text and illustrative materials comprise electronic medium. In an embodiment, the instruction element may be a video that provides information to the individual or an audiotape linked to illustrative materials. In a specific embodiment, the text and illustrative materials are on the Internet or computer. In another alternative embodiment, the text and illustrative materials are comprised of a combination of printed materials, electronic medium, and/or objects.

**[0098]** The instruction element comprises text and illustrative materials intended to assist a practitioner in the use of the elements that comprise the instrument. The text and instructional materials contain instructions for the practitioner on use of the instrument, instructions for to be provided by the practitioner to the individual on the use of the instrument and the process of providing informed consent, instructional materials to guide discussion with the individual concerning a genetic test for one gene, more than one gene, related genes, a clinical outcome, or a gene screen, the nature of a specific clinical outcome, and how to prevent or manage a clinical

outcome including the role of genetic tests and test results, the genes that constitute risk factors for that clinical outcome, the significance of different genes that constitute risk factors for that clinical outcome, the potential actions that could be taken to prevent or treat the clinical outcome based on genetic test results. The text and illustrative materials also contain instructional materials to guide a discussion with the individual concerning how genetic tests are performed, including the nature and purpose of informed consent, how samples are obtained and handled, what happens to the sample after the test is performed, whether the sample can be used for other purposes, whether the sample will be available for additional tests in the future, who will perform the test, who receives the test results, what information will be placed in a medical or genetic record, how this information may be used, policies for protecting the privacy and confidentiality of test results, the availability, nature and role of genetic counseling, instruction guiding the individual's choice whether or not to perform a test, potential uses of test results in health and wellness management and lifestyle decisions, the recommendation of professional organizations, instructions for using the element for assessment including answers to the questions and instructions to determine whether the individual demonstrates a minimum adequate level of understanding, instructions for completing informed consent, instructions for obtaining sample, instructions for labeling sample, instructions for completing medical record, additional background information on patterns of inheritance, genes, DNA, chromosomes, specific clinical outcomes, psychosocial issues in genetic testing, the potential for genetic discrimination, and answers to frequently asked questions. The text and illustrative materials in the instruction element are integrated with those in the information element in that the text and illustrative materials in each element may be "overlapping", i.e., one or more portions of the text and/or illustrative materials in the instruction element may be quoted in, recapitulated in, or similar in wording or meaning, to a corresponding text and/or illustrative material in the information element. The instruction element is intended for use by the practitioner in helping individuals understand and retain the information in the information element. The instruction element can be in any language, most preferably the primary language of the practitioner.

**[0099]** The instruction elements also direct the practitioner in how to, inter alia, (a) provide information to an individual concerning one or more than one genetic tests; (b) collect information concerning the individual's personal medical history or their family medical history; (c) perform an assessment the individual's retention or comprehension of said information; (d) obtain certification of the individual's consent for said test; (e) obtain a sample for testing; (f) properly label the sample; (g) deliver the sample to the appropriate laboratory for the test to be performed; (h) bill the individual either directly or through a reimbursement agency and (i) add appropriate information to the individual's medical record. Preferred embodiments provide the instructions in a stepwise manner.

**[0100]** In a preferred embodiment, the instruction element contains a checklist, and in an embodiment of the method, the practitioner uses a checklist to document the steps in obtaining the informed consent. In a preferred embodiment the instruction element contains specific language designed to ensure standardization and quality of the informed consent to be used by the practitioner to instruct the individual. The

checklist contains items to be discussed with the individual and contains the steps that comprise the method for use of the instrument. In a preferred embodiment of the method, the practitioner uses the checklist and integrated elements in obtaining informed consent. In a specific embodiment, the instruction element is validated.

**[0101]** The text or illustrative materials comprising the instruction element describe the test to be performed, the potential test results, the medical significance of potential test results as well as choices that an individual may be able to make based on the test results. The instruction element may also provide general background information about genetics to aid understanding of genetic testing by the individual. The instruction element may describe specific benefits and risks of performing the tests and recommendations concerning such the use of such tests. The text and/or illustrative materials may describe the procedure for obtaining a sample and performing a test, the disposition and potential future use of the sample as well as the test results, guidelines for protecting the privacy and confidentiality of the individual, procedures for banking DNA, restriction on the use of banked DNA, as well as legal boundaries concerning the liability of various parties that may be involved in providing information, handling the sample, performing the test results, or providing the individual with guidance on the use of the test results. The text and/or illustrative materials comprising the instruction element may also provide stepwise direction on how to collect a personal medical history or a family medical history, preferably using an integrated collection element. In a preferred embodiment, the instruction element includes text, methodology and illustrative materials that teach the practitioner how to use the information collected in the collection element. More preferably the instruction element comprises a worksheet that enables the practitioner to assess the significance of the personal medical history or family medical history, for example, by calculating the risk of a specific genetic disorder based on the number of affected family members. In a preferred embodiment, the instruction element includes text for calculating genetic risks based on the family history. In a further embodiment, the instruction element may comprise a worksheet or computer program that enables a calculation of genetic risk based on family history.

**[0102]** In a preferred embodiment in which an assessment element is included in the instrument, the instruction element directs the practitioner through an assessment of the individual retention or comprehension. In such embodiments, the assessment element contains text comprising a series of questions to be asked by the practitioner in assessing the individual's retention or comprehension of the information and a corresponding answer set. In an alternative embodiment, the element for assessment comprises a series of questions in the form of a questionnaire that can be completed by the individual, and the instruction element directs the practitioner in how to administer the questionnaire and provides correct answers to these questions as well as guidelines for responding to correct and incorrect answers.

**[0103]** In a specific embodiment of the present invention, the instruction element is printed material. In a preferred embodiment the instruction element can be physically separated from the other elements of the instrument and retained for use by the practitioner. In an alternative embodiment the information element is one element of an instrument comprising printed materials and electronic medium. For example, the instruction element may be printed material

with directions on the use of a computer program or web site that comprises the information element or other elements of the instrument. In further embodiments the information element is comprised, without limitation, of mixed medium including printed materials, electronic medium, and objects.

**[0104]** In an alternative embodiment, the information element comprises text and illustrative materials in electronic medium. In a specific embodiment the instruction element is in electronic medium comprised of text and illustrative materials that are used by the practitioner to instruct the patient regarding the genetic test and the use of the instrument. In a specific embodiment the practitioner is a virtual embodiment of the electronic medium and the instruction element is a computer program that guides the individual directly through the process of informed consent in a stepwise or interactive manner. For example, the instruction element may be a computer program to present the individual with information using the information element, perform an assessment of the individual's retention and understanding using the assessment element, create the record using the recording element, provide a label for the sample using the labeling element, and arrange payment using the billing element. The instruction element in electronic medium may also provide the individual with direction on the appropriate use of one or more of the elements, monitor the progress of the individual through the informed consent process, and provide additional information or directions as necessary to assist in the effective completion of the informed consent process and proper processing of the sample. In an embodiment, the instruction element may be a computer program that instructs the individual in the use of the instrument. In a specific embodiment, the computer program may integrate the information element and the instruction element. In an embodiment, the instruction element in electronic medium may use an animated figure, photographic or video image and/or a synthetic voice to represent a practitioner in presenting information to the individual and/or instructions on the use of the instrument. In a specific embodiment the electronic medium employs synthetic voice and voice recognition systems.

**[0105]** The instruction element may contain objects that can be used by the practitioner in presenting information to the individual. Objects may include models, diagrams, or pictures of the human body or disease states, for example, representations of the skeleton, organs or tissues, "Games of chance" such as dice may be useful in explaining the statistical nature of genetic risk and may be incorporated as objects within the instruction element. These objects may be integrated with the information element with text or illustrative materials designed to demonstrate genetic principles.

**[0106]** The certification element is a document that can be signed by an individual to signify their consent for a genetic test to be performed. This document resembles informed consent documents known in the art and, by itself, is designed to comply with any legal or statutory requirements for certification of informed consent. The informed consent document comprising the certification element summarizes the individual's understanding of the specific test that will be performed, the benefits and risks involved, the procedure for obtaining a sample and performing the test, the disposition and potential future use of the sample and the test results, guidelines for protecting the privacy and confidentiality of the individual and their genetic information, and information concerning the liability of parties involved in providing information, handling the sample, performing the test, or provid-

ing the individual with guidance on the use of the test results. The certification element may also enable the individual to signify their consent for DNA banking as well as stated uses of the banked DNA. The certification element may also include the individual's consent to specific forms of follow up, may indicate who should receive the test results and how they want the results to be reported, may indicate whether they are interested in receiving information with updates on research about the genetic test, the test results, or new tests related to a clinical outcome. The document contains blank signature lines for execution by the individual, the practitioner, and at least one witness. The certification element is integrated with other elements of the instrument. In preferred embodiments, the certification element is integrated with the information element and instruction element. For example, the certification element may recapitulate essential information from the information element or may incorporate the summary of instruction provided to the individual or a checklist from the instruction element. In another preferred embodiment, the certification element is integrated with the recording element. In further embodiments, the certification element may be integrated with the assessment element, for example by incorporating the results of the assessment. In a specific embodiment, the certification element is validated.

**[0107]** The certification element comprises printed material that preferably includes multiple execution copies or carbon copies so that duplicate copies can be retained by the individual and incorporated into the medical record, or provided to others who may require certification of the individual's consent. In an alternative embodiment, the certification element is in electronic form and execution is by a legally recognized electronic signature. In a preferred embodiment, the instrument is constructed such that the signature entered into the certification element is directly entered into other elements, for example the recording element or the labeling element. The certification element may additionally include a prescription to be issued by the practitioner, which authorizes a testing laboratory to perform a test. Such prescriptions for tests are required by certified laboratories in certain states. In a preferred embodiment, certification element is integrated with the labeling element such that the prescription entered into the certification is copied on the label provided to the laboratory with the sample.

**[0108]** The collection element comprises text and/or illustrative materials useful in obtaining an individual's personal medical history or their family medical history. Methods for obtaining personal medical history are described in basic textbooks and clinical manuals, and tools such as worksheets and computer programs are well known in the art. Such texts and illustrative materials contain questions about past illnesses as well as a "review of systems" with questions concerning the health of various bodily functions. Standardized instruments and methods for obtaining a family medical history are also known in the art and involve the cataloging of information concerning the individual's family members, determining their familial relationship to the proband, and recording their state of health or cause of death. This information is typically portrayed in the form of a family tree. Methods for recording an individual's medical history and family history are known in the art and may comprise printed materials with worksheets or may comprise electronic medium in the form of computer programs such as GeneTree of Cyrillic. In the preferred embodiment, the collection element is integrated with other elements of the instrument. For

example, the collection element may be integrated with the information element such that the individual is provided with information about the genetics of different diseases, disorders, or clinical outcomes that would be useful in a personal or family history. The collection element may be integrated with the instruction element such that the practitioner can instruct the individual in the use of the element and use the data to perform a quantitative assessment of genetic risk. In a specific embodiment, the collection element is validated.

**[0109]** In a further embodiment the collection element may be linked to the recording element to enable follow-up of the proband and family members with information regarding the genetic test or test results that may be relevant to clinical outcomes of the proband or family members. For example, the collection element may incorporate email, telephone, or mailing addresses of family members or provide the proband with materials that can be mailed to these individuals. Information from these family members may be incorporated in the collection element to provide a more complete and accurate collection of the proband's medical and family history. In a specific embodiment, the collection element is integrated with the certification element to assure proper authorization of procedures to contact family members. In a specific environment, the collection element may be integrated with the certification element and recording element, enabling the proband and family members to authorize the distribution of genetic and medical information, receive-follow-up, and release genetic information to their respective medical records

**[0110]** The assessment element comprises a series of questions in the form of text and illustrative materials that are posed to the individual to assess their retention and comprehension of information. The legal principle underlying informed consent for genetic testing is that an individual must have sufficient comprehension of information to make an informed choice. The assessment element is designed to determine whether the individual has retained and comprehends sufficient information concerning the genetic test to provide such a valid informed consent. The assessment element includes text comprising basic questions covering information presented in the information element and instruction element concerning a genetic test for one gene, more than one gene, related genes, a clinical outcome or a gene screen to be performed, possible test results, DNA banking, the medical significance of potential test results, standard of care recommendations concerning such tests, the choices available based on the test results, the specific benefits and risks of performing the tests, the procedure for obtaining a sample and performing a test, the disposition and potential future use of the sample as well as the test results, guidelines for protecting the privacy and confidentiality of the individual, and legal issues regarding liability. The text of the assessment element may incorporate questions in the form of short answers, multiple choice, true/false, matching, fill in the blank, or other test formats known in the art. The assessment element is integrated with other elements of the instrument. In a specific embodiment, the assessment element is validated.

**[0111]** In a preferred embodiment, the assessment element comprises printed material in the form of a questionnaire that can be completed by the individual. In an alternative embodiment, the assessment element is in the form of interactive electronic medium in which the individual reads and responds to questions on a computer or the Internet. In another alternative embodiment, the assessment element is integrated with

the instruction element and the practitioner reads the questions to the individual and the individual either provides answers on a worksheet or responds orally and the practitioner records the answers. In a specific embodiment, the assessment element is integrated with the information element with provides the individual with sufficient information to correctly answer questions in the assessment, is integrated with the instruction element which provides the practitioner with directions on administering the assessment and scoring the results, is integrated with the certification element such that certification can only be provided if the individual exhibits a minimum number of correct answers on the assessment, and integrated with the recording element which incorporates the individual's responses to the questions and/or the score on the assessment.

**[0112]** The labeling element comprises materials that are to be attached to a sample or a sample collection device to identify the individual, direct the sample to the appropriate laboratory, and designate how the sample is extracted and banked, and what test is performed. The labeling element may also designate, either in text, color code, or other recognized medium, whether the sample is to be preserved, whether DNA is to be banked, and what uses may be made of the sample. In preferred embodiments, the element comprises one or more than one copy of printed materials that form a label that is affixed to the sample or one or more sample collection devices used in the course of obtaining a sample, handling the sample, banking DNA, and performing the genetic test. In a specific embodiment, the labeling element comprises printed materials with an adhesive backing that can be separated from the instrument and attached directly to the sample. In alternative embodiments, the labeling element comprises an electronic medium for generating information required for the label and a method for printing the label that can be attached to the sample. In preferred embodiments, the labeling element is integrated with other elements of the instrument. In a specific embodiment, the labeling element is validated.

**[0113]** In a specific embodiment of this invention, the instruction element includes text and/or illustrative materials directing the practitioner how to use the labeling element so that the sample is properly collected, labeled, and directed to the laboratory. In a specific embodiment, the labeling element is integrated with the recording element so that there is a record that the sample has been obtained, processed and sent, and the status of the sample, test procedure, and test results can be tracked. In another specific embodiment, the labeling element is integrated with the certification element so that the laboratory receiving the sample is notified that an informed consent has been obtained for the specific test and that a prescription has been provided by the practitioner.

**[0114]** In a preferred embodiment of this invention the labeling element encodes the identity of the individual to preserve their privacy and confidentiality. This may involve attaching a label to the sample that has personal information encoded or in a form such as a barcode or personal identification number that is not readily identifiable except to those with appropriate authorization.

**[0115]** The billing element comprises forms required for direct payment by the individual or forms required to obtain reimbursement or arrange payment by a third party payor. Such elements are commonly known in the art and may comprise forms to be completed by the individual and/or the practitioner with a credit card number, insurance policy num-

ber, and billing codes. Alternatively these forms may comprise electronic medium or an interactive electronic medium designed to print a form with information from the individual or practitioner. In the preferred embodiment the billing element is integrated with other elements of the instrument.

**[0116]** The recording element comprises materials designed to be placed in an appropriate personal medical records maintained by the practitioner, provided to the individual for their own records, and deposited in other records as may be required, for example, by the practitioner, payor, or regulations. The recording element constitutes the legal record of the informed consent process, providing a record of the procedures used to obtaining the consent, including, for example, information provided to the individual and any assessment that is performed, documentation of the test that is to be performed and any restrictions on the use of the information or sample, and certification of the informed consent. The process of maintaining medical records is known in the art and may involve printed materials or electronic medium. In the preferred embodiment, the recording element is integrated with other elements of the instrument. In specific embodiments the recording element may incorporate one or more of the following: a checklist documenting the procedures for informed consent that were used by the practitioner from the instruction element, the personal medical history and family history of the individual from the collection element, the informed consent and prescription from the certification element, information used to label the sample from the labeling element, and information for billing from the billing element.

**[0117]** In preferred embodiments, one or more than one of the elements of the instrument are designed so that information entered into one element is also incorporated into the recording element in a form suitable for incorporation in the medical record or provided to the individual. In a preferred embodiment these copies comprise printed materials and the design of the integrated instrument enables these pages to be physically separated from their respective elements and the complete instrument for inclusion in the record. In alternative embodiments, the instrument is designed so that carbon copies of essential information are imprinted on the recording element, for example, responses or scores from the assessment instrument, the prescription provided by the practitioner, or the checklist used by the practitioner may be copied directly onto a recording element in carbon copy. Informed consent must be generally completed in several copies including one that is given to the individual and one that becomes part of the individual's record. In a specific embodiment the recording element incorporates a copy of the certification element (informed consent document). In an alternative embodiment, these copies comprise electronic medium that can produce materials for inclusion in the record in either printed material or electronic medium.

**[0118]** The recording element will commonly contain other information to identify the individual including a medical record number, information on the referring practitioner, information on payors, information on the disposition of the sample, whether DNA has been banked, restrictions on the use of the sample and banked DNA, restrictions on the use of personal information, and directions on how to contact the individual or their practitioner with the test results. State and federal laws set standards for the protection of genetic information in individual medical records. The recording element also incorporates codes, mechanisms, procedures, and physi-

cal barriers, or fire walls necessary to protect the privacy of such information. For example, patient information may be represented in bar code or personal identifying code, de-identified, or encrypted. Methods and procedures for protecting the privacy of individual medical records are well known to those skilled in the art. This invention specifically provides for the individual to provide necessary releases in the certification element as may be required by law for the dissemination of information entered into the recording element to practitioners or others authorized by the individual.

**[0119]** The training element comprises text and illustrative materials designed to train practitioners in the use of the instrument for obtaining informed consent and methods for obtaining informed consent using said instruments. Materials designed for use in medical education and Continuing Medical Education (CME) are known in the art and frequent comprise printed materials, electronic medium, or mixed medium, for example, including books, CDs, web sites, pamphlets, slides, presentations. The element may comprise curriculum to be used in medical education or CME as well as illustrative materials that can be used in training and education. In a preferred embodiment, materials used to train practitioners in the use of the instrument are integrated with the integrated with instrument, for example, by describing the composition or methods of using the instrument, incorporating information, text or illustrative materials from the instrument, diagrams or incorporating representations of the instrument itself.

**[0120]** The quality control element comprises a reporting form that is used to determine whether performance specifications are being met by the practitioner using the instrument in the field. This element contains information about the process used to obtain informed consent that can be used for a review of the performance of the instrument and the practitioner. A specific utility of this invention is the standardization and validation of procedures for obtaining informed consent. There is also provided with this invention a method for performing quality assessment and quality control of the informed consent process using the quality control element. This method involves the reporting and review of results from the assessment element to determine whether performance specifications are being achieved in the field by different practitioners using the instrument in different populations and healthcare settings. The method may involve analysis of test results from random or selected regions or populations, instruments dealing with specific tests, the specialty or subspecialty of the practitioner, the language of the instrument, or the health, language, ethnic origin, or socioeconomic status of the individual. The results of such analysis can be used to measure the performance of individual practitioner against performance specifications or to further refine the integrated instrument, for example through modifications of the instruction element or modifications of a training element. The quality control element is integrated with other elements of the instrument. For example, the instruction element may inform the practitioner concerning quality control procedures, and the quality control element may incorporate data from the assessment element and the recording element.

**[0121]** The indemnification element certifies that the methods and instruments described in this invention were used to obtain consent and that these methods are validated and may provide indemnification against claims related to the adequacy of the informed consent process. The failure to obtain a proper informed consent may render a practitioner

liable to legal action on the part of the individual or government regulatory body governing medical practice claiming that the individual was not adequately informed prior to certifying their consent or a test being performed. Use of the integrated and validated instruments and methods of this invention as described herein is designed to achieve certain performance specifications and standards including a minimum level of retention and understanding of information concerning the genetic test by the individual and the effective handling of the sample and genetic information.

**[0122]** The indemnification element documents the procedures that were used by the practitioner to obtain informed consent. The indemnification element is integrated with other elements of the instrument. For example, the indemnification element may incorporate elements of the information element to document the information that was provided to the individual, may incorporate a checklist from the instruction element to document that procedure were followed, may incorporate the results of the assessment element to demonstrate that a requisite level of retention and understanding was observed, and may incorporate the certification element to establish that the individual certified their consent. The indemnification element may be incorporated in the recording element and maintained with the individual's medical record, or filed with a central facility. In a further aspect of this invention, practitioners filing an indemnification element documenting their effective use of the instrument may receive indemnification against claims related to the adequacy of the informed consent process.

**[0123]** Some exemplary instruments are described below. These are provided for the purpose of illustrating the invention and are not intended to limit its scope.

#### Integrated Instruments Containing an Information Element

**[0124]** In a preferred embodiment of this invention, the instrument contains an information element integrated with an instruction element and a certification element, and with one or more than one of the following, optionally integrated, elements: a collection element, an assessment element, a labeling element, a billing element, a recording element, a training element, a quality control element and an indemnification element. In another embodiment, this instrument contains an integrated information element, an integrated instruction element and an integrated certification element, optionally integrated with two, three, four, five, six, seven or eight of the elements set forth above.

#### Integrated Instrument Containing an Assessment Element

**[0125]** In a preferred embodiment of this invention, the instrument contains an instruction element integrated with an information element and a certification element and further contains an optionally integrated assessment element. In another embodiment, this instrument also contains an optionally integrated collection element. In yet another embodiment, this instrument additionally contains one or more than one of the following, optionally integrated elements: a labeling element, a billing element, a recording element, a training element, a quality control element and an indemnification element. In another embodiment, this instrument contains an instruction element integrated with an information element and a certification element and optionally integrated with two, three, four, five, six, seven or eight of the elements set forth above.

#### Integrated Instrument Containing a Collection Element

**[0126]** In a preferred embodiment of this invention, the instrument contains an information element, instruction element and certification element, optionally integrated with a collection element. In another embodiment, this instrument contains in addition one or more than one of the following integrated elements: an assessment element, a labeling element, a billing element, a recording element, a training element, a quality control element and an indemnification element. In yet another embodiment, this instrument contains an integrated information element, integrated instruction element, integrated certification element and an integrated collection element, optionally integrated with two, three, four, five, six, seven or eight of the elements set forth above.

#### Integrated Instrument Containing a Collection Element and an Assessment Element

**[0127]** In a preferred embodiment of this invention, the instrument contains a certification element integrated with an instruction element, with an information element and with a collection element and an assessment element. Additionally, this embodiment may further include one or more than one of the following optionally integrated elements: a labeling element, a billing element, a recording element a training element, a quality control element and an indemnification element. In a specific embodiment of this invention, the instrument contains a certification element integrated an instruction element, an information element, a collection element and an assessment element, and optionally integrated with two, three, four, five, six, or seven of the elements listed above.

#### Training Element, Quality Control Element, and Indemnification Elements

**[0128]** A preferred embodiment of this invention is an instrument for obtaining informed consent containing an integrated training element. In such embodiment, the training element is integrated with the instruction element, the information element and the certification element. In an alternative embodiment, the training element is integrated with these three element and with an assessment element or a collection element, or both assessment and collection elements. In another alternative embodiment, the training element is integrated with these three elements and with one or more of the following optionally integrated elements: recording element, labeling element, billing element, quality control element, and indemnification element.

**[0129]** A specific object of this invention is an instrument for obtaining informed consent containing an integrated quality control element. In such embodiment, the quality control element is integrated with the instruction element, the information element and the certification element. In an alternative embodiment, the quality control element is integrated with these three element and with an assessment element or a collection element, or both assessment and collection elements. In another alternative embodiment, the quality control element is integrated with these three elements and with one or more of the following elements: recording element, labeling element, billing element, training element, and indemnification element. In a preferred embodiment, the quality control element is integrated with these three elements and with the reporting element. In a preferred embodiment, the quality control element is integrated with these three elements and

with the training element. In further embodiments, the quality control element is integrated with two or more than two of the collection element, the assessment element, the recording element, the labeling element, the billing element, the training element and the indemnification element.

**[0130]** A specific object of this invention is an instrument for obtaining informed consent integrated with an indemnification element. In such embodiment, the indemnification element is integrated with the information element, the instruction element and the certification element. In an alternative embodiment, the indemnification element is integrated with these three elements and an assessment element or a collection element or with both of these elements. A specific embodiment is the integration of the indemnification element with these three elements and one or more than one of the assessment element, the collection element, the quality control element, the labeling element, the billing element, the recording element, and the training element. In a preferred embodiment the indemnification element incorporates a checklist from the instruction element. In a preferred embodiment the indemnification element incorporates the assessment element and the certification element.

#### Integrated and Validated Instrument

**[0131]** A preferred embodiment of this invention is a validated instrument for obtaining informed consent comprising the following integrated elements:

- (a) an information element for an individual concerning a genetic test for one gene, more than one gene, related genes, a clinical outcome or a gene screen;
- (b) an instruction element that can be used by a practitioner in providing instruction to the individual and guidance in the use of the instrument and obtaining informed consent;
- (c) a collection element of information concerning the individual's personal medical history or their family medical history;
- (d) an assessment element of the individual's retention or comprehension of said information;
- (e) a certification element of the individual's consent for said test;
- (f) a labeling element for labeling a sample or sample collection device obtained for genetic testing with the identity of the individual;
- (g) a billing element either for direct payment by the individual or through a reimbursement agency; and
- (h) a recording element that can be attached to the individual's medical record.

**[0132]** A specific embodiment of this invention is a validated instrument for obtaining informed consent that contains two or more of the following, optionally integrated, elements, an information element, an instruction element, a collection element, an assessment element, a certification element, a labeling element, a billing element, a recording element, a training element, a quality control element, and an indemnification element. In such embodiments, the instrument contains two, three, four, five, six, seven, eight, nine, or ten of these elements. Another specific embodiment of this invention is a validated instrument for obtaining informed consent that contains an instruction element integrated with one or more than one of the following elements: an information element, a collection element, an assessment element, a certification element, a labeling element, billing element, a recording element, a training element, a quality control element, and an indemnification element. In specific embodiment

of this invention, the instrument contains a instruction element integrated with two, three, four, five, six, seven, eight or nine of said elements.

#### Integrated Instruments Useful in the Field of Medicine

**[0133]** A preferred embodiment of this invention is an instrument for obtaining consent for a genetic test for predicting a clinical outcome or determining the genetic risk of a clinical outcome, which instrument comprises the following integrated elements:

- (a) an information element for an individual concerning a genetic test for one gene, more than one gene, related genes, associated with a clinical outcome;
- (b) an instruction element that can be used by a practitioner in providing instruction to the individual and guidance in the use of the instrument and obtaining informed consent;
- (c) a collection element of information concerning the individual's personal medical history or their family medical history;
- (d) an assessment element of the individuals retention or comprehension of said information;
- (e) a certification element of the individual's consent for said test;
- (f) a labeling element for labeling a sample or sample collection device obtained for genetic testing with the identity of the individual;
- (g) a billing element either for direct payment by the individual or through a reimbursement agency; and
- (h) a recording element that can be attached to the individual's medical record.

**[0134]** A specific embodiment of this invention is an instrument for obtaining consent for a genetic test for predicting a clinical outcome or determining the genetic risk of a clinical outcome that contains an instruction element integrated with an information element and with a certification element, and optionally integrated with one or more than one of the following elements: a collection element, an assessment element, a labeling element, a billing element, a recording element, a training element, a quality control element, and an indemnification element. In specific embodiment of this invention, the instrument contains the integrated instruction, information and certification elements optionally integrated with two, three, four, five, six, seven, or eight of the other of the elements listed above.

#### **[0135]** C. Method of Use

**[0136]** There is provided by this invention a novel method for obtaining informed consent in which the practitioner uses an integrated instrument for obtaining such consent, more specifically a validated instrument. In specific embodiments, the method involves the use of an instrument with the following integrated elements: an information element, an instruction element, and a certification element, and optionally one or more elements selected from the group consisting of a collection element, an assessment element, a labeling element, a billing element, a recording element, a training element, a quality control element and an indemnification element. The method comprises completing a checklist of steps to obtain an informed consent using the instrument and the practitioner indicates on the checklist the steps that have been performed and completed. In a preferred embodiment, the method involves the steps of:

- [0137]** (a) procuring an integrated instrument for obtaining informed consent to a genetic test from an individual,

which instrument contains an information element, an instruction element and a certification element;

**[0138]** (b) conveying to the individual information concerning the genetic test using the integrated information element;

**[0139]** (c) instructing an individual according to the directions contained in the integrated instruction element; and

**[0140]** (d) certifying the individual's consent for the test using the integrated certification element.

**[0141]** In addition, the method may include collecting a personal medical history and family history using an integrated collection element and may further or additionally include assessing the individual's retention or comprehension of the information using an integrated assessment element. Optionally, the method may further include the steps of labeling a sample with the identity of the individual using an integrated labeling element, and recording information concerning the informed consent process using an integrated recording element.

**[0142]** In a preferred embodiment, the method further includes posting of one or more elements of an integrated instrument for obtaining informed consent. Posting makes the element or elements available as a resource to practitioners in printed or electronic medium (for example, on an Internet site or computer) or by incorporation of the element in policies, practices, guidelines, recommendations, training materials, or lessons. The posting of more than one element may be by the same or different means. For example, an instruction element may be posted in a procedure manual, and information elements provided as booklets to the individual, and recording elements provided as part of a medical record system. For example, an instruction element from an integrated instrument for obtaining informed consent may be posted with or without any of the additional elements included in the instruments and methods of the invention.

**[0143]** In detail, the step of "procuring" refers to obtaining an integrated instrument useful for obtaining informed consent for a specific gene, more than one related gene, a clinical outcome, or a gene screen. For example, an instrument may be procured by purchasing the instrument in written or electronic form, downloading the instrument from an Internet site, accessing the instrument on a computer, or printing it from a computer. Elements of the integrated instrument may be procured separately. For example, selected elements may be procured in written form, and others downloaded from an Internet site. Procuring also refers to the retrieval of elements that have been posted. Alternatively, one or more elements may be posted after they are procured by other means. Procuring may involve a payment for the instrument or one or more elements of the instrument or may be free of charge.

**[0144]** The step of "posting" of an element means to make it generally available to individuals or practitioners, for example by placing it on a web site, providing it as a resource in printed or electronic medium accessible to individuals or practitioners. Alternatively, posting may refer to policies, business practices, guidelines, recommendations, training materials, lessons that incorporate the use of one or more of said element.

**[0145]** The step of "conveying" refers to the delivery of an information element to an individual designed to give the individual with background information on a genetic test sufficient to provide an informed consent. For example, the individual can be given a booklet containing information about the genetic test or provided with access to an Internet

site or computer with this information. Preferably conveying is performed using an information element integrated with one or more elements of the instrument.

**[0146]** The step of "instructing" refers to giving of instruction to an individual by a practitioner concerning a genetic test. Preferably, instructing is performed by the practitioner according to directions included in an instruction element integrated with one or more elements of the instrument.

**[0147]** The step of "collecting" refers to obtaining a personal medical history and family history from an individual. Preferably, collecting is performed using a worksheet and instructions included in a collection element integrated with one or more elements of the instrument.

**[0148]** The step of "assessing" refers to an assessment of an individual's retention or comprehension of information sufficient to provide an informed consent by presenting the individual with questions concerning aspects of the test and testing process and scoring their responses. Preferably assessing is performed using an assessment element integrated with one or more elements of the instrument element integrated with one or more elements of the instrument.

**[0149]** The step of "certifying" refers to the completion of a legal informed consent document by an individual and appropriate witnesses. Preferably certifying is performed using a certification element integrated with one or more elements of the instrument.

**[0150]** The step of "labeling" refers to the labeling of a sample with information required for the proper handling of the sample, performance of the test, and protection of individual privacy. Preferably, labeling is performed using a labeling element integrated with one or more elements of the instrument.

**[0151]** The step of "recording" refers to the placement of essential information concerning the informed consent process and the individual's medical and family history in a medical record. Preferably recording is performed using a recording element integrated with one or more elements of the instrument. Indemnifying refers to the issuance of an insurance policy which pays for claims against the practitioner related to the quality of the informed consent obtained using the instrument.

#### Sample Collection and Diagnostic Devices

**[0152]** An additional embodiment of this invention is kit comprising a sample collection device and an integrated instrument for obtaining informed consent for a genetic test. Sample collection devices are known in the art. Samples can be collected using routine procedures from blood drawing and tubes that enable the separation of white blood cells (that contain DNA) from red blood cells, serum, or plasma. Specialized devices are also known in the art and approved by the FDA for sample collection. The OraSure Oral Specimen Collection Device from Orasure Technologies, Inc. is one example of an FDA-approved sample collection device that can be used for the collection of DNA from the oral mucosa for clinical applications. Another example is S&S 903 Specimen Collection Paper from Schleicher & Schuell, GmbH is another FDA listed device that is widely used for adult sample collection, including genetic studies. S&S 903 Specimen Collection Paper, is used widely for newborn screening and has also been used for genetic studies. S&S 903 Specimen Collection Paper has also been incorporated into single and multi-part forms and forms and customized printing is available from the manufacturer with biologically inactive inks

and glues that enable the paper to incorporate information or codes for patient identification, processing, and lot traceability. The 903 device can be used to collect blood or body fluids such as urine, tears, or saliva that are spotted and dried onto the 903 paper. In this form the sample is stable and can be mailed to centralized labs for analysis, sample extraction, or DNA banking.

**[0153]** An additional embodiment of this invention is kit comprising a sample collection device and an integrated instrument for obtaining informed consent for a genetic test. In one example, the sample collection device is printed S&S 903 paper that is included as part of the labeling element of the integrated instrument. Alternatively, the sample collection device may be included in the recording element and may be comprised of a multi-part form comprising S&S 903 paper for sample collection. In a preferred example, a booklet comprising one or more of the elements of the integrated element may contain a page made of S&S 903 paper which is perforated or glued to the booklet for easy separation. The booklet may be constructed such that information concerning the individual's identity, the test to be performed, handling of the sample and test results, and valid certification of consent for DNA banking and testing is entered simultaneously onto a sample collection device such as S&S 903 paper and onto other elements of the instrument, for example, by constructing the instrument such that carbon copies are made on one or more elements such as the checklist within the instruction element, the labeling element, or certification element. In another preferred example, sample collection device, for example, S&S 903 paper, may be integrated with other elements of the instrument, by describing the process for sample collection in the information element or directions for obtaining and processing a sample in the instruction element. It will be recognized by those skilled in the art that other sample collection devices may be integrated with the instrument for informed consent in an analogous manner.

Example 1

Examples of Genetic Tests

**[0154]** A. Genetic Tests Predicting the Risk of Common Disease.

**[0155]** Most common diseases are considered to be multifactorial or polygenic, meaning that many different genes may contribute to the risk of the disorder. Examples include:

Disorder	Genetic test
Cancer	Breast Cancer (BRCA1)*; BRCA1; Ovarian Cancer (BRCA1) Breast Cancer (BRCA2)*; BRCA2; Ovarian Cancer (BRCA2) p53, p21, p16 Ataxia Telangectasia NHPCCm FAP (colon cancer) Medullary Thyroid Carcinoma; MTC Alzheimer's Disease Apolipoprotein E amyloid precursor protein presenilin-1, presenilin-2 2-macroglobulin alpha 1-antichymotrypsin
Heart attack, stroke	Apolipoprotein E Lipoprotein lipase LDL receptor MTHFR Angiotensinogen

-continued

Disorder	Genetic test
ALS	Superoxide Dismutase (SOD)
COPD	alpha 1-antitrypsin (AAT)
Anemia	hemoglobin S hemoglobin C thalassemia (alpha) thalassemia (beta) G-6 PD
Liver failure	Hemochromatosis
Spina Bifida	MTHFR
Arthritis	HLA-B, HLA-D
Periodontal disease	IL-1
Osteoporosis	Col 1A1

**[0156]** B. Genetic Tests Predictive of Drug Response.

**[0157]** Variations in genes that affect the metabolism of drugs can increase drug levels, drug toxicity and drug interactions. Genetic tests can be used to avoid drugs that have a higher probability of toxicity and individualize the dose to maximize the therapeutic benefit while minimizing toxicity. Examples include:

Gene test	Drugs and chemical affected
CYP1A1	Chlorinated benzenes (environmental toxin)
CYP1A2	Caffeine, phenacetin, warfarin, Erythromycin, Ropivacaine, Haloperidol, antipyrine, theophylline, Paracetamol
CYP2C8	TCA, Diazepam, Hexabarbitone
CYP2C9/10	Phenytoin, S-warfarin, Diclofenac, Tolbutamide
CYP2C19	Mephenytoin, Diazepam (Valium), TCA
CYP2D6	Debrisoquine, Codeine, Dextrometorphan, b-blockers, SSRIs, others
CYP2E1	Paracetamol, Isoflurane, Sevoflurane, Methoxyflurane, Enflurane,
CYP3A4	Nifedipine, Dextrometorphan, Alfentanil, Sufentanil, Fentanyl, Erythromycin, Lignocaine, Ropivacaine, Midazolam, Codeine, Granisetron, Hydrocortisone
CYP3A5	Caffeine, Diltiazem
CYP3A7	Midazolam
CYP17	Pregnonolone
CYP19	Testosterone
CYP21A2	17-hydroxyprogesterone

**[0158]** C. Variations in Genes that Affect Drug Targets and Drug Response May Affect the Safety and Efficacy of a Drug.

**[0159]** Genetic tests can be used to avoid drugs that have a higher probability of toxicity and individualize the dose to maximize the therapeutic benefit while minimizing toxicity. Examples include:

Gene test	Drugs or chemicals affected
Factor V	Oral contraceptives
Prothrombin	Oral contraceptives
TPMT (thiopurine methyltransferase)	Azothioprine, mercaptopurine(purine analogues)
5' lipoxegenase	Zilutin (5' lipoxegenase inhibitors)
CETP(cholesterol ester transfer protein)	Pravastatin, others (statins)
ApoE (apolipoprotein E)	Tacrine (cholinesterase inhibitors, muscarinic agonists, others) sulfur drugs
G-6 PD	pseudocholinesterase inhibitors
Pseudocholinesterase	Isoproterenol (beta-agonists)
Beta-receptor	SSRI antidepressants (Prozac, Pindolol, others)
Serotonin transporter	isoniazid, others
Acetyltransferase	alcohol
ADH(2h) (aldehyde dehydrogenase)	

-continued

Gene test	Drugs or chemicals affected
ACE (angiotensin converting enzyme)	Enalapril, others
Opioid receptors	Endorphins, morphine

Genetic Tests for Inherited or Genetic Disorders.

**[0160]** A large number of inherited genetic diseases are caused by well-characterized mutations in genes that impair the function of a gene or cause a gene to have dominant, adverse effects. The following is partial list of genetic tests for diseases that are generally considered to be genetic or congenital.

**[0161]** DiGeorge Syndrome 2

**[0162]** Velocardiofacial Syndrome 2

1p36 Deletion Syndrome

22q11 Deletion Syndrome

**[0163]** Cayler Cardiofacial Syndrome

**[0164]** Conotruncal Anomaly Face Syndrome

**[0165]** DiGeorge Syndrome

**[0166]** Opitz G/BBB

**[0167]** Sedlackova Syndrome

**[0168]** Shprintzen Syndrome

**[0169]** Velocardiofacial Syndrome

3-Methylglutaconic Aciduria

46,XY Gonadal Dysgenesis

Achalasia-Addisonianism-Alacrima Syndrome

Achondrogenesis

**[0170]** Achondrogenesis Type IA Achondrogenesis Type IB

**[0171]** Achondrogenesis Type II

Achondroplasia

Acute Hepatic Porphyria

Acute Intermittent Porphyria

Adenosine Monophosphate Deaminase 1

Adrenoleukodystrophy, X-Linked

**[0172]** Adrenomyeloneuropathy

Alagille Syndrome

Albinism

**[0173]** Ocular Albinism, X-Linked

**[0174]** Oculocutaneous Albinism

**[0175]** Oculocutaneous Albinism Type 1

**[0176]** Oculocutaneous Albinism Type 1A

**[0177]** Oculocutaneous Albinism Type 1B

**[0178]** Oculocutaneous Albinism Type 2 (P Related)

**[0179]** Oculocutaneous Albinism Type 3 (TRP1 Related)

Aldosteronism, Sensitive to Dexamethasone

Alpha-1-Antitrypsin Deficiency

Alpha-Mannosidosis

Alpha-Thalassemia

Alpha-Thalassemia X-Linked Mental Retardation Syndrome

Alport Syndrome

**[0180]** Alport Syndrome, Autosomal Dominant

**[0181]** Alport Syndrome, Autosomal Recessive

**[0182]** Alport Syndrome, X-Linked

Alzheimer Disease

Early Onset Familial Alzheimer Disease

**[0183]** Alzheimer Disease Type 1

**[0184]** Alzheimer Disease Type 3

**[0185]** Alzheimer Disease Type 4

**[0186]** Late-Onset Familial Alzheimer Disease

**[0187]** Alzheimer Disease Type 2

**[0188]** Alzheimer Disease Type 5

Amino Adipic Aciduria

Amyotrophic Lateral Sclerosis

Androgen Insensitivity Syndrome

**[0189]** Complete Androgen Insensitivity Syndrome

**[0190]** Mild Androgen Insensitivity Syndrome

**[0191]** Partial Androgen Insensitivity Syndrome

Angelman Syndrome

Anhaptoglobinemia

Aniridia

**[0192]** An kyloblepharon-Ectodermal Defects-Cleft Lip/Palate

Ankylosing Spondylitis

Apolipoprotein E Genotyping

Apparent Mineralocorticoid Excess Syndrome,

Argininemia

Argininosuccinicaciduria

Aromatic L-Amino Acid Decarboxylase Deficiency

Aspartylglycosaminuria

Atelosteogenesis Type II

Autoimmune Polyendocrinopathy Syndrome Type 1

Autosomal Recessive Adrenoleukodystrophy

Autosomal Recessive Congenital Ichthyosis

**[0193]** Congenital Ichthyosiform Erythroderma

- [0194] Non-Bullous Congenital Ichthyosiform Erythroderma
- Avellino Corneal Dystrophy
- Barth Syndrome
- Beckwith-Wiedemann Syndrome
- Beta-Mannosidosis
- Beta-Methylcrotonylglycinuria
- Beta-Thalassemia
- [0195] Thalassemia Intermedia
- [0196] Thalassemia Major
- [0197] Thalassemia Minor
- Biotin-Responsive Multiple Carboxylase Deficiencies
- [0198] Biotinidase Deficiency
- [0199] Holocarboxylase Synthetase Deficiency
- Bloom Syndrome
- Breast Cancer Genetics
- BRCA1 and BRCA2 Hereditary Breast/Ovarian Cancer
- [0200] BRCA1 Hereditary Breast/Ovarian Cancer
- [0201] BRCA2 Hereditary Breast/Ovarian Cancer
- Brugada Syndrome
- CADASIL
- Camurati-Engelmann Disease
- Canavan Disease
- Carbamoylphosphate Synthetase I Deficiency
- Carney Complex
- Carnitine Deficiency, Systemic
- [0202] Carnitine Palmitoyltransferase IA (liver) Deficiency
- Carnitine Palmitoyltransferase II Deficiency
- Carnitine-Acylcarnitine Translocase Deficiency
- Cartilage-Hair Hypoplasia
- Catecholaminergic Ventricular Tachycardia
- Catecholaminergic Ventricular Tachycardia, Dominant
- Catecholaminergic Ventricular Tachycardia, Recessive
- Celiac Disease
- Cerebrotendinous Xanthomatosis
- [0203] Charcot-Marie-Tooth Disease, Type 4B
- [0204] Charcot-Marie-Tooth Hereditary Neuropathy
- [0205] Charcot-Marie-Tooth Neuropathy Type 1
- [0206] Charcot-Marie-Tooth Neuropathy Type 1A
- [0207] Charcot-Marie-Tooth Neuropathy Type 1B
- [0208] Dejerine-Sottas Disease
- [0209] Charcot-Marie-Tooth Neuropathy Type 1C
- [0210] Charcot-Marie-Tooth Neuropathy Type 1 D
- [0211] Charcot-Marie-Tooth Neuropathy Type 2
- [0212] Charcot-Marie-Tooth Disease, Neuronal/Axonal
- [0213] Charcot-Marie-Tooth Neuropathy Type 2A
- [0214] Charcot-Marie-Tooth Neuropathy Type 2B
- [0215] Charcot-Marie-Tooth Neuropathy Type 2C
- [0216] Charcot-Marie-Tooth Neuropathy Type 2D
- [0217] Charcot-Marie-Tooth Neuropathy Type 2E
- [0218] Charcot-Marie-Tooth Neuropathy Type 4
- [0219] Charcot-Marie-Tooth Neuropathy Type 4A
- [0220] Charcot-Marie-Tooth Neuropathy Type 4B
- [0221] Charcot-Marie-Tooth Neuropathy Type 4C
- [0222] Charcot-Marie-Tooth Neuropathy Type 4D
- [0223] Charcot-Marie-Tooth Neuropathy Type 4E
- [0224] Charcot-Marie-Tooth Neuropathy Type 4F
- [0225] Dejerine-Sottas Disease
- [0226] Charcot-Marie-Tooth Neuropathy Type X
- [0227] Hereditary Neuropathy with Liability to Pressure Palsies
- CHILD Syndrome
- Chondrodysplasia Punctata, X-Linked Dominant
- Choroideremia
- Citrullinemia
- Clinical Confirmation of Mutations Identified in Research Labs Cockayne Syndrome
- [0228] Cockayne Syndrome Type A
- [0229] Cockayne Syndrome Type B
- [0230] Cockayne Syndrome Type I
- [0231] Cockayne Syndrome Type II
- [0232] Cockayne Syndrome Type III
- [0233] Xeroderma Pigmentosa-Cockayne Syndrome
- Coffin-Lowry Syndrome
- Congenital Adrenal Hyperplasia
- [0234] 11 beta Hydroxylase Deficiency
- [0235] 17 alpha Hydroxylase Deficiency
- [0236] 21-Hydroxylase Deficiency
- [0237] 3 beta Hydroxysteroid Dehydrogenase Deficiency
- [0238] Cholesterol Desmolase Deficiency
- Congenital Contractural Arachnodactyly
- Congenital Disorders of Glycosylation
- Congenital Erythropoietic Porphyria
- Congenital Hypomyelination
- [0239] Congenital Insensitivity to Pain with Anhidrosis
- Congenital Muscular Dystrophy
- [0240] Congenital Muscular Dystrophy with Cerebellar Hypoplasia
- Congenital Muscular Dystrophy with Early Spine Rigidity

- Congenital Muscular Dystrophy with Integrin alpha 7 Mutations
- Congenital Muscular Dystrophy with Merosin Deficiency
- Congenital Muscular Dystrophy with Mitochondrial Structural Abnormalities
- [0241] Congenital Muscular Dystrophy, Merosin-Positive
- [0242] Fukuyama Muscular Dystrophy
- [0243] Muscle-Eye-Brain Disease
- [0244] Walker-Warburg Syndrome
- Coronal Synostosis
- Coronary Artery Disease Risk Factor (ACE)
- Coronary Artery Disease Risk Factor (PLA1/2)
- Craniosynostosis
- [0245] FGFR-Related Craniosynostosis Syndromes
- FGFR1-Related Craniosynostosis Syndrome Pfeiffer Syndrome Type 1, 2, and 3
- FGFR2-Related Craniosynostosis Syndromes
- [0246] Apert Syndrome
- [0247] Beare-Stevenson Syndrome
- [0248] Crouzon Syndrome
- [0249] Jackson-Weiss Syndrome
- [0250] Pfeiffer Syndrome Type 1, 2, and 3
- FGFR3-Related Craniosynostosis Syndromes
- [0251] Crouzon Syndrome with Acanthosis Nigricans
- [0252] Muenke Syndrome
- Cri du Chat Syndrome
- Cystic Fibrosis
- [0253] Congenital Bilateral Absence of the Vas Deferens
- Cystinosis
- [0254] Intermediate Cystinosis
- [0255] Nephropathic Cystinosis
- [0256] Non-Nephropathic Cystinosis
- Cystinuria
- Cytochrome C Oxidase Deficiency
- Darier Disease
- Diabetes Mellitus, Noninsulin-Dependent
- Diabetes Mellitus, Transient Neonatal
- Diastrophic Dysplasia
- Disorders of Galactose Metabolism
- [0257] Galactokinase Deficiency
- [0258] Galactose Epimerase Deficiency
- [0259] Galactosemia
- Variant Galactosemias Duarte Variant Galactosemia
- Disorders of Phenylalanine Metabolism
- Phenylalanine Hydroxylase Deficiency
- [0260] Non-PKU Hyperphenylalanemia
- [0261] Phenylketonuria
- [0262] Variant PKU
- [0263] Tetrahydrobiopterin deficiencies
- 6-Pyruvoyl-Tetrahydropterin Synthase Deficiency
- Dihydropteridine Reductase Deficiency (DHPR)
- [0264] GTP Cyclohydrolase-1 Deficiency (GTPCH)
- [0265] Pterin-4a Carbinolamine Dehydratase Deficiency
- [0266] Tetrahydrobiopterin deficiencies
- [0267] GTP Cyclohydrolase 1-Deficient DRD
- [0268] Sepiapterin Reductase Deficiency (SR)
- Dopa-Responsive Dystonia
- [0269] GTP Cyclohydrolase 1-Deficient DRD
- [0270] Tyrosine Hydroxylase-Deficient DRD
- Down Syndrome Critical Region
- Dubin-Johnson Syndrome
- Dystrophinopathies
- [0271] Duchenne/Becker Muscular Dystrophy
- [0272] Becker Muscular Dystrophy
- [0273] Duchenne Muscular Dystrophy
- [0274] X-Linked Dilated Cardiomyopathy
- Early-Onset Primary Dystonia
- Ectrodactyly, Ectodermal Dysplasia, and Cleft Lip/Palate Syndrome
- Ehlers-Danlos Syndrome, Arthrochalasia Type
- Ehlers-Danlos Syndrome, Kyphoscoliotic Form
- Ehlers-Danlos Syndrome, Vascular Type
- Emery-Dreifuss Muscular Dystrophy
- Epidermolysis Bullosa Dystrophica, Bart Type
- Epidermolysis Bullosa Dystrophica, Cockayne-Touraine Type Epidermolysis Bullosa Dystrophica,
- [0275] Hallopeau-Siemens Type Epidermolysis Bullosa Dystrophica, Inverse Type
- Epidermolysis Bullosa Dystrophica, Pasini Type
- Epidermolysis Bullosa Junctional, Disentis Type
- Epidermolysis Bullosa Junctional, Herlitz-Pearson Type
- [0276] Epidermolysis Bullosa Letalis with Pyloric Atresia
- Epidermolysis Bullosa Simplex
- [0277] Epidermolysis Bullosa Simplex with Mottled Pigmentation

Epidermolysis Bullosa Simplex, Dowling-Meara Type	Familial Hibernia Fever
Epidermolysis Bullosa Simplex, Koebner Type	Familial Lipoprotein Lipase Deficiency
Epidermolysis Bullosa Simplex, Recessive	Familial Malignant Melanoma
Epidermolysis Bullosa Simplex, Weber-Cockayne Type	Familial Mediterranean Fever
<b>[0278]</b> Epidermolysis Bullosa with Muscular Dystrophy	Fanconi Anemia
Epidermolysis Bullosa, Pretibial	Farber Disease
Epidermolytic Hyperkeratosis	Fatty Acid Oxidation Disorder, Unspecified
Epidermolytic Palmoplantar Keratoderma	Fragile X Syndrome
Erythrokeratoderma Variabilis	FRAXE Syndrome
Erythropoietic Protoporphyrin	Frontotemporal Dementia
Ethylmalonic Encephalopathy	Amyotrophic Lateral Sclerosis/Frontotemporal Dementia
Fabry Disease	<b>[0297]</b> Frontotemporal Dementia with Parkinsonism-17
<b>[0279]</b> Cardiac Variant Fabry Disease	Disinhibition-Dementia-Parkinsonism-Amyotrophy
<b>[0280]</b> Classic Fabry Disease	<b>[0298]</b> Familial Pick's Disease
Facioscapulohumeral Muscular Dystrophy	<b>[0299]</b> Wilhelmsen-Lynch Disease
Familial Atypical Mycobacteriosis	<b>[0300]</b> Progressive Supranuclear Palsy
Familial Colon Cancer Syndromes	Fructose 1,6 Bisphosphatase Deficiency
<b>[0281]</b> Colon Cancer (APC 11307K related)	Fucosidosis
<b>[0282]</b> Familial Adenomatous Polyposis	Fumarate Hydratase Deficiency
<b>[0283]</b> Attenuated FAP	Gaucher Disease
<b>[0284]</b> Gardner Syndrome	<b>[0301]</b> Gaucher Disease Type 1
<b>[0285]</b> Turcot Syndrome	<b>[0302]</b> Gaucher Disease Type 2 (Acute)
<b>[0286]</b> Hereditary Non-Polyposis Colon Cancer	<b>[0303]</b> Gaucher Disease Type 3 (Subacute/Chronic)
<b>[0287]</b> Turcot Syndrome	<b>[0304]</b> Gaucher Disease, Cardiovascular Form
<b>[0288]</b> Juvenile Polyposis Syndrome	<b>[0305]</b> Gaucher Disease, Perinatal-Lethal Form
<b>[0289]</b> PTEN Hamartoma Tumor Syndrome (PHTS)	Genotypic Gender Assignment
<b>[0290]</b> Bannayan-Riley-Ruvalcaba Syndrome	Gilbert Syndrome
<b>[0291]</b> Cowden Syndrome	Gliosis, Familial Progressive Subcortical
<b>[0292]</b> Proteus Syndrome	Glutaricacidemia Type 2
<b>[0293]</b> Proteus-Like Syndrome	Glycerol Kinase Deficiency
<b>[0294]</b> Peutz-Jeghers Syndrome	Glycogen Storage Disease Type Ia
Familial Combined Hyperlipidemia	Glycogen Storage Disease Type Ib
Familial Dysautonomia	Glycogen Storage Disease Type II
Familial Hemiplegic Migraine	Glycogen Storage Disease Type III
<b>[0295]</b> Familial Hemiplegic Migraine 1	Glycogen Storage Disease Type IV
<b>[0296]</b> Familial Hemiplegic Migraine 2	Glycogen Storage Disease Type IX
	Glycogen Storage Disease Type V
	Glycogen Storage Disease Type VI
	Glycogen Storage Disease Type VII
	Glycoprotein 1a Deficiency
	GM1 Gangliosidosis
	GM2 Gangliosidosis (Hexosaminidase A- and B-Deficient)
	<b>[0306]</b> Sandhoff Disease
	Granular Corneal Dystrophy

Greig Cephalopolysyndactyly Syndrome	Mitochondrial Disorders with Ataxia
Guanidinoacetate Methyltransferase Deficiency	MERF
Hailey-Hailey Disease	NARP
Hallervorden-Spatz Syndrome	X-Linked Recessive Hereditary Ataxias
Hartnup Disease	Sideroblastic Anemia and Ataxia
Hemoglobin C	Hereditary Coproporphyrria
Hemoglobin Constant Spring	Hereditary Diffuse Gastric Cancer
Hemoglobin D	Hereditary Fructose Intolerance
Hemoglobin E	Hereditary Hearing Loss and Deafness
Hemoglobin O	[0329] Nonsyndromic Hearing Loss and Deafness
Hemoglobin S	Nonsyndromic Hearing Loss and Deafness, Autosomal Dominant
Hemophilia A	[0330] DFNA 3 (Connexin 26)
Hemophilia B	[0331] Nonsyndromic Hearing Loss and Deafness, Autosomal Recessive
Hereditary Angioneurotic Edema	[0332] DFNB 1 (Connexin 26)
Hereditary Ataxias	[0333] Nonsyndromic Hearing Loss and Deafness, X-Linked
[0307] Autosomal Dominant Hereditary Ataxias DRPLA	Syndromic Hearing Loss and Deafness
[0308] Episodic Ataxia Type 1	[0335] Mitochondrial Disorders
[0309] Episodic Ataxia Type 2	[0336] Diabetes and Hearing Loss
[0310] Spinocerebellar Ataxia Type 1	[0337] Kearns-Sayre Syndrome
[0311] Spinocerebellar Ataxia Type 2	[0338] MELAS
[0312] Spinocerebellar Ataxia Type 3	[0339] MERRF
[0313] Spinocerebellar Ataxia Type 4	[0340] NARP
[0314] Spinocerebellar Ataxia Type 5	Syndromic Hearing Loss and Deafness, Dominant
[0315] Spinocerebellar Ataxia Type 6	[0341] Alport Syndrome, Autosomal Dominant
[0316] Spinocerebellar Ataxia Type 7	[0342] Branchiootorenal Syndrome
[0317] Spinocerebellar Ataxia Type 8	[0343] Neurofibromatosis 2
[0318] Spinocerebellar Ataxia Type I 10	[0344] Stickler Syndrome
[0319] Spinocerebellar Ataxia Type 12	[0345] Stickler Syndrome Type I
[0320] Autosomal Recessive Hereditary Ataxias	[0346] Stickler Syndrome Type II
Ataxia with Oculomotor Apraxia	[0347] Stickler Syndrome Type III
[0321] Ataxia with Oculomotor Apraxia 1	[0348] Waardenburg Syndrome
[0322] Ataxia with Oculomotor Apraxia 2	[0349] Waardenburg Syndrome Type I
[0323] Ataxia with Vitamin E Deficiency (AVED)	[0350] Waardenburg Syndrome Type II
[0324] Ataxia-Telangiectasia	[0351] Waardenburg Syndrome Type III
[0325] Autosomal Recessive Spastic Ataxia of Charlevoix-Saguenay	[0352] Waardenburg Syndrome Type IV
[0326] Friedreich Ataxia	Syndromic Hearing Loss and Deafness, Recessive
FRDA1	[0353] Alport Syndrome, Autosomal Recessive
FRDA2	[0354] Jervell and Lange-Nielsen Syndrome
[0327] Infantile Onset Spinocerebellar Ataxia (IOSCA)	[0355] LQT 1
[0328] Marinesco-Sjogren Syndrome	[0356] LQT 5
	[0357] Pendred Syndrome
	[0358] Refsum Disease
	[0359] Refsum Disease, Adult
	[0360] Refsum Disease, Infantile

- [0361] Usher Syndrome  
 [0362] Usher Syndrome Type 1  
 [0363] Usher Syndrome Type 2  
 [0364] Usher Syndrome Type 3
- Syndromic Hearing Loss and Deafness, X-Linked  
 [0365] Alport Syndrome, X-Linked  
 [0366] DFN 1  
 [0367] Norrie Disease
- X-Linked Familial Exudative Vitreoretinopathy
- Hereditary Hemochromatosis  
 [0368] Hereditary Hemorrhagic Telangiectasia  
 [0369] Hereditary Hemorrhagic Telangiectasia Type 1  
 [0370] Hereditary Hemorrhagic Telangiectasia Type 2
- Hereditary Inclusion Body Myopathy 2
- Hereditary Multiple Exostoses  
 [0371] Multiple Exostoses Type 1  
 [0372] Multiple Exostoses Type II
- Hereditary Pancreatitis
- Hereditary Sensory and Autonomic Neuropathy II
- Hereditary Sensory Neuropathy Type I
- Hereditary Spastic Paraplegia  
 [0373] Hereditary Spastic Paraplegia, Dominant  
 [0374] Hereditary Spastic Paraplegia, Complicated  
 [0375] SPG 9  
 [0376] Hereditary Spastic Paraplegia, Uncomplicated
- SPG 3  
 [0377] SPG 4  
 [0378] SPG 6  
 [0379] SPG 8  
 [0380] SPG10  
 [0381] SPG12  
 [0382] SPG13  
 [0383] Hereditary Spastic Paraplegia, Recessive  
 [0384] Hereditary Spastic Paraplegia, Complicated  
 [0385] SPG 7  
 [0386] Hereditary Spastic Paraplegia, Uncomplicated  
 [0387] SPG 5  
 [0388] SPG 11  
 [0389] Hereditary Spastic Paraplegia, X-Linked
- Pelizaeus-Merzbacher Disease/Spastic Paraplegia
- Spastic Paraplegia 1
- Hermansky-Pudlak Syndrome
- HPS1  
 [0390] HPS2  
 [0391] HPS3
- Hexosaminidase A Deficiency  
 Chronic and Adult-Onset Hexosaminidase A Deficiency  
 [0392] Juvenile (Subacute) Hexosaminidase A Deficiency  
 [0393] Tay-Sachs Disease
- Hidrotic Ectodermal Dysplasia 2
- Holoprosencephaly  
 Nonsyndromic Holoprosencephaly, Autosomal Dominant  
 [0394] Holoprosencephaly 2  
 [0395] Holoprosencephaly 3  
 [0396] Holoprosencephaly 4  
 [0397] Holoprosencephaly 5
- Syndromic Holoprosencephaly, Autosomal Dominant  
 [0398] Ectrodactyly and hypertelorism  
 [0399] Martin Syndrome  
 [0400] Pallister-Hall Syndrome  
 [0401] Rubinstein-Taybi Syndrome  
 [0402] Steinfeld syndrome
- Syndromic Holoprosencephaly, Autosomal Recessive  
 [0403] Facial clefts and brachial amelia  
 [0404] Genoa Syndrome  
 [0405] Hydrolethrus Syndrome  
 [0406] Lambotte Syndrome  
 [0407] Meckel-Gruber Syndrome  
 [0408] Smith-Lemli-Opitz Syndrome
- Homocystinuria
- Huntington Disease
- Hydrocephalus, X-Linked
- Hyper IgD Syndrome
- Hyperbilirubinemia, Rotor Type
- Hyperekplexia
- Hyperlipoproteinemia Type III
- Hyperlysinemia
- Hyperoxaluria, Primary, Type I
- Hyperpeicolatemia
- Hypochondroplasia
- Hypohidrotic Ectodermal Dysplasia, Dominant
- Hypohidrotic Ectodermal Dysplasia, Recessive
- Hypohidrotic Ectodermal Dysplasia, X-Linked
- Hypophosphatasia
- Hypophosphatemic Rickets, Dominant
- Hypophosphatemic Rickets, X-Linked
- Ichthyosis Bullosa of Siemens
- Ichthyosis, X-Linked
- Identity Testing  
 [0409] Parentage Testing  
 [0410] Family Relatedness

<b>[0411]</b> Maternity Testing	Microcephaly with Simplified Gyral Pattern, Group
<b>[0412]</b> Paternity Testing	<b>[0437]</b> Microlissencephaly I
<b>[0413]</b> Zygosity Testing	<b>[0438]</b> Microlissencephaly II
Incontinentia Pigmenti	<b>[0439]</b> Microlissencephaly III
Kallmann Syndrome, X-Linked	Long Chain 3-Hydroxyacyl-CoA Dehydrogenase Deficiency
Krabbe Disease	Long Chain Acyl-CoA Dehydrogenase Deficiency
Lactate Dehydrogenase Deficiency	Long QT Syndrome
Langer Mesomelic Dwarfism	<b>[0440]</b> Jervell and Lange-Nielsen Syndrome
Langer-Giedion Syndrome	LQT 1
Lattice Corneal Dystrophy Type I	LQT 5
Lecithin Cholesterol Acyltransferase Deficiency	<b>[0441]</b> Long QT Syndrome, Dominant
Leprechaunism	LQT 1
Leri-Weill Dyschondrosteosis	<b>[0442]</b> LQT 2
Lesch-Nyhan Syndrome	<b>[0443]</b> LQT 3
Li-Fraumeni Syndrome	<b>[0444]</b> LQT 4
Limb-Girdle Muscular Dystrophy	<b>[0445]</b> LQT 5
Limb-Girdle Muscular Dystrophies, Autosomal Dominant	<b>[0446]</b> LQT 6
<b>[0414]</b> Bethlem Myopathy	Lowe Syndrome
<b>[0415]</b> Caveolinopathy	Lymphoproliferative Disease, X-Linked
<b>[0416]</b> LGMD1A	Malignant Hyperthermia Susceptibility
<b>[0417]</b> LGMD1B	Marfan Syndrome
Limb-Girdle Muscular Dystrophies, Autosomal Recessive	Medium Chain 3-Ketothiolase Deficiency
<b>[0418]</b> Calpainopathy	Medium Chain Acyl-Coenzyme A Dehydrogenase Deficiency Menkes Disease
<b>[0419]</b> Dysferlinopathy	Mental Retardation Syndromes, Undiagnosed
<b>[0420]</b> Sarcoglycanopathies	Metachromatic Leukodystrophy
<b>[0421]</b> Alpha-Sarcoglycanopathy	Metaphyseal Chondrodysplasia, Schmid Type
<b>[0422]</b> Beta-Sarcoglycanopathy	Mevalonicaciduria
<b>[0423]</b> Delta-Sarcoglycanopathy	Mitochondrial Disorders
<b>[0424]</b> Gamma-Sarcoglycanopathy	<b>[0447]</b> Chorea and Dementia
<b>[0425]</b> Telethoninopathy	<b>[0448]</b> Chronic Progressive External Ophthalmoplegia
Limb-Mammary Syndrome	<b>[0449]</b> Diabetes and Hearing Loss
Lissencephaly	<b>[0450]</b> Infantile Myopathy and Lactic Acidosis (Fatal and Non-Fatal Forms)
Classic Lissencephaly and Subcortical Band Heterotopia (Agyria-Pachygyria-Band Spectrum)	<b>[0451]</b> Kearns-Sayre Syndrome
<b>[0426]</b> Baraitser-Winter Syndrome	<b>[0452]</b> Leber Hereditary Optic Neuropathy
<b>[0427]</b> Isolated Lissencephaly/Subcortical Heterotopia	<b>[0453]</b> Leigh Syndrome (mtDNA mutation)
<b>[0428]</b> X-Linked Lissencephaly/Subcortical Heterotopia	MELAS
<b>[0429]</b> 17-Linked Lissencephaly/Subcortical Heterotopia	<b>[0454]</b> MERRF
<b>[0430]</b> Miller-Dieker Syndrome	<b>[0455]</b> NARP
<b>[0431]</b> Cobblestone Dysplasia (Lissencephaly)	<b>[0456]</b> Nonsyndromic Hearing Loss and Deafness
<b>[0432]</b> Cobblestone Lissencephaly	<b>[0457]</b> Aminoglycoside-Induced Deafness
<b>[0433]</b> Muscle-Eye-Brain Disease	<b>[0458]</b> Pearson Syndrome
<b>[0434]</b> Walker-Warburg Syndrome	
<b>[0435]</b> Lissencephaly Variants with Other Anomalies	
<b>[0436]</b> Microlissencephaly	

- Molybdenum Cofactor Deficiency
- MTHFR Deficiency
- Mucopolipidosis I
- Mucopolipidosis II
- Mucopolipidosis IV
- Mucopolysaccharidosis Type I
- Mucopolysaccharidosis Type II
- Mucopolysaccharidosis Type IIIA
- Mucopolysaccharidosis Type IIIB
- Mucopolysaccharidosis Type IIIC
- Mucopolysaccharidosis Type IIID
- Mucopolysaccharidosis Type IVA
- Mucopolysaccharidosis Type IVB
- Mucopolysaccharidosis Type VI
- Mucopolysaccharidosis Type VII
- Multiple Endocrine Neoplasia Type 1
- Multiple Endocrine Neoplasia Type 2
- [0459] Familial Medullary Thyroid Carcinoma
- [0460] Multiple Endocrine Neoplasia Type 2A
- [0461] Multiple Endocrine Neoplasia Type 2B
- Multiple Epiphyseal Dysplasia
- Myoclonic Epilepsy of Unverricht and Lundborg
- Myotonia Congenita, Dominant
- Myotonic Dystrophy
- [0462] Myotonic Dystrophy Type 1
- [0463] Myotonic Dystrophy Type 2
- Myotubular Myopathies
- [0464] Myotubular Myopathy, Dominant
- [0465] Myotubular Myopathy, Recessive
- [0466] Myotubular Myopathy, X-Linked
- [0467] Myotubular Myopathy Type 1
- Narcolepsy
- Nephrogenic Diabetes Insipidus
- [0468] Nephrogenic Diabetes Insipidus, Autosomal
- [0469] Nephrogenic Diabetes Insipidus, X-Linked
- Nephronophthisis
- [0470] Nephronophthisis, Adolescent
- [0471] Nephronophthisis, Infantile
- [0472] Nephronophthisis, Juvenile
- Netherton Syndrome
- Neurofibromatosis 1
- Neuronal Ceroid-Lipofuscinoses
- [0473] Neuronal Ceroid-Lipofuscinosis, Adult
- [0474] Neuronal Ceroid-Lipofuscinosis, Infantile
- [0475] Neuronal Ceroid-Lipofuscinosis, Juvenile
- [0476] Neuronal Ceroid-Lipofuscinosis, Late Infantile
- [0477] Neuronal Ceroid-Lipofuscinosis, Late Infantile
- [0478] Neuronal Ceroid-Lipofuscinosis, Finnish Variant
- [0479] Neuronal Ceroid-Lipofuscinosis, Gypsy/Indian,
- [0480] Early Juvenile Variant
- Neuronal Ceroid-Lipofuscinosis, Turkish variant
- [0481] Northern Epilepsy
- Neutrophil Antigen Genotyping
- Nevoid Basal Cell Carcinoma Syndrome
- Niemann-Pick Disease Due to Sphingomyelinase Deficiency
- [0482] Niemann-Pick Disease Type A
- [0483] Niemann-Pick Disease Type B
- [0484] Niemann-Pick Disease Type C
- [0485] Niemann-Pick Disease Type C1
- [0486] Niemann-Pick Disease, Nova Scotia Type
- [0487] Niemann-Pick Disease Type C2
- Nijmegen Breakage Syndrome
- Non-Ketotic Hyperglycinemia
- Nonepidermolytic Palmoplantar Hyperkeratosis
- Noonan Syndrome
- Oculopharyngeal Muscular Dystrophy
- Organic Acidemias
- [0488] 3-Hydroxy-3-Methylglutaryl-Coenzyme A Lyase
- [0489] Glutaricacidemia Type 1
- [0490] Isovaleric Acidemia
- [0491] Ketothiolase Deficiency
- [0492] Maple Syrup Urine Disease
- [0493] Maple Syrup Urine Disease Type 1A
- [0494] Maple Syrup Urine Disease Type 1B
- [0495] Maple Syrup Urine Disease Type 2
- [0496] Methylmalonic Aciduria

Methylmalonic Acidemia cb1C Variant [0497] Propionic Acidemia	[0503] Polycystic Kidney Disease, Autosomal Recessive
Ornithine Transcarbamylase Deficiency	Porphyria Cutanea Tarda
Osteogenesis Imperfecta Type I	Potocki-Shaffer Syndrome
Osteogenesis Imperfecta Type II	Prader-Willi Syndrome
Osteogenesis Imperfecta Type III	Preeclampsia
Osteogenesis Imperfecta Type IV	Primary Pulmonary Hypertension
Osteopetrosis, Autosomal Dominant, Type II	Prion Disorders
Pachyonychia Congenita	[0504] Creutzfeldt-Jakob Disease
Paget Disease of Bone	[0505] Familial Fatal Insomnia
Pallidopontonigral Degeneration; PPND	[0506] Gerstmann-Straussler Disease
Papillary Renal Carcinoma	Progressive Familial Intrahepatic Cholestasis
Paraganglioma	[0507] Progressive Familial Intrahepatic Cholestasis 1
Parkin Type of Juvenile Parkinson Disease	[0508] Progressive Familial Intrahepatic Cholestasis 2
Periodic Paralyzes	PROP 1-Related Combined Pituitary Hormone Deficiency
[0498] Hyperkalemic Periodic Paralysis	[0509] Proximal Renal Tubular Acidosis with Ocular Abnormalities
[0499] Hypokalemic Periodic Paralysis	Pseudoachondroplasia
[0500] Hypokalemic Periodic Paralysis Type 1	Pseudoneonatal Adrenoleukodystrophy
[0501] Hypokalemic Periodic Paralysis Type 2	Pseudovitamin D Deficiency Rickets
Potassium-Sensitive Cardiodysrhythmic Type Periodic Paralysis	Pseudoxanthoma Elasticum
Periodontitis	Pulmonary Surfactant Protein B Deficiency
Peroxisomal Bifunctional Enzyme Deficiency	Pycnodysostosis
Phosphoglycerate Kinase Deficiency	Pyridoxine-Dependent Seizures
Phosphoglycerate Mutase Deficiency	Pyruvoyltetrahydropterin Synthase Deficiency
Phosphorylase Kinase Deficiency of Liver and Muscle	Red Cell Antigens
Platelet Antigen Genotyping	[0510] Duffy Antigen Genotyping
PLOSL	[0511] Kell Antigen Genotyping
Polycystic Kidney Disease	[0512] Kidd Genotyping
[0502] Polycystic Kidney Disease, Autosomal Dominant	[0513] M Antigen Genotyping
Polycystic Kidney Disease 1, Autosomal Dominant	[0514] Rh C Genotyping
Polycystic Kidney Disease 2, Autosomal Dominant	[0515] Rh D Genotyping
Polycystic Kidney Disease 3, Autosomal Dominant	[0516] Rh E Genotyping
	[0517] S Antigen Genotyping
	Retinitis Pigmentosa
	[0518] Retinitis Pigmentosa, Autosomal Dominant
	[0519] Retinitis Pigmentosa, Autosomal Recessive

Retinitis Pigmentosa, Autosomal Recessive, Bothnia Type	Spinal Muscular Atrophy with Respiratory Distress 1
Retinitis Pigmentosa, X-Linked	Split-Hand/Foot Malformation, Type 4
Retinoblastoma	Spondyloepimetaphyseal Dysplasia, Strudwick Type
Rett Syndrome	Spondyloepiphyseal Dysplasia Tarda, X-Linked
Rhizomelic Chondrodysplasia Punctata	Steatocystoma Multiplex
[0520] Rhizomelic Chondrodysplasia Punctata Type 1	Succinic Semialdehyde Dehydrogenase Deficiency
[0521] Rhizomelic Chondrodysplasia Punctata Type 2	Sulfatidosis, Juvenile, Austin Type
[0522] Rhizomelic Chondrodysplasia Punctata Type 3	Thanatophoric Dysplasia Type I
Rod Monochromacy	Thanatophoric Dysplasia Type II
Rothmund-Thomson Syndrome	Thrombophilia
Russell-Silver Syndrome	[0531] Factor V Leiden Thrombophilia
Saethre-Chotzen Syndrome	[0532] Factor V R2 Mutation Thrombophilia
Salla Disease	[0533] MTHFR Thermolabile Variant
Sclerosteosis	[0534] Prothrombin G20210A Thrombophilia
Sex-Determining Region Y	Thyroid Hormone Resistance
Short Chain 3-Hydroxyacyl-CoA Dehydrogenase Deficiency,	Townes-Brocks Syndrome
Short Chain Acyl-CoA Dehydrogenase Deficiency	Transthyretin Amyloidosis
Short Stature	[0535] Familial Amyloid Cardiomyopathy
Shox Deficiency	[0536] Familial Amyloid Polyneuropathy Type I (Portuguese-Swedish-Japanese type)
Simpson-Golabi-Behmel Syndrome	[0537] Familial Amyloid Polyneuropathy Type II (Indiana/Swiss or Maryland/German type)
Sitosterolemia	[0538] Familial Oculoleptomeningeal Amyloidosis
Sjogren-Larsson Syndrome	[0539] Leptomeningeal Amyloidosis Trichorhinophalangeal Syndrome Type I
Smith-Magenis Syndrome	Trichothiodystrophy
Specialized Cytogenetics Services	Tuberous Sclerosis Complex
[0523] Telomere Analysis	[0540] Tuberous Sclerosis I
[0524] X Inactivation Studies	[0541] Tuberous Sclerosis II
Spinal and Bulbar Muscular Atrophy	[0542] Type II Collagenopathies
Spinal Muscular Atrophy	[0543] Achondrogenesis Type II
[0525] Arthrogryposis multiplex congenita	[0544] Kniest Dysplasia
[0526] Congenital axonal neuropathy	[0545] Spondyloepiphyseal Dysplasia
[0527] Spinal Muscular Atrophy I	[0546] Spondyloepiphyseal Dysplasia, Congenita
[0528] Spinal Muscular Atrophy II	[0547] Stickler Syndrome Type I
[0529] Spinal Muscular Atrophy III	Tyrosinemia Type I
[0530] Spinal Muscular Atrophy IV	Tyrosinemia Type II
	Uniparental Disomy Testing, General
	van Buchem Disease
	Variagate Porphyria
	Very Long Chain Acyl-CoA Dehydrogenase Deficiency
	Vohwinkel Syndrome
	Von Hippel-Lindau Syndrome
	Von Willebrand Disease
	[0548] Von Willebrand Disease Type 2A
	[0549] Von Willebrand Disease Type 2B

[0550] Von Willebrand Disease Type 2M  
 [0551] Von Willebrand Disease Type 2N (Normandy)

White Sponge Nevus of Cannon

Williams Syndrome

Wilson Disease

Wiskott-Aldrich Syndrome

Wolf-Hirschhorn Syndrome

Wolman Disease

X-Linked Adrenal Hypoplasia Congenita

X-Linked Agammaglobulinemia

Xeroderma Pigmentosa

Y Chromosome Deletion

[0552] Sertoli Cell Only Syndrome

[0553] Y Chromosome Detection/Molecular Genetics  
 Zellweger syndrome

Zonular Pulverulent Cataract

#### Example 2

##### Integrated Instrument to Obtain Informed Consent for Genetic Tests for Cystic Fibrosis

[0554] Genetic testing for cystic fibrosis is now recommended for all caucasian couples anticipating childbearing. There are currently ~4 million pregnancies/year. Laws in several states require that informed consent be obtained for all genetic tests. Most primary care physicians and OB/GYNs have little training in genetics and limited ability to provide information and instruction to patients concerning genetic tests for cystic fibrosis, the utility and interpretation of test results, the procedures governing genetic testing and genetic information, the social, medical, and psychological implications of testing, and the balance of risk and benefit involved in having such tests performed. The instruments and methods described in this invention enable healthcare practitioners with little training or knowledge of genetics to obtain a meaningful informed consent using validated and integrated elements for providing information and instruction to individuals, collecting a personal medical and family history, assessing the individual's retention and comprehension of information concerning the genetic test, certifying the individual's consent for the test, establishing a proper medical record, and properly processing the sample.

[0555] The integrated instrument contains an instruction element which includes stepwise directions to the practitioner in the process of obtaining an informed consent and provides text and illustrative materials that the practitioner can use to explaining the test, the test procedures, and its consequences to the individual. The instrument also contains text and illustrative materials designed for individuals that constitutes a reliable and understandable source of information about the test. A collection element constitutes a worksheet that can be used by the practitioner and individual to construct a personal medical and family history. The worksheet contains specific

questions about the individual's racial make-up, and the racial make-up of the individual's family (siblings, parents, siblings of the parents, grandparents and siblings of the grandparents, and so on), the individual's health status and the health status and history of the individual's family. An assessment element enables the provider to assess the individual's retention of information. It comprises a series of questions about the reasons for the test, the test procedures, the possible test results and the meaning of the test results and basic question about cystic fibrosis. The certification element enables the individual to indicate their permission for testing to be performed and for this permission to be witnessed, it includes a written document that states that the individual has reviewed and understands the information transmitted in the information element and includes blank signature lines for the individual's signature, and the signatures of the practitioner and the witness. Other elements assist in establishing a medical record, labeling the sample, and billing for the cost of the test. The instrument is validated through clinical trials which establish that the language comprising the information element and the procedures established in the instruction element are effective in establishing the requisite level of understanding required for an individual to provide a valid informed consent. Table I below sets forth the contents of an exemplary informed consent instrument for Cystic Fibrosis testing.

#### Example 3

##### Integrated Instrument to Obtain Informed Consent for Genetic Tests for Alzheimer's Disease

[0556] Genetic testing for genes involved in Alzheimer's Disease can be performed for individuals with early symptoms of dementia or asymptomatic individuals with a family history of the disease. While Alzheimer's Disease is highly genetic (i.e., it exhibits high heritability) it is also polygenic, meaning many different genes may be involved in its etiology. Genetic tests for variances in apolipoprotein E (apoE4) are associated with a more rapid progression of Alzheimer's disease, and variations in the genes for amyloid precursor protein, antichymotrypsin, and presenillin have also been associated with the disease. The genetics of the disease and determinations of risk based on family history and genetic test results currently requires specialized training in genetics. Most primary care physicians do not have the training to instruct patients in the genetics of Alzheimer's Disease, use of genetic information to assess their risk of Alzheimer's Disease the social, medical, and psychological implications of testing, and the balance of risk and benefit involved in having such tests performed.

[0557] The instruments and methods described in this invention enable healthcare practitioners with little training or knowledge of genetics to obtain a meaningful informed consent using validated and integrated elements for providing information and instruction to individuals, collecting a personal medical and family history, assessing the individual's retention and comprehension of information concerning the genetic test, certifying the individual's consent for the test, establishing a proper medical record, and properly processing the sample. These elements comprise a booklet with information about Alzheimer's Disease and the role of genetic testing written at an 8<sup>th</sup> grade level for the patients and give the practitioner stepwise directions and explicit language to use in explaining the genetics of Alzheimer's Disease, dia-

grams illustrating the natural course of early and late forms of Alzheimer's Disease and the characteristic patterns of inheritance of polygenetic disorders, as well as reference information and answers to frequently asked questions. The instrument also helps the practitioner collect a family history and provides a worksheet that can be used to make a quantitative assessment of genetic risk based on this history. These elements are validated through clinical trials which establish that the language comprising the information element and the procedures established in the instruction element are effective in establishing the requisite level of understanding required for an individual to provide a valid informed consent. Other elements help the provider to assess the individual's retention of information, enable the individual to certify their consent, establish a medical record, label the sample, and arrange payment for the test. Table II below sets forth the contents of an exemplary informed consent instrument for Alzheimer's Disease risk.

#### Example 4

##### Integrated Instrument to Obtain Informed Consent for Genetic Tests for Risk of Stroke

**[0558]** Stroke and other symptomatic manifestations of cardiovascular disease can be caused by several different genetic variations. These different forms of cardiovascular disease may require different therapies. For example, variances in apolipoprotein E, LDL, or LDL-R can lead to increased levels of cholesterol and require therapy with diet and drugs aimed at lowering cholesterol. Variances in methylenetetrahydro-folatereductase may increase levels of homocysteine and require therapy with diet and folate aimed at lowering cholesterol. Variances in the angiotensinogen gene may lead to cardiovascular disease due to imbalances of salt and require therapy with diet, salt restriction, or diuretics aimed at reducing the salt load. Variances in genes involved in the clotting cascade, particularly factor V, may predispose to blood clots and stroke which may be treated with anti-coagulants and anti-thrombotics. Other genetic tests for cardiovascular disease are currently in research and development. To provide informed consent for such tests, the practitioner reviews the patient's family history to make a preliminary calculation of genetic risk and identify likely candidates for such risk (e.g. history of high cholesterol or thrombosis). Based on this information the practitioner may recommend one or more genetic tests that could be used to customize measures to prevent cardiovascular disease and stroke. Most primary care physicians do not have the sufficient training or knowledge of recent developments in cardiovascular genetics to make such determinations and counsel patients in the potential use of genetic information in the prevention of cardiovascular disease.

**[0559]** The instruments and methods described in this invention enable healthcare practitioners with little training or knowledge of genetics to obtain a meaningful informed consent using validated and integrated elements for providing information and instruction to individuals, collecting a personal medical and family history, assessing the individual's retention and comprehension of information concerning the genetic test, certifying the individual's consent for the test, establishing a proper medical record, and properly processing the sample. These elements comprise a booklet with information about the genetic and non-genetic factors that contribute to stroke written at an 8<sup>th</sup> grade level for the patients and

give the practitioner stepwise directions and explicit language to use in explaining the genetics of stroke, diagrams illustrating the different factors that contribute to stroke, as well as reference information and answers to frequently asked questions. The instrument also helps the practitioner collect a family history and provides a worksheet that can be used to make a quantitative assessment of genetic risk based on this history. These elements are validated through clinical trials which establish that the language comprising the information element and the procedures established in the instruction element are effective in establishing the requisite level of understanding required for an individual to provide a valid informed consent. Other elements help the provider to assess the individual's retention of information, enable the individual to certify their consent, establish a medical record, label the sample, and arrange payment for the test. The method comprises procuring a booklet that comprises the instrument. The information element is separated from the booklet and given to the patient. The practitioner follows directions in the instruction element to guide the patient through information concerning the etiology of stroke, genetic tests that may be useful in identifying genetic risk factors for stroke, and the process and consequences of performing a test. The practitioner uses a check list to indicate the completion of each step of the process. The practitioner then uses the collection element to collect a personal family and medical history and a worksheet within this element to make a determination of the patient's genetic risk. An assessment of the patient's retention and understanding of the information is made using the assessment instrument, and, when an acceptable level of understanding is demonstrated, the patient signs an informed consent form with witnesses from the certification element according to directions in the instruction element. Carbon copies of the checklist, assessment, and certification are made onto a recording element coincident with the original signatures, and this element is placed in the patient's medical record as described in the instruction element. The sample is labeled with an adhesive backed label that is separated from the back cover of the instrument as described in the instruction element, and the invoice is separated from the instrument and given to the patient. Table III sets forth the contents of an exemplary informed consent instrument for genetic risk of stroke.

#### Example 5

##### Integrated Instrument to Obtain Informed Consent for Pharmagenetic Testing

**[0560]** Genetic variation in genes that are responsible for drug metabolism may alter the safety and efficacy of these medications for an individual. These tests may, for example, identify individuals who are refractory to the pain-killing effects of codeine, individuals who are at risk from undue toxicity from various neuro-psychiatric drugs, and individuals who are at risk of abnormally high levels of warfarin. CYP2D6 and CYP3C9 are two examples of genes that may be tested to help guide the choice of pharmaceutical therapy. Genetic tests for pharmacogenetic testing will commonly be performed by the prescribing physician who may have little or no training in genetics and in situations where professional genetics support may not be available. While the genetic predisposition to adverse drug events or drug resistance may not raise some of the ethical issues that surround genetic tests for disease predisposition, informed consent is, nevertheless,

necessary regarding issues such as sample handling, DNA banking, and the privacy of genetic records. Accordingly, physicians need to have an effective method for providing individuals with information concerning the test, how the test results can be used, and how follow-up may be maintained, instructing the individual concerning the handling of the sample and information from the genetic test, and obtaining a valid informed consent.

[0561] The instruments and methods described in this invention enable healthcare practitioners with little training or knowledge of genetics to obtain a meaningful informed consent using validated and integrated elements for providing information and instruction to individuals. These elements comprise a booklet with information about genetic effects on drug action and the process of genetic testing written at an 8<sup>th</sup> grade level for the patients and give the practitioner stepwise directions and explicit language to use in explaining how this information could be used to improve the choice of the medication and the dose that will be prescribed. The instrument also contains an assessment to determine the individual's comprehension and retention of information concerning the test and testing procedures. These information element and instruction element also contain materials relating to a follow-up service through which individuals are contacted with regular updates concerning new medications and how these medications are affected by genetic variations. Individuals are asked to indicate their consent for such contacts by the service or to formally reject such contacts in the certification element. The choice whether or not to participate in the follow-up program is also noted in the recording element. If the individual chooses to participate, this element will also include contact information for such follow-up and copies of this element will be recorded automatically with the follow-up service. The billing element is used to pay both for the genetic tests that are to be performed and for an initial subscription to this service. Also included in the instrument are elements for labeling of the sample. Table IV below sets forth the contents of an exemplary informed consent instrument for pharmacogenetic testing.

#### REFERENCES

- [0562] Code Of Federal Regulations—§46.116, 46.117
- [0563] Elias S, Annas G J. Generic consent for genetic screening. *N Engl J Med* 1994; 330:1611-1613
- [0564] Andrews L B, Fullarton J E, Holtzman N A, Motulsky A G, eds. *Assessing genetic risks: implications for health and social policy*. Washington, D.C.: National Academy Press, 1994
- [0565] Ciske D J, Haavisto A, Laxova A, Rock L Z, Farrell P M. Genetic counseling and neonatal screening for cystic fibrosis: an assessment of the communication process. *Pediatrics* 2001 April; 107(4):699-705
- [0566] Andrews L B., Compromised consent: deficiencies in the consent process for genetic testing. *J Am Med Womens Assoc* 1997 Winter; 52(1):39-42
- [0567] Hofman K J, Tambor E S, Chase G A, Geller G, Faden R R, Holtzman N A., Physicians' knowledge of genetics and genetic tests. *Acad Med* 1993 August; 68(8): 625-32
- [0568] Cho M K, Arruda M, Holtzman N A., Educational material about genetic tests: does it provide key information for patients and practitioners? *Am J Med Genet* 1997 Dec. 19; 73(3):314-20
- [0569] Robertson J A., Consent and privacy in pharmacogenetic testing. *Nat Genet* 2001 July; 28(3):207-9
- [0570] Geller G, Strauss M, Bernhardt B A, Holtzman N A., "Decoding" informed consent. Insights from women regarding breast cancer susceptibility testing. *Hastings Cent Rep* 1997, March-April; 27(2):28-33
- [0571] Rieger P T, Pentz R D., Genetic testing and informed consent. *Semin Oncol Nurs* 1999 May; 15(2):104-15
- [0572] U.S. Pat. No. 6,149,440 entitled Methods and Apparatus for Authenticating Informed Consent
- [0573] U.S. Pat. No. 5,999,909 entitled Methods for Establishing a Certifiable Informed Consent For A Procedure
- [0574] U.S. Pat. No. 5,799,282 entitled Methods for Establishing Certifiable Informed Consent For A Medical Procedure
- I claim:
1. An instrument for obtaining from an individual informed consent to a genetic test, said instrument comprising:
    - (a) an information element;
    - (b) an instruction element, integrated with said information element; and
    - (c) a certification element, integrated with said instruction and said information elements.
  2. An instrument according to claim 1 wherein said genetic test is selected from the group consisting of a test for one gene, a test for more than one gene, a test for related genes, a test for genes associated with a specified clinical outcome and a gene screen test.
  3. An instrument according to claim 1 comprising at least one additional element selected from the group consisting of a collection element, an assessment element, a labeling element, a billing element, a recording element, a training element, a quality control element, and an indemnification element.
  4. An instrument according to claim 3 wherein said additional element comprises an assessment element.
  5. An instrument according to claim 3 wherein said additional element comprises a collection element.
  6. An instrument according to claim 3 wherein said additional elements comprise an assessment element and a collection element.
  7. An instrument according to claim 6, additionally comprising at least one element selected from the group consisting of a labeling element, a billing element, a recording element, a training element, a quality control element and an indemnification element.
  8. An instrument for obtaining from an individual informed consent to a genetic test, said instrument comprising:
    - (a) an information element;
    - (b) an instruction element, integrated with said information element;
    - (c) a certification element, integrated with said instruction and said information elements;
    - (d) an assessment element, integrated with said information and said instruction elements; and
    - (e) a collection element, integrated with said information and said instruction elements.
  9. An instrument according to claim 8 wherein said genetic test is selected from the group consisting of a test for one gene, a test for more than one gene, a test for related genes, a test for genes associated with a specified clinical outcome and a gene screen test.
  10. A method for obtaining informed consent to a genetic test from an individual comprising the steps of:

- (a) procuring an integrated instrument for obtaining informed consent to the genetic test, said instrument including an information element, an instruction element integrated with said information element, and a certification element integrated with said information and said instruction elements;
- (b) conveying to the individual information concerning said genetic test using said information element;
- (c) instructing an individual according to the directions contained in said instruction element; and
- (d) certifying the individual's consent for said test using said certification element.

**11.** The method according to claim **10**, wherein said integrated instrument additionally includes a collection element integrated with said information and said instruction elements, and said method comprises the additional step of collecting a personal medical history and family history using said collection element.

**12.** The method according to claim **10** wherein said integrated instrument additionally includes an assessment element integrated with said information and said instruction elements, and said method comprises the additional step of assessing the individual's retention or comprehension of the information using said assessment element.

**13.** The method according to claim **10** wherein said integrated instrument additionally includes a labeling element integrated with said information and said instruction elements, and said method includes the additional step of labeling a sample with the identity of the individual using said labeling element.

**14.** The method according to claim **10** wherein said integrated instrument additionally includes a recording element integrated with said information and said instruction ele-

ments, and said method includes the additional step of recording information concerning the informed consent process using said recording element.

**15.** A method for obtaining informed consent to a genetic test from an individual comprising the steps of:

- (a) procuring an integrated instrument for informed consent to a genetic test, said instrument including an information element, an instruction element integrated with said information element, a certification element integrated with said information and said instruction elements, a collection element integrated with said information and said instruction elements, and an assessment element integrated with said information and said instruction elements;
- (b) conveying to the individual information concerning said genetic test using said information element;
- (c) instructing an individual according to the directions contained in said instruction element;
- (d) certifying the individual's consent for said test using said certification element;
- (e) collecting a personal medical history and family history using said collection element; and
- (f) assessing the individual's retention or comprehension of the information using said assessment element.

**16.** The method according to claim **10** wherein said genetic test is selected from the group consisting of a test for one gene, a test for more than one gene, a test for related genes, a test for genes associated with a specified clinical outcome and a gene screen test.

**17.** The method according to claim **15** wherein said genetic test is selected from the group consisting of a test for one gene, a test for more than one gene, a test for related genes, a test for genes associated with a specified clinical outcome and a gene screen test.

\* \* \* \* \*