

METHODS FOR SAMPLE QUALITY ASSESSMENT

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application claims the benefit of priority of US Provisional Application No. 63/334,156, filed April 24, 2022, which is incorporated by reference herein in its entirety for any purpose.

FIELD OF THE INVENTION

[0002] The present application relates generally to the detection of biomarkers and a method of evaluating the quality or suitability of a sample or set of samples for use in biomarker discovery or in a medical evaluation of a subject, such as a diagnostic assay.

BACKGROUND

[0003] Blood contains various cellular and humoral systems for reacting to injury or foreign and infectious agents. Small challenges can induce the innate immune system (complement system and cells such as macrophages) to release signals and enzymes, lead to activation of the platelets and trigger the coagulation of the blood. These signals are of interest because they can be directly involved in defense and repair systems and serve as markers for disease. However, such process signals may also be responsive to the effects of blood sample preparation or processing. If cells in the samples lyse, if platelets degranulate, or if the complement system is activated, then changes in analyte concentration may occur in the sample after it has been taken, and a “high fidelity” measurement technique may detect them. Merely exposing blood to air can result in unintended activation of these mechanisms. Thus, altering the time of sample processing steps can alter the apparent composition of serum or plasma such that physiologic information is masked by the pre-analytic variability imparted on the sample during collection and processing. The susceptibility of these processes and proteins to subtle alterations in sample handling can compromise the use of them as biomarkers.

[0004] Currently, researchers in multivariate biology are concerned about pre-analytical sample variation (often called “batch effects”). The extent to which sample quality can be determined is largely limited to visually obvious changes, such as red color indicating red cell lysis and cloudiness indicating high lipid or other contaminants. These relatively crude methods limit the reliability of all but the hardest and most robust protein

measurements. Ostroff, R. et al. (2010) J. Proteomics 73:649-666, documents some of the complex and nonlinear effects of variations in serum and plasma preparation.

[0005] Specific techniques to determine compliance with sample processing protocols are needed to monitor compliance, reject low quality samples, and/or make corrections in analytes of interest. Such techniques would improve evaluation of the quality of human or animal blood samples used in biomarker research, clinical diagnostic applications, bio-banks, and drug development.

SUMMARY OF THE INVENTION

[0006] The present application includes biomarkers, methods, reagents, devices, systems, and kits for assessing sample quality. The biomarkers of the present application were identified using linear regression of measurements of a specific set of proteins affected by variation in sample processing protocol. In some embodiments, the biomarker panels comprise proteins that are sensitive to sample handling.

[0007] In some embodiments, the methods comprise detecting the biomarkers using a multiplex slow off-rate aptamer-based assay described herein, for example, for assessing sample quality. In some embodiments, the sample is a blood sample, plasma sample, serum sample, or urine sample. In some embodiments, the sample is a plasma sample or a serum sample.

[0008] In some embodiments, the number of times a sample is frozen and thawed (freeze-thaw cycle) is predicted or estimated. In some embodiments, the sample processing steps include one or more of sample centrifugation, decanting or aspirating of the centrifuged supernatant, and freezing the decanted or aspirated sample.

[0009] In some embodiments, methods of assessing quality of a sample collected from a subject are provided, the method comprising detecting the level of each of N biomarker proteins in the sample, wherein N is at least 1, and wherein at least 1 of the N biomarker proteins are selected from Keratin-1, KRT5, PUR8, TEX29, RIC8A, LANC2, Glyoxalase I, PGP, FBXL4, SLAF1, CASQ1, wherein the sample is a plasma sample.

[0010] In some embodiments, methods comprises measuring the level of each of N biomarker proteins in a plasma sample from a subject are provided, wherein N is at least 1, and wherein at least 1 of the N biomarker proteins are selected from Keratin-1, KRT5, PUR8, TEX29, RIC8A, LANC2, Glyoxalase I, PGP, FBXL4, SLAF1, CASQ1, and identifying the sample as an analysis sample or negative sample based on the level of the N biomarker proteins, wherein the analysis sample is a sample that is suitable for use in one or more of the

following: protein biomarker discovery analysis, protein expression level analysis, a diagnostic method or a prognostic method, and the negative sample is a sample that is not suitable for use as an analysis sample. In some embodiments, the sample was frozen and thawed prior to the detecting. In some such embodiments, the number of times the sample was frozen and thawed prior to the detecting is determined.

[0011] In some embodiments, methods are provided. The methods comprising a) contacting a serum sample from a subject with a set of capture reagents, wherein each capture reagent has affinity for a different biomarker protein of N biomarker proteins wherein N is at least 1, and wherein at least 1 of the N biomarker proteins is selected from Keratin-1, KRT5, PUR8, TEX29, RIC8A, LANC2, Glyoxalase I, PGP, FBXL4, SLAF1, CASQ1; and b) measuring the level of each N biomarker protein with the set of capture reagents.

[0012] In some embodiments, methods are provided for comparing a plurality of samples collected from a plurality of subjects comprising detecting the level of each of N biomarker proteins in each of the plurality of samples, wherein N is at least 1, and wherein at least 1 of the N biomarker proteins are selected Keratin-1, KRT5, PUR8, TEX29, RIC8A, LANC2, Glyoxalase I, PGP, FBXL4, SLAF1, CASQ1, wherein the sample is a plasma sample. In some embodiments, methods comprise a) determining the number of freeze-thaw cycles and b) comparing the determined number freeze-thaw cycles for each of the plurality of samples. In some embodiments, methods comprise identifying the plurality of samples as handled consistently or inconsistently, wherein samples handled consistently all have a determined number of freeze-thaw cycles within 1, 2, 3, 4 or 5 freeze-thaw cycles of each other. In some embodiments, the determining is based on comparing the detected levels of each of the N biomarker proteins to reference levels, wherein the reference levels are average levels of each of the N biomarker proteins present in samples having 1 freeze-thaw cycle or 2 freeze-thaw cycles. In some embodiments, the detected levels of each of the N biomarker proteins compared to the reference levels indicates that the number of freeze-thaw cycles was greater than 1, greater than 2, greater than 3, greater than 4, greater than 5, greater than 7 or greater than 10 freeze-thaw cycles; or wherein the levels of each of the N biomarker proteins used in a linear regression model predicts the number of freeze-thaw cycles was greater than 1, greater than 2, greater than 3, greater than 4, greater than 5, greater than 7 or greater than 10 freeze-thaw cycles. In some embodiments, the determining is based on a panel of N biomarker proteins having an R^2 value of at least 0.600, at least 0.650, at least 0.700, at least 0.750, at least 0.800, at least 0.850, at least 0.900, or at least 0.950.

[0013] In some embodiments, the methods comprise performing protein biomarker discovery analysis, protein expression level analysis, a diagnostic method or a prognostic method on the plurality of samples. In some embodiments, the methods comprise modifying a panel of proteins in the protein biomarker discovery analysis, the protein expression level analysis, the diagnostic method or the prognostic method based on the determined number of freeze-thaw cycles for each of the plurality of samples; or identifying one or more proteins in the sample as being affected by the number of freeze-thaw cycles; or identifying the level of one or more proteins in the sample as being affected by the number of freeze-thaw cycles; or changing the proteins used in a diagnostic, a prognostic or a health assessment related test based on the predicted number of freeze-thaw cycles; removing the proteins used in a diagnostic, a prognostic or a health assessment related test based on the predicted number of freeze-thaw cycles. In some embodiments, the panel of biomarker proteins is reduced in number of biomarker proteins measured.

[0014] In some embodiments, the determining measures compliance with a clinical trial sample collection and processing protocol. In some embodiments, the plurality of samples are collected at more than one sample collection site. In some embodiments, the plurality of samples from a first sample collection site are compared to a second plurality of samples from a second sample collection site. In some embodiments, one or more of the plurality of samples may be removed based on the number of freeze-thaw cycles.

[0015] In some embodiments, methods are provided comprising detecting the level of each of N biomarker proteins in a sample, wherein N is at least 1, and wherein at least 1 of the N biomarker proteins is selected from Keratin-1, KRT5, PUR8, TEX29, RIC8A, LANC2, Glyoxalase I, PGP, FBXL4, SLAF1, CASQ1. In some embodiments, the sample is a serum sample. In some embodiments, the serum sample is a human serum sample. In some embodiments, the number of freeze-thaw cycles is determined with the level of each of the N biomarkers. In some embodiments, the number of freeze-thaw cycles was greater than 1, greater than 2, greater than 3, greater than 4, greater than 5, greater than 7 or greater than 10 freeze-thaw cycles. In some embodiments, the determined number of freeze-thaw cycles is derived from the input of the level of each of N biomarker proteins in a statistical model. In some embodiments, the statistical model is a linear regression model.

[0016] In some embodiments, methods are provided comprising detecting the level of each of at least 1, 2, 3, 4, 5, 6, 7, 8, 9, 10 or 11 biomarker proteins in a sample, wherein biomarker proteins are selected from Keratin-1, KRT5, PUR8, TEX29, RIC8A, LANC2, Glyoxalase I, PGP, FBXL4, SLAF1, CASQ1. In some embodiments, the sample is a serum

sample. In some embodiments, the serum sample is a human serum sample. In some embodiments, a number of freeze-thaw cycles is determined with the level of each of the at least 1, 2, 3, 4, 5, 6, 7, 8, 9, 10 or 11 biomarker proteins. In some embodiments, the number of freeze-thaw cycles was greater than 1, greater than 2, greater than 3, greater than 4, greater than 5, greater than 7 or greater than 10 freeze-thaw cycles. In some embodiments, the determined number of freeze-thaw cycles was greater than 1, greater than 2, greater than 3, greater than 4, greater than 5, greater than 7 or greater than 10 freeze-thaw cycles is derived from the input of the level each of the at least 1, 2, 3, 4, 5, 6, 7, 8, 9, 10 or 11 biomarker proteins in a statistical model. In some embodiments, the statistical model is a linear regression model. In some embodiments, the methods further comprise modifying a panel of proteins in a protein biomarker discovery analysis, a protein expression level analysis, a diagnostic method or a prognostic method; identifying one or more proteins in the sample as being affected; identifying the level of one or more proteins in the sample as being affected; changing the proteins used in a diagnostic, a prognostic or a health assessment related test; or removing one or more proteins used in a diagnostic, a prognostic or a health assessment related test, each based on the outcome of the linear regression model.

[0017] In some embodiments, methods of assessing quality of a sample collected from a subject comprise detecting N biomarker proteins, wherein one or more of the N biomarker proteins are associated with the number of times the sample was frozen and thawed prior to the detecting.

[0018] In some embodiments, N is 1, N is 2, N is 3, N is 4, N is 5, N is 6, N is 7, or N is 8, N is 9, N is 10, or N is 11. In embodiments, additional biomarkers are measured and N is 12, N is 13, N is 14, N is 15, N is 16, N is 17, N is 18, N is 19, or N is 20 or greater. In some embodiments, all of the N biomarker proteins are selected from the list in Table 1.

[0019] In some embodiments, the subject is a human subject. In some embodiments, the sample is a plasma or serum sample obtained from a whole blood sample. In some embodiments, the number of freeze-thaw cycles determined by a method herein is 1, 2, 3, 4, 5, 7, 10 or greater freeze-thaw cycles. In some embodiments, the method is performed *in vitro*. In some embodiments, the approximate duration of fasting time is derived from the input of the level of each of N biomarker proteins in a statistical model. In some embodiments, the statistical model is a linear regression model.

[0020]

[0021] In some embodiments, the sample is identified as passing a quality assessment or failing a quality assessment. In some such embodiments, the identifying is based, at least

in part, on the detected levels of the N biomarker proteins in the sample. In some embodiments, the identifying is based, at least in part, of the determined number of freeze-thaw cycles. In some embodiments, the sample undergoes further analysis if it is identified as passing quality assessment, or the sample is discarded if it is identified as failing the quality assessment.

[0022] In some embodiments, methods of assessing the quality of a plurality of samples are provided herein, comprising detecting the level of each of N biomarkers in a plurality of sample from a plurality of subjects. In some such embodiments, the number of freeze-thaw cycles is determined and compared across the plurality of samples. In some such embodiments, the consistency of sample handling across the plurality of samples is determined.

[0023] In some embodiments, the method comprises contacting biomarker proteins of the sample from the subject with a set of capture reagents, wherein each capture reagent of the set of capture reagents specifically binds to one biomarker protein being detected. In some embodiments, the method comprises contacting biomarker proteins of the sample from the subject with a set of capture reagents, wherein each capture reagent of the set of capture reagents specifically binds to a different biomarker protein being detected. In some embodiments, each capture reagent is an antibody or an aptamer. In some embodiments, each biomarker capture reagent is an aptamer. In some embodiments, at least one aptamer is a slow off-rate aptamer. In some embodiments, at least one slow off-rate aptamer comprises at least 1, at least 2, at least 3, at least 4, at least 5, at least 6, at least 7, at least 8, at least 9, or at least 10 nucleotides with modifications. In some embodiments, each slow off-rate aptamer binds to its target protein with an off rate ($t_{1/2}$) of ≥ 30 minutes, ≥ 60 minutes, ≥ 90 minutes, ≥ 120 minutes, ≥ 150 minutes, ≥ 180 minutes, ≥ 210 minutes, or ≥ 240 minutes.

[0024] In some embodiments, a kit is provided, the kit comprising N biomarker protein capture reagents, wherein N is at least 1 and at least 1 of the capture reagents bind to Keratin-1, KRT5, PUR8, TEX29, RIC8A, LANC2, Glyoxalase I, PGP, FBXL4, SLAF1, CASQ1. In some embodiments, each capture reagent binds to a different biomarker protein. In some embodiments, N is 1, N is 2, N is 3, N is 4, N is 5, N is 6, N is 7, N is 8, N is 9, N is 10, N is 11, N is 12, N is 13, N is 14, N is 15, N is 16, N is 17, N is 18, N is 19, or N is 20. In some embodiments, the kit comprises capture reagents from multiple sample processing panels.

[0025] In some embodiments, each of the N biomarker protein capture reagents specifically binds to a biomarker protein selected from Table 1. In some embodiments, each

of the N biomarker capture reagents is an antibody or an aptamer. In some embodiments, each biomarker capture reagent is an aptamer. In some embodiments, at least one aptamer is a slow off-rate aptamer. In some embodiments, at least one slow off-rate aptamer comprises at least 1, at least 2, at least 3, at least 4, at least 5, at least 6, at least 7, at least 8, at least 9, or at least 10 nucleotides with modifications. In some embodiments, each slow off-rate aptamer binds to its target protein with an off rate ($t_{1/2}$) of ≥ 30 minutes, ≥ 60 minutes, ≥ 90 minutes, ≥ 120 minutes, ≥ 150 minutes, ≥ 180 minutes, ≥ 210 minutes, or ≥ 240 minutes. In some embodiments, the kit is for use in detecting the N biomarker proteins in a sample from a subject. In some embodiments, the kit is for use in assessing the quality of the sample or a plurality of samples.

BRIEF DESCRIPTION OF THE DRAWINGS

[0026] Fig. 1 illustrates a nonlimiting exemplary computer system for use with various computer-implemented methods described herein.

[0027] Fig. 2 illustrates a nonlimiting exemplary aptamer assay that can be used to detect one or more biomarkers in a biological sample.

[0028] Figs. 3-5 show certain exemplary modified pyrimidines that may be incorporated into aptamers, such as slow off-rate aptamers.

DETAILED DESCRIPTION

[0029] While the invention will be described in conjunction with certain representative embodiments, it will be understood that the invention is defined by the claims, and is not limited to those embodiments.

[0030] One skilled in the art will recognize many methods and materials similar or equivalent to those described herein may be used in the practice of the present invention. The present invention is in no way limited to the methods and materials described.

[0031] Unless defined otherwise, technical and scientific terms used herein have the meaning commonly understood by one of ordinary skill in the art to which this invention belongs. Although any methods, devices, and materials similar or equivalent to those described herein can be used in the practice of the invention, certain methods, devices, and materials are described herein.

[0032] All publications, published patent documents, and patent applications cited herein are hereby incorporated by reference to the same extent as though each individual

publication, published patent document, or patent application was specifically and individually indicated as being incorporated by reference.

[0033] As used herein, the terms “comprises,” “comprising,” “includes,” “including,” “contains,” “containing,” and any variations thereof, are intended to cover a non-exclusive inclusion, such that a process, method, product-by-process, or composition of matter that comprises, includes, or contains an element or list of elements may include other elements not expressly listed.

[0034] “Biological sample”, “sample”, and “test sample” are used interchangeably herein to refer to any material, biological fluid, tissue, or cell obtained or otherwise derived from an individual. This includes blood (including whole blood, leukocytes, peripheral blood mononuclear cells, buffy coat, plasma, and serum), sputum, tears, mucus, nasal washes, nasal aspirate, urine, saliva, peritoneal washings, ascites, cystic fluid, glandular fluid, lymph fluid, bronchial aspirate, synovial fluid, joint aspirate, organ secretions, cells, a cellular extract, and cerebrospinal fluid. This also includes experimentally separated fractions of all of the preceding. For example, a blood sample can be fractionated into serum, plasma, or into fractions containing particular types of blood cells, such as red blood cells or white blood cells (leukocytes). In some embodiments, a sample is a plasma sample. As used herein, a “plasma sample” comprises plasma and, optionally, one or more preservatives or additives. A plasma sample is isolated from whole blood and therefore does not comprise a substantial amount of any other blood component. In some embodiments, a sample is a serum sample. As used herein, a “serum sample” comprises serum and, optionally, one or more preservatives or additives. A serum sample is isolated from whole blood and therefore does not comprise a substantial amount of any other blood component. In some embodiments, a sample is a urine sample. As used herein, a “urine sample” comprises urine and, optionally, one or more preservatives or additives. In some embodiments, a blood sample is a dried blood spot. In some embodiments, a plasma sample is a dried plasma spot. In some embodiments, a sample can be a combination of samples from an individual, such as a combination of a tissue and fluid sample. The term “biological sample” also includes materials containing homogenized solid material, such as from a stool sample, a tissue sample, or a tissue biopsy, for example. The term “biological sample” also includes materials derived from a tissue culture or a cell culture. Any suitable methods for obtaining a biological sample can be employed; exemplary methods include, e.g., phlebotomy, swab (e.g., buccal swab), and a fine needle aspirate biopsy procedure. Exemplary tissues susceptible to fine needle aspiration include lymph node, lung, thyroid, breast, pancreas, and liver. Samples can

also be collected, e.g., by micro dissection (e.g., laser capture micro dissection (LCM) or laser micro dissection (LMD)), bladder wash, smear (e.g., a PAP smear), or ductal lavage. A “biological sample” obtained or derived from an individual includes any such sample that has been processed in any suitable manner after being obtained from the individual.

[0035] Further, in some embodiments, a biological sample may be derived by taking biological samples from a number of individuals and pooling them, or pooling an aliquot of each individual’s biological sample. The pooled sample may be treated as described herein for a sample from a single individual, and, for example, if a poor sample quality is established in the pooled sample, then each individual biological sample can be re-tested to determine which must be discarded, or the entire group of samples may be discarded if known to have been handled or processed in the same way.

[0036] For purposes of this specification, the phrase “data attributed to a biological sample from an individual” is intended to mean that the data in some form derived from, or were generated using, the biological sample of the individual. The data may have been reformatted, revised, or mathematically altered to some degree after having been generated, such as by conversion from units in one measurement system to units in another measurement system; but, the data are understood to have been derived from, or were generated using, the biological sample.

[0037] “Target”, “target molecule”, and “analyte” are used interchangeably herein to refer to any molecule of interest that may be present in a biological sample. A “molecule of interest” includes any minor variation of a particular molecule, such as, in the case of a protein, for example, minor variations in amino acid sequence, disulfide bond formation, glycosylation, lipidation, acetylation, phosphorylation, or any other manipulation or modification, such as conjugation with a labeling component, which does not substantially alter the identity of the molecule. A “target molecule”, “target”, or “analyte” refers to a set of copies of one type or species of molecule or multi-molecular structure. Exemplary target molecules include proteins, polypeptides, nucleic acids, carbohydrates, lipids, polysaccharides, glycoproteins, hormones, receptors, antigens, antibodies, affibodies, antibody mimics, viruses, pathogens, toxic substances, substrates, metabolites, transition state analogs, cofactors, inhibitors, drugs, dyes, nutrients, growth factors, cells, tissues, and any fragment or portion of any of the foregoing. In some embodiments, a target molecule is a protein, in which case the target molecule may be referred to as a “target protein.”

[0038] As used herein, a “capture agent” or “capture reagent” refers to a molecule that is capable of binding specifically to a biomarker. A “target protein capture reagent” refers to

a molecule that is capable of binding specifically to a target protein. Nonlimiting exemplary capture reagents include aptamers, antibodies, adnectins, ankyrins, other antibody mimetics and other protein scaffolds, autoantibodies, chimeras, small molecules, nucleic acids, lectins, ligand-binding receptors, imprinted polymers, avimers, peptidomimetics, hormone receptors, cytokine receptors, synthetic receptors, and modifications and fragments of any of the aforementioned capture reagents. In some embodiments, a capture reagent is selected from an aptamer and an antibody.

[0039] The term “antibody” refers to full-length antibodies of any species and fragments and derivatives of such antibodies, including Fab fragments, F(ab')₂ fragments, single chain antibodies, Fv fragments, and single chain Fv fragments. The term “antibody” also refers to synthetically-derived antibodies, such as phage display-derived antibodies and fragments, affibodies, nanobodies, etc.

[0040] As used herein, “marker” and “biomarker” are used interchangeably to refer to a target molecule that indicates or is a sign of a normal or abnormal process in an individual or of a high or low quality sample. More specifically, a “marker” or “biomarker” is an anatomic, physiologic, biochemical, or molecular parameter associated with the presence of a specific state or process. Biomarkers are detectable and measurable by a variety of methods including laboratory assays and medical imaging.

[0041] As used herein, “biomarker level” and “level” refer to a measurement that is made using any analytical method for detecting the biomarker in a biological sample and that indicates the presence, absence, absolute amount or concentration, relative amount or concentration, titer, a level, an expression level, a ratio of measured levels, or the like, of, for, or corresponding to the biomarker in the biological sample. The exact nature of the “level” depends on the specific design and components of the particular analytical method employed to detect the biomarker.

[0042] When a biomarker indicates or is a sign of a poor quality sample, that biomarker is generally described as being either over-expressed or under-expressed as compared to an expression level or value of the biomarker that indicates or is a sign of a normal or quality sample. “Up-regulation”, “up-regulated”, “over-expression”, “over-expressed”, and any variations thereof are used interchangeably to refer to a value or level of a biomarker in a biological sample that is greater than a value or level (or range of values or levels) of the biomarker that is typically detected in similar, properly handled biological samples.

[0043] "Down-regulation", "down-regulated", "under-expression", "under-expressed", and any variations thereof are used interchangeably to refer to a value or level of a biomarker in a biological sample that is less than a value or level (or range of values or levels) of the biomarker that is typically detected in similar, properly handled biological samples.

[0044] Further, a biomarker that is either over-expressed or under-expressed can also be referred to as being "differentially expressed" or as having a "differential level" or "differential value" as compared to a "normal" expression level or value of the biomarker that indicates or is a sign of a normal process or proper sample handling. Thus, "differential expression" of a biomarker can also be referred to as a variation from a "normal" expression level of the biomarker.

[0045] A "control level" of a target molecule refers to the level of the target molecule in a properly handled sample of the same sample type. Control level may refer to the average level of the target molecule in properly handled samples from a population of individuals.

[0046] As used herein, "individual," "subject," and "patient" are used interchangeably to refer to a mammal. A mammalian individual can be a human or non-human. In various embodiments, the individual is a human. A healthy or normal individual is an individual in which the disease or condition of interest (including, for example, chronic heart failure and cardiovascular events such as myocardial infarction, stroke and hospitalization for heart failure) is not detectable by conventional diagnostic methods.

[0047] As used herein, "detecting" or "determining" with respect to a biomarker value includes the use of both the instrument used to observe and record a signal corresponding to a biomarker level and the material/s required to generate that signal. In various embodiments, the biomarker level is detected using any suitable method, including fluorescence, chemiluminescence, surface plasmon resonance, surface acoustic waves, mass spectrometry, infrared spectroscopy, Raman spectroscopy, atomic force microscopy, scanning tunneling microscopy, electrochemical detection methods, nuclear magnetic resonance, quantum dots, and the like.

[0048] As used herein, "sample processing" and "sample handling" refer to steps or procedures performed on a sample, such as a blood sample, after sample collection in order to prepare it for storage or analysis. In some embodiments, sample processing steps include centrifugation of the sample and decanting or aspirating the supernatant. In some embodiments, sample quality is assessed by determining the approximate durations of time that elapsed between sample processing steps. A sample processing time of or near zero

means that each sample processing step was performed immediately with minimal time elapsed in between sample processing steps.

[0049] As used herein, “time-to-centrifugation” means the time elapsed between the moment that a blood sample is collected from a subject into a tube to the moment that the tube begins spinning in a centrifuge. In some embodiments, time-to-centrifugation is measured in hours. In some embodiments, ideal time-to-centrifugation for optimal sample quality is two hours or less. In some embodiments, the time-to-centrifugation is rounded to the nearest hour. In some embodiments, the time-to-centrifugation is rounded to the nearest half hour. Thus, in some embodiments, a time-to-centrifugation of less than a half hour or less than a quarter of an hour is rounded to zero.

[0050] As used herein, “time-to-decant” means the time elapsed between the moment that centrifugation of a sample is complete to the moment that the supernatant of the centrifuged sample begins to be decanted or aspirated from the precipitate. In some embodiments, time-to-decant is measured in hours. In some embodiments, ideal time-to-decant for optimal sample quality is less than one hour or less than half an hour, or less than a quarter hour. In some embodiments, the time-to-decant is rounded to the nearest hour. In some embodiments, the time-to-decant is rounded to the nearest half hour. Thus, in some embodiments, a time-to-decant of less than a half hour or less than a quarter of an hour is rounded to zero.

[0051] As used herein, “time-to-freeze” means the time elapsed between the moment that decanting or aspirating of a centrifuged sample is complete to the moment that the decanted or aspirated sample is placed in conditions at or under -20 °C. In some embodiments, time-to-freeze is measured in hours. In some embodiments, ideal time-to-decant for optimal sample quality is less than one hour or less than half an hour, or less than a quarter hour. In some embodiments, the time-to-freeze is rounded to the nearest hour. In some embodiments, the time-to-freeze is rounded to the nearest half hour. Thus, in some embodiments, a time-to-freeze of less than a half hour or less than a quarter of an hour is rounded to zero.

[0052] As used herein, “freeze-thaw cycle” means one round of exposing the sample to freezing temperatures (anywhere from approximately 0°C to -20 °C), or as low as -80°C or the temperature of liquid nitrogen), and then allowing the sample to thaw to liquid (for example, on ice or at room temperature).

[0053] “Solid support” refers herein to any substrate having a surface to which molecules may be attached, directly or indirectly, through either covalent or non-covalent

bonds. A “solid support” can have a variety of physical formats, which can include, for example, a membrane; a chip (e.g., a protein chip); a slide (e.g., a glass slide or coverslip); a column; a hollow, solid, semi-solid, pore- or cavity- containing particle, such as, for example, a bead; a gel; a fiber, including a fiber optic material; a matrix; and a sample receptacle. Exemplary sample receptacles include sample wells, tubes, capillaries, vials, and any other vessel, groove or indentation capable of holding a sample. A sample receptacle can be contained on a multi-sample platform, such as a microtiter plate, slide, microfluidics device, and the like. A support can be composed of a natural or synthetic material, an organic or inorganic material. The composition of the solid support on which capture reagents are attached generally depends on the method of attachment (e.g., covalent attachment). Other exemplary receptacles include microdroplets and microfluidic controlled or bulk oil/aqueous emulsions within which assays and related manipulations can occur. Suitable solid supports include, for example, plastics, resins, polysaccharides, silica or silica-based materials, functionalized glass, modified silicon, carbon, metals, inorganic glasses, membranes, nylon, natural fibers (such as, for example, silk, wool and cotton), polymers, and the like. The material composing the solid support can include reactive groups such as, for example, carboxy, amino, or hydroxyl groups, which are used for attachment of the capture reagents. Polymeric solid supports can include, e.g., polystyrene, polyethylene glycol tetraphthalate, polyvinyl acetate, polyvinyl chloride, polyvinyl pyrrolidone, polyacrylonitrile, polymethyl methacrylate, polytetrafluoroethylene, butyl rubber, styrenebutadiene rubber, natural rubber, polyethylene, polypropylene, (poly)tetrafluoroethylene, (poly)vinylidene fluoride, polycarbonate, and polymethylpentene. Suitable solid support particles that can be used include, e.g., encoded particles, such as Luminex®-type encoded particles, magnetic particles, and glass particles.

Exemplary Uses of Biomarkers

[0054] In various exemplary embodiments, methods are provided for evaluating or assessing sample quality by detecting one or more biomarker values corresponding to one or more biomarkers present in a sample from an individual, such as a blood, serum, or plasma sample, by any number of analytical methods, including any of the analytical methods described herein. These biomarkers are, for example, present at different levels in samples with differing quality. In some embodiments, the differing sample quality is due to differences in sample processing. Detection of the different levels of a biomarker in a sample

can be used, for example, to estimate the time that elapsed between sample processing steps, such as time-to-centrifugation, time-to-decant, and/or time-to-freeze.

[0055] In addition to detecting biomarkers to assess sample quality, biomarkers can be used in diagnostic applications or to determine if a disease or condition is present in the subject from whom the sample was taken. In some embodiments, only samples that pass the quality assessment are further analyzed for diagnostic applications.

Detection and Determination of Biomarkers and Biomarker Levels

[0056] Levels of the biomarkers described herein can be detected using any of a variety of known analytical methods. In one embodiment, a biomarker level is detected using a capture reagent. In various embodiments, the capture reagent can be exposed to the biomarker in solution or can be exposed to the biomarker while the capture reagent is immobilized on a solid support. In other embodiments, the capture reagent contains a feature that is reactive with a secondary feature on a solid support. In these embodiments, the capture reagent can be exposed to the biomarker in solution, and then the feature on the capture reagent can be used in conjunction with the secondary feature on the solid support to immobilize the biomarker on the solid support. The capture reagent is selected based on the type of analysis to be conducted. Capture reagents include but are not limited to aptamers, antibodies, adnectins, ankyrins, other antibody mimetics and other protein scaffolds, autoantibodies, chimeras, small molecules, F(ab')₂ fragments, single chain antibody fragments, Fv fragments, single chain Fv fragments, nucleic acids, lectins, ligand-binding receptors, affibodies, nanobodies, imprinted polymers, avimers, peptidomimetics, hormone receptors, cytokine receptors, and synthetic receptors, and modifications and fragments of these.

[0057] In some embodiments, a biomarker level is detected using a biomarker/capture reagent complex.

[0058] In some embodiments, the biomarker level is derived from the biomarker/capture reagent complex and is detected indirectly, such as, for example, as a result of a reaction that is subsequent to the biomarker/capture reagent interaction, but is dependent on the formation of the biomarker/capture reagent complex.

[0059] In some embodiments, the biomarker level is detected directly from the biomarker in a biological sample.

[0060] In some embodiments, biomarkers are detected using a multiplexed format that allows for the simultaneous detection of two or more biomarkers in a biological sample.

In some embodiments of the multiplexed format, capture reagents are immobilized, directly or indirectly, covalently or non-covalently, in discrete locations on a solid support. In some embodiments, a multiplexed format uses discrete solid supports where each solid support has a unique capture reagent associated with that solid support, such as, for example quantum dots. In some embodiments, an individual device is used for the detection of each one of multiple biomarkers to be detected in a biological sample. Individual devices can be configured to permit each biomarker in the biological sample to be processed simultaneously. For example, a microtiter plate can be used such that each well in the plate is used to uniquely analyze one or more biomarkers to be detected in a biological sample.

[0061] In one or more of the foregoing embodiments, a fluorescent tag can be used to label a component of the biomarker/capture reagent complex to enable the detection of the biomarker level. In various embodiments, the fluorescent label can be conjugated to a capture reagent specific to any of the biomarkers described herein using known techniques, and the fluorescent label can then be used to detect the corresponding biomarker level. Suitable fluorescent labels include rare earth chelates, fluorescein and its derivatives, rhodamine and its derivatives, dansyl, allophycocyanin, PBXL-3, Qdot 605, Lissamine, phycoerythrin, Texas Red, and other such compounds.

[0062] In some embodiments, the fluorescent label is a fluorescent dye molecule. In some embodiments, the fluorescent dye molecule includes at least one substituted indolium ring system in which the substituent on the 3-carbon of the indolium ring contains a chemically reactive group or a conjugated substance. In some embodiments, the dye molecule includes an AlexaFluor molecule, such as, for example, AlexaFluor 488, AlexaFluor 532, AlexaFluor 647, AlexaFluor 680, or AlexaFluor 700. In other embodiments, the dye molecule includes a first type and a second type of dye molecule, such as, e.g., two different AlexaFluor molecules. In some embodiments, the dye molecule includes a first type and a second type of dye molecule, and the two dye molecules have different emission spectra.

[0063] Fluorescence can be measured with a variety of instrumentation compatible with a wide range of assay formats. For example, spectrofluorimeters have been designed to analyze microtiter plates, microscope slides, printed arrays, cuvettes, etc. See Principles of Fluorescence Spectroscopy, by J.R. Lakowicz, Springer Science + Business Media, Inc., 2004. See Bioluminescence & Chemiluminescence: Progress & Current Applications; Philip E. Stanley and Larry J. Kricka editors, World Scientific Publishing Company, January 2002.

[0064] In one or more embodiments, a chemiluminescence tag can optionally be used to label a component of the biomarker/capture complex to enable the detection of a biomarker

level. Suitable chemiluminescent materials include any of oxalyl chloride, Rodamin 6G, $\text{Ru}(\text{bipy})_3^{2+}$, TMAE (tetrakis(dimethylamino)ethylene), Pyrogallol (1,2,3-trihydroxybenzene), Lucigenin, peroxyoxalates, Aryl oxalates, Acridinium esters, dioxetanes, and others.

[0065] In some embodiments, the detection method includes an enzyme/substrate combination that generates a detectable signal that corresponds to the biomarker level. Generally, the enzyme catalyzes a chemical alteration of the chromogenic substrate which can be measured using various techniques, including spectrophotometry, fluorescence, and chemiluminescence. Suitable enzymes include, for example, luciferases, luciferin, malate dehydrogenase, urease, horseradish peroxidase (HRPO), alkaline phosphatase, beta-galactosidase, glucoamylase, lysozyme, glucose oxidase, galactose oxidase, and glucose-6-phosphate dehydrogenase, uricase, xanthine oxidase, lactoperoxidase, microperoxidase, and the like.

[0066] In some embodiments, the detection method can be a combination of fluorescence, chemiluminescence, radionuclide or enzyme/substrate combinations that generate a measurable signal. In some embodiments, multimodal signaling could have unique and advantageous characteristics in biomarker assay formats.

[0067] In some embodiments, the biomarker levels for the biomarkers described herein can be detected using any analytical methods including, singleplex aptamer assays, multiplexed aptamer assays, singleplex or multiplexed immunoassays, mRNA expression profiling, miRNA expression profiling, mass spectrometric analysis, histological/cytological methods, etc. as discussed below.

Determination of Biomarker Levels using Aptamer-Based Assays

[0068] Assays directed to the detection and quantification of biomarker molecules in biological samples and other samples are important tools in scientific research and in the health care field. One class of such assays involves the use of a microarray that includes one or more aptamers immobilized on a solid support. The aptamers are each capable of binding to a target molecule in a highly specific manner and with very high affinity. See, e.g., U.S. Patent No. 5,475,096 entitled "Nucleic Acid Ligands"; see also, e.g., U.S. Patent No. 6,242,246, U.S. Patent No. 6,458,543, and U.S. Patent No. 6,503,715, each of which is entitled "Nucleic Acid Ligand Diagnostic Biochip". Once the microarray is contacted with a sample, the aptamers bind to their respective target molecules present in the sample and thereby enable a determination of a biomarker level corresponding to a biomarker.

[0069] As used herein, an “aptamer” refers to a nucleic acid that has a specific binding affinity for a target molecule. It is recognized that affinity interactions are a matter of degree; however, in this context, the “specific binding affinity” of an aptamer for its target means that the aptamer binds to its target generally with a much higher degree of affinity than it binds to other components in a test sample. An “aptamer” is a set of copies of one type or species of nucleic acid molecule that comprises a particular nucleotide sequence. An aptamer can include any suitable number of nucleotides, including any number of chemically modified nucleotides. “Aptamers” refers to more than one such set of molecules. Different aptamers can have either the same or different numbers of nucleotides. Aptamers can be DNA or RNA or chemically modified nucleic acids and can be single-stranded, double-stranded, or contain double-stranded regions, and can include higher ordered structures. An aptamer can also be a photoaptamer, where a photoreactive or chemically reactive functional group is included in the aptamer to allow it to be covalently linked to its corresponding target. Any of the aptamer methods disclosed herein can include the use of two or more aptamers that specifically bind the same target molecule. As further described below, an aptamer may include a tag. If an aptamer includes a tag, all copies of the aptamer need not have the same tag. Moreover, if different aptamers each include a tag, these different aptamers can have either the same tag or a different tag.

[0070] An aptamer can be identified using any known method, including the SELEX process. Once identified, an aptamer can be prepared or synthesized in accordance with any known method, including chemical synthetic methods and enzymatic synthetic methods.

[0071] The terms “SELEX” and “SELEX process” are used interchangeably herein to refer generally to a combination of (1) the selection of aptamers that interact with a target molecule in a desirable manner, for example binding with high affinity to a protein, with (2) the amplification of those selected nucleic acids. The SELEX process can be used to identify aptamers with high affinity to a specific target or biomarker.

[0072] SELEX generally includes preparing a candidate mixture of nucleic acids, binding of the candidate mixture to the desired target molecule to form an affinity complex, separating the affinity complexes from the unbound candidate nucleic acids, separating and isolating the nucleic acid from the affinity complex, purifying the nucleic acid, and identifying a specific aptamer sequence. The process may include multiple rounds to further refine the affinity of the selected aptamer. The process can include amplification steps at one or more points in the process. See, e.g., U.S. Patent No. 5,475,096, entitled “Nucleic Acid Ligands”. The SELEX process can be used to generate an aptamer that covalently binds its

target as well as an aptamer that non-covalently binds its target. See, e.g., U.S. Patent No. 5,705,337 entitled “Systematic Evolution of Nucleic Acid Ligands by Exponential Enrichment: Chemi-SELEX.”

[0073] The SELEX process can be used to identify high-affinity aptamers containing modified nucleotides that confer improved characteristics on the aptamer, such as, for example, improved *in vivo* stability or improved delivery characteristics. Examples of such modifications include chemical substitutions at the ribose and/or phosphate and/or base positions. SELEX process-identified aptamers containing modified nucleotides are described in U.S. Patent No. 5,660,985, entitled “High Affinity Nucleic Acid Ligands Containing Modified Nucleotides”, which describes oligonucleotides containing nucleotide derivatives chemically modified at the 5'- and 2'-positions of pyrimidines. U.S. Patent No. 5,580,737, see *supra*, describes highly specific aptamers containing one or more nucleotides modified with 2'-amino (2'-NH₂), 2'-fluoro (2'-F), and/or 2'-O-methyl (2'-Ome). See also, U.S. Patent Application Publication 20090098549, entitled “SELEX and PHOTOSELEX”, which describes nucleic acid libraries having expanded physical and chemical properties and their use in SELEX and photoSELEX.

[0074] SELEX can also be used to identify aptamers that have desirable off-rate characteristics. See U.S. Publication No. 20090004667, entitled “Method for Generating Aptamers with Improved Off-Rates”, which describes improved SELEX methods for generating aptamers that can bind to target molecules. Methods for producing aptamers and photoaptamers having slower rates of dissociation from their respective target molecules are described. The methods involve contacting the candidate mixture with the target molecule, allowing the formation of nucleic acid-target complexes to occur, and performing a slow off-rate enrichment process wherein nucleic acid-target complexes with fast dissociation rates will dissociate and not reform, while complexes with slow dissociation rates will remain intact. Additionally, the methods include the use of modified nucleotides in the production of candidate nucleic acid mixtures to generate aptamers with improved off-rate performance. Nonlimiting exemplary modified nucleotides include, for example, the modified pyrimidines shown in Figs. 3-5. In some embodiments, an aptamer comprises at least one nucleotide with a modification, such as a base modification. In some embodiments, an aptamer comprises at least one nucleotide with a hydrophobic modification, such as a hydrophobic base modification, allowing for hydrophobic contacts with a target protein. Such hydrophobic contacts, in some embodiments, contribute to greater affinity and/or slower off-rate binding by the aptamer. Nonlimiting exemplary nucleotides with hydrophobic modifications are

shown in Figure 3. In some embodiments, an aptamer comprises at least 2, at least 3, at least 4, at least 5, at least 6, at least 7, at least 8, at least 9, or at least 10 nucleotides with hydrophobic modifications, where each hydrophobic modification may be the same or different from the others. In some embodiments, at least 1, at least 2, at least 3, at least 4, at least 5, at least 6, at least 7, at least 8, at least 9, or at least 10 hydrophobic modifications in an aptamer may be independently selected from the hydrophobic modifications shown in Figure 3.

[0075] In some embodiments, the aptamer is a slow off-rate aptamer. In some embodiments, a slow off-rate aptamer (including an aptamer comprising at least one nucleotide with a hydrophobic modification) has an off-rate ($t_{1/2}$) of ≥ 30 minutes, ≥ 60 minutes, ≥ 90 minutes, ≥ 120 minutes, ≥ 150 minutes, ≥ 180 minutes, ≥ 210 minutes, or ≥ 240 minutes.

[0076] In some embodiments, an assay employs aptamers that include photoreactive functional groups that enable the aptamers to covalently bind or “photocrosslink” their target molecules. See, e.g., U.S. Patent No. 6,544,776 entitled “Nucleic Acid Ligand Diagnostic Biochip”. These photoreactive aptamers are also referred to as photoaptamers. See, e.g., U.S. Patent No. 5,763,177, U.S. Patent No. 6,001,577, and U.S. Patent No. 6,291,184, each of which is entitled “Systematic Evolution of Nucleic Acid Ligands by Exponential Enrichment: Photoselection of Nucleic Acid Ligands and Solution SELEX”; see also, e.g., U.S. Patent No. 6,458,539, entitled “Photoselection of Nucleic Acid Ligands”. After the microarray is contacted with the sample and the photoaptamers have had an opportunity to bind to their target molecules, the photoaptamers are photoactivated, and the solid support is washed to remove any non-specifically bound molecules. Harsh wash conditions may be used, since target molecules that are bound to the photoaptamers are generally not removed, due to the covalent bonds created by the photoactivated functional group(s) on the photoaptamers. In this manner, the assay enables the detection of a biomarker level corresponding to a biomarker in the test sample.

[0077] In some assay formats, the aptamers are immobilized on the solid support prior to being contacted with the sample. Under certain circumstances, however, immobilization of the aptamers prior to contact with the sample may not provide an optimal assay. For example, pre-immobilization of the aptamers may result in inefficient mixing of the aptamers with the target molecules on the surface of the solid support, perhaps leading to lengthy reaction times and, therefore, extended incubation periods to permit efficient binding of the aptamers to their target molecules. Further, when photoaptamers are employed in the

assay and depending upon the material utilized as a solid support, the solid support may tend to scatter or absorb the light used to effect the formation of covalent bonds between the photoaptamers and their target molecules. Moreover, depending upon the method employed, detection of target molecules bound to their aptamers can be subject to imprecision, since the surface of the solid support may also be exposed to and affected by any labeling agents that are used. Finally, immobilization of the aptamers on the solid support generally involves an aptamer-preparation step (i.e., the immobilization) prior to exposure of the aptamers to the sample, and this preparation step may affect the activity or functionality of the aptamers.

[0078] Aptamer assays that permit an aptamer to capture its target in solution and then employ separation steps that are designed to remove specific components of the aptamer-target mixture prior to detection have also been described (see U.S. Publication No. 20090042206, entitled “Multiplexed Analyses of Test Samples”). The described aptamer assay methods enable the detection and quantification of a non-nucleic acid target (e.g., a protein target) in a test sample by detecting and quantifying a nucleic acid (i.e., an aptamer). The described methods create a nucleic acid surrogate (i.e., the aptamer) for detecting and quantifying a non-nucleic acid target, thus allowing the wide variety of nucleic acid technologies, including amplification, to be applied to a broader range of desired targets, including protein targets.

[0079] Aptamers can be constructed to facilitate the separation of the assay components from an aptamer biomarker complex (or photoaptamer biomarker covalent complex) and permit isolation of the aptamer for detection and/or quantification. In one embodiment, these constructs can include a cleavable or releasable element within the aptamer sequence. In other embodiments, additional functionality can be introduced into the aptamer, for example, a labeled or detectable component, a spacer component, or a specific binding tag or immobilization element. For example, the aptamer can include a tag connected to the aptamer via a cleavable moiety, a label, a spacer component separating the label, and the cleavable moiety. In one embodiment, a cleavable element is a photocleavable linker. The photocleavable linker can be attached to a biotin moiety and a spacer section, can include an NHS group for derivatization of amines, and can be used to introduce a biotin group to an aptamer, thereby allowing for the release of the aptamer later in an assay method.

[0080] Homogenous assays, done with all assay components in solution, do not require separation of sample and reagents prior to the detection of signal. These methods are rapid and easy to use. These methods generate signal based on a molecular capture or binding reagent that reacts with its specific target. In some embodiments, the molecular capture

reagents comprise one or more aptamers and/or antibodies or the like and the specific target of each of the one or more aptamers and/or antibodies or the like may be a biomarker shown in Table 1.

[0081] In some embodiments, a method for signal generation takes advantage of anisotropy signal change due to the interaction of a fluorophore-labeled capture reagent with its specific biomarker target. When the labeled capture reacts with its target, the increased molecular weight causes the rotational motion of the fluorophore attached to the complex to become much slower changing the anisotropy value. By monitoring the anisotropy change, binding events may be used to quantitatively measure the biomarkers in solutions. Other methods include fluorescence polarization assays, molecular beacon methods, time resolved fluorescence quenching, chemiluminescence, fluorescence resonance energy transfer, and the like.

[0082] An exemplary solution-based aptamer assay that can be used to detect a biomarker level in a biological sample includes the following: (a) preparing a mixture by contacting the biological sample with an aptamer that includes a first tag and has a specific affinity for the biomarker, wherein an aptamer affinity complex is formed when the biomarker is present in the sample; (b) exposing the mixture to a first solid support including a first capture element, and allowing the first tag to associate with the first capture element; (c) removing any components of the mixture not associated with the first solid support; (d) attaching a second tag to the biomarker component of the aptamer affinity complex; (e) releasing the aptamer affinity complex from the first solid support; (f) exposing the released aptamer affinity complex to a second solid support that includes a second capture element and allowing the second tag to associate with the second capture element; (g) removing any non-complexed aptamer from the mixture by partitioning the non-complexed aptamer from the aptamer affinity complex; (h) eluting the aptamer from the solid support; and (i) detecting the biomarker by detecting the aptamer component of the aptamer affinity complex.

[0083] Any means known in the art can be used to detect a biomarker value by detecting the aptamer component of an aptamer affinity complex. A number of different detection methods can be used to detect the aptamer component of an affinity complex, such as, for example, hybridization assays, mass spectroscopy, or QPCR. In some embodiments, nucleic acid sequencing methods can be used to detect the aptamer component of an aptamer affinity complex and thereby detect a biomarker value. Briefly, a test sample can be subjected to any kind of nucleic acid sequencing method to identify and quantify the sequence or sequences of one or more aptamers present in the test sample. In some embodiments, the

sequence includes the entire aptamer molecule or any portion of the molecule that may be used to uniquely identify the molecule. In other embodiments, the identifying sequencing is a specific sequence added to the aptamer; such sequences are often referred to as “tags,” “barcodes,” or “zipcodes.” In some embodiments, the sequencing method includes enzymatic steps to amplify the aptamer sequence or to convert any kind of nucleic acid, including RNA and DNA that contain chemical modifications to any position, to any other kind of nucleic acid appropriate for sequencing.

[0084] In some embodiments, the sequencing method includes one or more cloning steps. In other embodiments the sequencing method includes a direct sequencing method without cloning.

[0085] In some embodiments, the sequencing method includes a directed approach with specific primers that target one or more aptamers in the test sample. In other embodiments, the sequencing method includes a shotgun approach that targets all aptamers in the test sample.

[0086] In some embodiments, the sequencing method includes enzymatic steps to amplify the molecule targeted for sequencing. In other embodiments, the sequencing method directly sequences single molecules. An exemplary nucleic acid sequencing-based method that can be used to detect a biomarker value corresponding to a biomarker in a biological sample includes the following: (a) converting a mixture of aptamers that contain chemically modified nucleotides to unmodified nucleic acids with an enzymatic step; (b) shotgun sequencing the resulting unmodified nucleic acids with a massively parallel sequencing platform such as, for example, the 454 Sequencing System (454 Life Sciences/Roche), the Illumina Sequencing System (Illumina), the ABI SOLiD Sequencing System (Applied Biosystems), the HeliScope Single Molecule Sequencer (Helicos Biosciences), or the Pacific Biosciences Real Time Single-Molecule Sequencing System (Pacific BioSciences) or the Polonator G Sequencing System (Dover Systems); and (c) identifying and quantifying the aptamers present in the mixture by specific sequence and sequence count.

[0087] A nonlimiting exemplary method of detecting biomarkers in a biological sample using aptamers is described in Example 1. *See also* Kraemer et al., 2011, *PloS One* 6(10): e26332.

Determination of Biomarker Levels using Immunoassays

[0088] Immunoassay methods are based on the reaction of an antibody to its corresponding target or analyte and can detect the analyte in a sample depending on the

specific assay format. To improve specificity and sensitivity of an assay method based on affibody-reactivity, monoclonal antibodies and fragments thereof are often used because of their specific epitope recognition. Polyclonal antibodies have also been successfully used in various immunoassays because of their increased affinity for the target as compared to monoclonal antibodies. Immunoassays have been designed for use with a wide range of biological sample matrices. Immunoassay formats have been designed to provide qualitative, semi-quantitative, and quantitative results.

[0089] Quantitative results are generated through the use of a standard curve created with known concentrations of the specific analyte to be detected. The response or signal from an unknown sample is plotted onto the standard curve, and a quantity or level corresponding to the target in the unknown sample is established.

[0090] Numerous immunoassay formats have been designed. ELISA or EIA can be quantitative for the detection of an analyte. This method relies on attachment of a label to either the analyte or the antibody and the label component includes, either directly or indirectly, an enzyme. ELISA tests may be formatted for direct, indirect, competitive, or sandwich detection of the analyte. Other methods rely on labels such as, for example, radioisotopes (I^{125}) or fluorescence. Additional techniques include, for example, agglutination, nephelometry, turbidimetry, Western blot, immunoprecipitation, immunocytochemistry, immunohistochemistry, flow cytometry, Luminex assay, and others (see *ImmunoAssay: A Practical Guide*, edited by Brian Law, published by Taylor & Francis, Ltd., 2005 edition).

[0091] Exemplary assay formats include enzyme-linked immunosorbent assay (ELISA), radioimmunoassay, fluorescent, chemiluminescence, and fluorescence resonance energy transfer (FRET) or time resolved-FRET (TR-FRET) immunoassays. Examples of procedures for detecting biomarkers include biomarker immunoprecipitation followed by quantitative methods that allow size and peptide level discrimination, such as gel electrophoresis, capillary electrophoresis, planar electrochromatography, and the like.

[0092] Methods of detecting and/or for quantifying a detectable label or signal generating material depend on the nature of the label. The products of reactions catalyzed by appropriate enzymes (where the detectable label is an enzyme; see above) can be, without limitation, fluorescent, luminescent, or radioactive or they may absorb visible or ultraviolet light. Examples of detectors suitable for detecting such detectable labels include, without limitation, x-ray film, radioactivity counters, scintillation counters, spectrophotometers, colorimeters, fluorometers, luminometers, and densitometers.

[0093] Any of the methods for detection can be performed in any format that allows for any suitable preparation, processing, and analysis of the reactions. This can be, for example, in multi-well assay plates (e.g., 96 wells or 386 wells) or using any suitable array or microarray. Stock solutions for various agents can be made manually or robotically, and all subsequent pipetting, diluting, mixing, distribution, washing, incubating, sample readout, data collection and analysis can be done robotically using commercially available analysis software, robotics, and detection instrumentation capable of detecting a detectable label.

Determination of Biomarker Levels using Gene Expression Profiling

[0094] Measuring mRNA in a biological sample may, in some embodiments, be used as a surrogate for detection of the level of the corresponding protein in the biological sample. Thus, in some embodiments, a biomarker or biomarker panel described herein can be detected by detecting the appropriate RNA.

[0095] In some embodiments, mRNA expression levels are measured by reverse transcription quantitative polymerase chain reaction (RT-PCR followed with qPCR). RT-PCR is used to create a cDNA from the mRNA. The cDNA may be used in a qPCR assay to produce fluorescence as the DNA amplification process progresses. By comparison to a standard curve, qPCR can produce an absolute measurement such as number of copies of mRNA per cell. Northern blots, microarrays, Invader assays, and RT-PCR combined with capillary electrophoresis have all been used to measure expression levels of mRNA in a sample. See Gene Expression Profiling: Methods and Protocols, Richard A. Shimkets, editor, Humana Press, 2004.

Detection of Biomarkers Using *In Vivo* Molecular Imaging Technologies

[0096] In some embodiments, a biomarker described herein may be used in molecular imaging tests. For example, an imaging agent can be coupled to a capture reagent, which can be used to detect the biomarker *in vivo*.

[0097] *In vivo* imaging technologies provide non-invasive methods for determining the state of a particular disease in the body of an individual. For example, entire portions of the body, or even the entire body, may be viewed as a three dimensional image, thereby providing valuable information concerning morphology and structures in the body. Such technologies may be combined with the detection of the biomarkers described herein to provide information concerning the biomarker *in vivo*.

[0098] The use of *in vivo* molecular imaging technologies is expanding due to various advances in technology. These advances include the development of new contrast agents or labels, such as radiolabels and/or fluorescent labels, which can provide strong signals within the body; and the development of powerful new imaging technology, which can detect and analyze these signals from outside the body, with sufficient sensitivity and accuracy to provide useful information. The contrast agent can be visualized in an appropriate imaging system, thereby providing an image of the portion or portions of the body in which the contrast agent is located. The contrast agent may be bound to or associated with a capture reagent, such as an aptamer or an antibody, for example, and/or with a peptide or protein, or an oligonucleotide (for example, for the detection of gene expression), or a complex containing any of these with one or more macromolecules and/or other particulate forms.

[0099] The contrast agent may also feature a radioactive atom that is useful in imaging. Suitable radioactive atoms include technetium-99m or iodine-123 for scintigraphic studies. Other readily detectable moieties include, for example, spin labels for magnetic resonance imaging (MRI) such as, for example, iodine-123 again, iodine-131, indium-111, fluorine-19, carbon-13, nitrogen-15, oxygen-17, gadolinium, manganese or iron. Such labels are well known in the art and could easily be selected by one of ordinary skill in the art.

[00100] Standard imaging techniques include but are not limited to magnetic resonance imaging, computed tomography scanning, positron emission tomography (PET), single photon emission computed tomography (SPECT), and the like. For diagnostic *in vivo* imaging, the type of detection instrument available is a major factor in selecting a given contrast agent, such as a given radionuclide and the particular biomarker that it is used to target (protein, mRNA, and the like). The radionuclide chosen typically has a type of decay that is detectable by a given type of instrument. Also, when selecting a radionuclide for *in vivo* diagnosis, its half-life should be long enough to enable detection at the time of maximum uptake by the target tissue but short enough that deleterious radiation of the host is minimized.

[00101] Exemplary imaging techniques include but are not limited to PET and SPECT, which are imaging techniques in which a radionuclide is synthetically or locally administered to an individual. The subsequent uptake of the radiotracer is measured over time and used to obtain information about the targeted tissue and the biomarker. Because of the high-energy (gamma-ray) emissions of the specific isotopes employed and the sensitivity and sophistication of the instruments used to detect them, the two-dimensional distribution of radioactivity may be inferred from outside of the body.

[00102] Commonly used positron-emitting nuclides in PET include, for example, carbon-11, nitrogen-13, oxygen-15, and fluorine-18. Isotopes that decay by electron capture and/or gamma-emission are used in SPECT and include, for example iodine-123 and technetium-99m. An exemplary method for labeling amino acids with technetium-99m is the reduction of pertechnetate ion in the presence of a chelating precursor to form the labile technetium-99m-precursor complex, which, in turn, reacts with the metal binding group of a bifunctionally modified chemotactic peptide to form a technetium-99m-chemotactic peptide conjugate.

[00103] Antibodies are frequently used for such *in vivo* imaging diagnostic methods. The preparation and use of antibodies for *in vivo* diagnosis is well known in the art. Similarly, aptamers may be used for such *in vivo* imaging diagnostic methods. For example, an aptamer that was used to identify a particular biomarker described herein may be appropriately labeled and injected into an individual to detect the biomarker *in vivo*. The label used will be selected in accordance with the imaging modality to be used, as previously described. Aptamer-directed imaging agents could have unique and advantageous characteristics relating to tissue penetration, tissue distribution, kinetics, elimination, potency, and selectivity as compared to other imaging agents.

[00104] Such techniques may also optionally be performed with labeled oligonucleotides, for example, for detection of gene expression through imaging with antisense oligonucleotides. These methods are used for *in situ* hybridization, for example, with fluorescent molecules or radionuclides as the label. Other methods for detection of gene expression include, for example, detection of the activity of a reporter gene.

[00105] Another general type of imaging technology is optical imaging, in which fluorescent signals within the subject are detected by an optical device that is external to the subject. These signals may be due to actual fluorescence and/or to bioluminescence. Improvements in the sensitivity of optical detection devices have increased the usefulness of optical imaging for *in vivo* diagnostic assays.

[00106] For a review of other techniques, see N. Blow, *Nature Methods*, 6, 465-469, 2009.

Determination of Biomarker Levels using Mass Spectrometry Methods

[00107] A variety of configurations of mass spectrometers can be used to detect biomarker levels. Several types of mass spectrometers are available or can be produced with various configurations. In general, a mass spectrometer has the following major components:

a sample inlet, an ion source, a mass analyzer, a detector, a vacuum system, and instrument-control system, and a data system. Difference in the sample inlet, ion source, and mass analyzer generally define the type of instrument and its capabilities. For example, an inlet can be a capillary-column liquid chromatography source or can be a direct probe or stage such as used in matrix-assisted laser desorption. Common ion sources are, for example, electrospray, including nanospray and microspray or matrix-assisted laser desorption. Common mass analyzers include a quadrupole mass filter, ion trap mass analyzer and time-of-flight mass analyzer. Additional mass spectrometry methods are well known in the art (see Burlingame et al. *Anal. Chem.* 70:647 R-716R (1998); Kinter and Sherman, New York (2000)).

[00108] Protein biomarkers and biomarker levels can be detected and measured by any of the following: electrospray ionization mass spectrometry (ESI-MS), ESI-MS/MS, ESI-MS/(MS)_n, matrix-assisted laser desorption ionization time-of-flight mass spectrometry (MALDI-TOF-MS), surface-enhanced laser desorption/ionization time-of-flight mass spectrometry (SELDI-TOF-MS), desorption/ionization on silicon (DIOS), secondary ion mass spectrometry (SIMS), quadrupole time-of-flight (Q-TOF), tandem time-of-flight (TOF/TOF) technology, called ultraflex III TOF/TOF, atmospheric pressure chemical ionization mass spectrometry (APCI-MS), APCI-MS/MS, APCI-(MS)_N, atmospheric pressure photoionization mass spectrometry (APPI-MS), APPI-MS/MS, and APPI-(MS)_N, quadrupole mass spectrometry, Fourier transform mass spectrometry (FTMS), quantitative mass spectrometry, and ion trap mass spectrometry.

[00109] Sample preparation and processing strategies are used to label and enrich samples before mass spectroscopic characterization of protein biomarkers and determination biomarker levels. Labeling methods include but are not limited to isobaric tag for relative and absolute quantitation (iTRAQ) and stable isotope labeling with amino acids in cell culture (SILAC). Capture reagents used to selectively enrich samples for candidate biomarker proteins prior to mass spectroscopic analysis include but are not limited to aptamers, antibodies, nucleic acid probes, chimeras, small molecules, an F(ab')₂ fragment, a single chain antibody fragment, an Fv fragment, a single chain Fv fragment, a nucleic acid, a lectin, a ligand-binding receptor, affibodies, nanobodies, ankyrins, domain antibodies, alternative antibody scaffolds (e.g. diabodies etc) imprinted polymers, avimers, peptidomimetics, peptoids, peptide nucleic acids, threose nucleic acid, a hormone receptor, a cytokine receptor, and synthetic receptors, and modifications and fragments of these.

Determination of Biomarker Levels using a Proximity Ligation Assay

[00110] A proximity ligation assay can be used to determine biomarker values. Briefly, a test sample is contacted with a pair of affinity probes that may be a pair of antibodies or a pair of aptamers, with each member of the pair extended with an oligonucleotide. The targets for the pair of affinity probes may be two distinct determinates on one protein or one determinate on each of two different proteins, which may exist as homo- or hetero-multimeric complexes. When probes bind to the target determinates, the free ends of the oligonucleotide extensions are brought into sufficiently close proximity to hybridize together. The hybridization of the oligonucleotide extensions is facilitated by a common connector oligonucleotide which serves to bridge together the oligonucleotide extensions when they are positioned in sufficient proximity. Once the oligonucleotide extensions of the probes are hybridized, the ends of the extensions are joined together by enzymatic DNA ligation.

[00111] Each oligonucleotide extension comprises a primer site for PCR amplification. Once the oligonucleotide extensions are ligated together, the oligonucleotides form a continuous DNA sequence which, through PCR amplification, reveals information regarding the identity and amount of the target protein, as well as, information regarding protein-protein interactions where the target determinates are on two different proteins. Proximity ligation can provide a highly sensitive and specific assay for real-time protein concentration and interaction information through use of real-time PCR. Probes that do not bind the determinates of interest do not have the corresponding oligonucleotide extensions brought into proximity and no ligation or PCR amplification can proceed, resulting in no signal being produced.

[00112] The foregoing assays enable the detection of biomarker values that are useful in methods for assessing sample quality, wherein the methods comprise detecting, in a biological sample from an individual, at least 2, at least 3, at least 4, at least 5, at least 6, at least 7, at least 8, at least 9, at least 10 or all 11 biomarkers selected from the biomarkers in Table 1. A classification, as described below, using the biomarker levels indicates whether the sample has acceptable quality for use in subsequent analysis. In accordance with any of the methods described herein, biomarker levels can be detected and classified individually or they can be detected and classified collectively, as for example in a multiplex assay format.

Classification of Biomarkers and Calculation of Sample Processing Times

[00113] In some embodiments, a biomarker “signature” for a given sample quality test contains a set of biomarkers, each biomarker having characteristic levels in samples of

acceptable quality or in sample of poor quality. Characteristic levels, in some embodiments, may refer to the mean or average of the biomarker levels for the samples in a particular group. In some embodiments, a method described herein can be used to assign a sample into one of two groups, either passing quality assessment or failing quality assessment.

[00114] The assignment of a sample into one of two or more groups is known as classification, and the procedure used to accomplish this assignment is known as a classifier or a classification method. Classification methods may also be referred to as scoring methods. There are many classification methods that can be used to construct a classifier from a set of biomarker levels. In some instances, classification methods are performed using supervised learning techniques in which a data set is collected using samples from two (or more, for multiple classification states) distinct groups one wishes to distinguish. Since the class (group or population) to which each sample belongs is known in advance for each sample, the classification method can be trained to give the desired classification response. It is also possible to use unsupervised learning techniques to produce a quality classifier.

[00115] Common approaches for developing classifiers include decision trees; bagging + boosting + forests; rule inference based learning; Parzen Windows; linear models; logistic; neural network methods; unsupervised clustering; K-means; hierarchical ascending/descending; semi-supervised learning; prototype methods; nearest neighbor; kernel density estimation; support vector machines; hidden Markov models; Boltzmann Learning; and classifiers may be combined either simply or in ways which minimize particular objective functions. For a review, see, e.g., *Pattern Classification*, R.O. Duda, et al., editors, John Wiley & Sons, 2nd edition, 2001; see also, *The Elements of Statistical Learning – Data Mining, Inference, and Prediction*, T. Hastie, et al., editors, Springer Science+Business Media, LLC, 2nd edition, 2009.

[00116] To produce a classifier using supervised learning techniques, a set of samples called training data are obtained. In the context of quality tests, training data includes samples from the distinct groups (classes) to which unknown samples will later be assigned. For example, samples that underwent processing with differing, set times between processing steps can constitute training data to develop a classifier that can classify unknown samples as either passing or failing quality assessment based on the elapsed time between sample processing steps. The development of the classifier from the training data is known as training the classifier. Specific details on classifier training depend on the nature of the supervised learning technique. Training a naïve Bayesian classifier is an example of such a supervised learning technique (see, e.g., *Pattern Classification*, R.O. Duda, et al., editors,

John Wiley & Sons, 2nd edition, 2001; see also, The Elements of Statistical Learning – Data Mining, Inference, and Prediction, T. Hastie, et al., editors, Springer Science+Business Media, LLC, 2nd edition, 2009). Training of a naïve Bayesian classifier is described, e.g., in U.S. Publication Nos: 2012/0101002 and 2012/0077695.

[00117] Since typically there are many more potential biomarker levels than samples in a training set, care must be used to avoid over-fitting. Over-fitting occurs when a statistical model describes random error or noise instead of the underlying relationship. Over-fitting can be avoided in a variety of way, including, for example, by limiting the number of biomarkers used in developing the classifier, by assuming that the biomarker responses are independent of one another, by limiting the complexity of the underlying statistical model employed, and by ensuring that the underlying statistical model conforms to the data.

[00118] An illustrative example of the development of a test using a set of biomarkers includes the application of a naïve Bayes classifier, a simple probabilistic classifier based on Bayes theorem with strict independent treatment of the biomarkers. Each biomarker is described by a class-dependent probability density function (pdf) for the measured RFU values or log RFU (relative fluorescence units) values in each class. The joint pdfs for the set of biomarkers in one class is assumed to be the product of the individual class-dependent pdfs for each biomarker. Training a naïve Bayes classifier in this context amounts to assigning parameters (“parameterization”) to characterize the class dependent pdfs. Any underlying model for the class-dependent pdfs may be used, but the model should generally conform to the data observed in the training set.

[00119] The performance of the naïve Bayes classifier is dependent upon the number and quality of the biomarkers used to construct and train the classifier. A single biomarker will perform in accordance with its KS-distance (Kolmogorov-Smirnov). The addition of subsequent biomarkers with good KS distances (>0.3 , for example) will, in general, improve the classification performance if the subsequently added biomarkers are independent of the first biomarker. Using the sensitivity plus specificity as a classifier score, many high scoring classifiers can be generated with a variation of a greedy algorithm. (A greedy algorithm is any algorithm that follows the problem solving metaheuristic of making the locally optimal choice at each stage with the hope of finding the global optimum.)

[00120] Another way to depict classifier performance is through a receiver operating characteristic (ROC), or simply ROC curve or ROC plot. The ROC is a graphical plot of the sensitivity, or true positive rate, vs. false positive rate ($1 - \text{specificity}$ or $1 - \text{true negative rate}$), for a binary classifier system as its discrimination threshold is varied. The ROC can

also be represented equivalently by plotting the fraction of true positives out of the positives (TPR = true positive rate) vs. the fraction of false positives out of the negatives (FPR = false positive rate). Also known as a Relative Operating Characteristic curve, because it is a comparison of two operating characteristics (TPR & FPR) as the criterion changes. The area under the ROC curve (AUC) is commonly used as a summary measure of diagnostic accuracy. It can take values from 0.0 to 1.0. The AUC has an important statistical property: the AUC of a classifier is equivalent to the probability that the classifier will rank a randomly chosen positive instance higher than a randomly chosen negative instance (Fawcett T, 2006. An introduction to ROC analysis. *Pattern Recognition Letters* .27: 861–874). This is equivalent to the Wilcoxon test of ranks (Hanley, J.A., McNeil, B.J., 1982. The meaning and use of the area under a receiver operating characteristic (ROC) curve. *Radiology* 143, 29–36.). Another way of describing performance of a diagnostic test in relation to a known reference standard is the net reclassification index: the ability of the new test to correctly upgrade or downgrade risk when compared with the reference standard test. See, e.g., Pencina et al., 2011, *Stat. Med.* 30: 11-21. While the AUC under the ROC curve is optimal for assessing performance of a 2-class classifier, stratified and personalized medicine relies upon the inference that the population contains more classes than 2. For such comparisons the hazard ratio of the upper vs. lower quartiles (or other stratifications such as deciles) can be used more appropriately.

Kits

[00121] Any combination of the biomarkers described herein can be detected using a suitable kit, such as for use in performing the methods disclosed herein. Furthermore, any kit can contain one or more detectable labels as described herein, such as a fluorescent moiety, etc.

[00122] In some embodiments, a kit includes (a) one or more capture reagents (such as, for example, at least one aptamer or antibody) for detecting one or more biomarkers in a biological sample, wherein the biomarkers include at least 2, at least 3, at least 4, at least 5, at least 6, at least 7, at least 8, at least 9, at least 10 or all 11 biomarkers selected from the biomarkers in Table 1; and optionally (b) one or more software or computer program products for classifying the sample was obtained as either passing or failing quality assessment or for determining the approximate time or times of sample processing steps, as further described herein. Alternatively, rather than one or more computer program products, one or more instructions for manually performing the above steps by a human can be provided.

[00123] In some embodiments, a kit comprises a solid support, at least one capture reagent, and a signal generating material. The kit can also include instructions for using the devices and reagents, handling the sample, and analyzing the data. Further the kit may be used with a computer system or software to analyze and report the result of the analysis of the biological sample.

[00124] The kit may further comprise reagents for diagnostic analysis of samples, particularly samples that pass quality assessment.

[00125] The kits can also contain one or more reagents (e.g., solubilization buffers, detergents, washes, or buffers) for processing a biological sample. Any of the kits described herein can also include, e.g., buffers, blocking agents, mass spectrometry matrix materials, antibody capture agents, positive control samples, negative control samples, software and information such as protocols, guidance and reference data.

[00126] In some embodiments, the kits comprise PCR primers for one or more aptamers specific to biomarkers described herein. In some embodiments, a kit may further include instructions for use and correlation of the biomarkers with estimation of sample processing times and/or sample quality. In some embodiments, a kit may also include a DNA array containing the complement of one or more of the aptamers specific for the biomarkers described herein, reagents, and/or enzymes for amplifying or isolating sample DNA. In some embodiments, kits may include reagents for real-time PCR, for example, TaqMan probes and/or primers, and enzymes.

[00127] For example, a kit can comprise (a) reagents comprising at least one capture reagent for determining the level of one or more biomarkers in a test sample, and optionally (b) one or more algorithms or computer programs for performing the steps of comparing the amount of each biomarker quantified in the test sample to one or more predetermined cutoffs. In some embodiments, an algorithm or computer program assigns a score for each biomarker quantified based on the comparison and, in some embodiments, combines the assigned scores for each biomarker quantified to obtain a total score. Further, in some embodiments, an algorithm or computer program compares the total score with a predetermined score, and uses the comparison to determine whether a sample passes or fails quality assessment. Alternatively, rather than one or more algorithms or computer programs, one or more instructions for manually performing the above steps by a human can be provided.

Biomarker Panels

[00128] In some embodiments, one or more of the biomarkers listed in Table 1 are detected. In some embodiments, the one or more biomarkers listed in Table 1 are detected in a plasma sample from a subject. In some embodiments, all of the biomarkers listed in Table 1 are detected. In some embodiments, the level of each protein listed in Table 1 is detected. In some embodiments, the detecting of the one or more biomarkers or all of the biomarkers is performed in order to determine the number of times a sample is frozen and thawed.

Table 1: Panel for Freeze-thaw cycles (plasma)

Protein	Gene	UniProt ID	Name
P04264	Keratin-1	KRT1	Keratin, type II cytoskeletal 1
P13647	K2C5	KRT5	Keratin, type II cytoskeletal 5
P30566	PUR8	ADSL	Adenylosuccinate lyase
Q8N6K0	TEX29	TEX29	Testis-expressed sequence 29 protein
Q9NPQ8	RIC8A	RIC8A	Synembryn-A
Q9NS86	LANC2	LANCL2	LanC-like protein 2
Q04760	Glyoxalase I	GLO1	Lactoylglutathione lyase
A6NDG6	PGP	PGP	Glycerol-3-phosphate phosphatase
Q9UKA2	FBXL4	FBXL4	F-box/LRR-repeat protein 4
Q13291	SLAF1	SLAMF1	Signaling lymphocytic activation molecule
P31415	CASQ1	CASQ1	Calsequestrin-1

Computer Methods and Software

[00129] A method for assessing sample quality, such as the length of time between sample processing and freezing can comprise the following: 1) obtain a biological sample, such as a sample that has already undergone sample processing; 2) perform an analytical method to detect and measure a biomarker or set of biomarkers in a panel in the biological sample; 3) optionally perform any data normalization or standardization; 4) determine each biomarker level; and 5) report the results. In some embodiments, the results are calibrated to the sample type. In some embodiments, the biomarker levels are combined in some way and a single value for the combined biomarker levels is reported. In this approach, in some embodiments, the score may be a single number or identity determined from the integration of all the biomarkers that is compared to a pre-set threshold value that is an indication of satisfactory (passing) or unsatisfactory (failing) quality. Or the predictive score may be a series of bars that each represent a biomarker value and the pattern of the responses may be compared to a pre-set pattern for determination of the satisfactory (passing) or unsatisfactory (failing) quality.

[00130] At least some embodiments of the methods described herein can be implemented with the use of a computer. An example of a computer system 100 is shown in Figure 1. With reference to Figure 1, system 100 is shown comprised of hardware elements that are electrically coupled via bus 108, including a processor 101, input device 102, output device 103, storage device 104, computer-readable storage media reader 105a, communications system 106, processing acceleration (e.g., DSP or special-purpose processors) 107 and memory 109. Computer-readable storage media reader 105a is further coupled to computer-readable storage media 105b, the combination comprehensively representing remote, local, fixed and/or removable storage devices plus storage media, memory, etc. for temporarily and/or more permanently containing computer-readable information, which can include storage device 104, memory 109 and/or any other such accessible system 100 resource. System 100 also comprises software elements (shown as being currently located within working memory 191) including an operating system 192 and other code 193, such as programs, data and the like.

[00131] With respect to Figure 1, system 100 has extensive flexibility and configurability. Thus, for example, a single architecture might be utilized to implement one or more servers that can be further configured in accordance with currently desirable protocols, protocol variations, extensions, etc. However, it will be apparent to those skilled in the art that embodiments may well be utilized in accordance with more specific application requirements. For example, one or more system elements might be implemented as sub-elements within a system 100 component (e.g., within communications system 106). Customized hardware might also be utilized and/or particular elements might be implemented in hardware, software or both. Further, while connection to other computing devices such as network input/output devices (not shown) may be employed, it is to be understood that wired, wireless, modem, and/or other connection or connections to other computing devices might also be utilized.

[00132] In one aspect, the system can comprise a database containing features of biomarkers characteristic of sample quality. The biomarker data (or biomarker information) can be utilized as an input to the computer for use as part of a computer implemented method. The biomarker data can include the data as described herein.

[00133] In one aspect, the system further comprises one or more devices for providing input data to the one or more processors.

[00134] The system further comprises a memory for storing a data set of ranked data elements.

[00135] In another aspect, the device for providing input data comprises a detector for detecting the characteristic of the data element, e.g., such as a mass spectrometer or gene chip reader.

[00136] The system additionally may comprise a database management system. User requests or queries can be formatted in an appropriate language understood by the database management system that processes the query to extract the relevant information from the database of training sets.

[00137] The system may be connectable to a network to which a network server and one or more clients are connected. The network may be a local area network (LAN) or a wide area network (WAN), as is known in the art. Preferably, the server includes the hardware necessary for running computer program products (e.g., software) to access database data for processing user requests.

[00138] The system may include an operating system (e.g., UNIX or Linux) for executing instructions from a database management system. In one aspect, the operating system can operate on a global communications network, such as the internet, and utilize a global communications network server to connect to such a network.

[00139] The system may include one or more devices that comprise a graphical display interface comprising interface elements such as buttons, pull down menus, scroll bars, fields for entering text, and the like as are routinely found in graphical user interfaces known in the art. Requests entered on a user interface can be transmitted to an application program in the system for formatting to search for relevant information in one or more of the system databases. Requests or queries entered by a user may be constructed in any suitable database language.

[00140] The graphical user interface may be generated by a graphical user interface code as part of the operating system and can be used to input data and/or to display inputted data. The result of processed data can be displayed in the interface, printed on a printer in communication with the system, saved in a memory device, and/or transmitted over the network or can be provided in the form of the computer readable medium.

[00141] The system can be in communication with an input device for providing data regarding data elements to the system (e.g., expression values). In one aspect, the input device can include a gene expression profiling system including, e.g., a mass spectrometer, gene chip or array reader, and the like.

[00142] The methods and apparatus for analyzing sample quality biomarker information according to various embodiments may be implemented in any suitable manner,

for example, using a computer program operating on a computer system. A conventional computer system comprising a processor and a random access memory, such as a remotely-accessible application server, network server, personal computer or workstation may be used. Additional computer system components may include memory devices or information storage systems, such as a mass storage system and a user interface, for example a conventional monitor, keyboard and tracking device. The computer system may be a stand-alone system or part of a network of computers including a server and one or more databases.

[00143] The sample quality biomarker analysis system can provide functions and operations to complete data analysis, such as data gathering, processing, analysis, reporting and/or sample quality identification. For example, in one embodiment, the computer system can execute the computer program that may receive, store, search, analyze, and report information relating to the sample quality assessment biomarkers. The computer program may comprise multiple modules performing various functions or operations, such as a processing module for processing raw data and generating supplemental data and an analysis module for analyzing raw data and supplemental data to generate a sample quality status and/or estimated sample processing time calculation. Calculation of sample processing time may optionally comprise generating or collecting additional information.

[00144] Some embodiments described herein can be implemented so as to include a computer program product. A computer program product may include a computer readable medium having computer readable program code embodied in the medium for causing an application program to execute on a computer with a database.

[00145] As used herein, a “computer program product” refers to an organized set of instructions in the form of natural or programming language statements that are contained on a physical media of any nature (e.g., written, electronic, magnetic, optical or otherwise) and that may be used with a computer or other automated data processing system. Such programming language statements, when executed by a computer or data processing system, cause the computer or data processing system to act in accordance with the particular content of the statements. Computer program products include without limitation: programs in source and object code and/or test or data libraries embedded in a computer readable medium. Furthermore, the computer program product that enables a computer system or data processing equipment device to act in pre-selected ways may be provided in a number of forms, including, but not limited to, original source code, assembly code, object code, machine language, encrypted or compressed versions of the foregoing and any and all equivalents.

[00146] In one aspect, a computer program product is provided for evaluation of sample quality. The computer program product includes a computer readable medium embodying program code executable by a processor of a computing device or system, the program code comprising: code that retrieves data attributed to a biological sample from an individual, wherein the data comprises biomarker levels that each correspond to one of the biomarkers in Table 1 and code that executes a classification method that indicates a sample quality status as a function of the biomarker levels.

[00147] In still another aspect, a computer program product is provided for determining sample processing time or times. The computer program product includes a computer readable medium embodying program code executable by a processor of a computing device or system, the program code comprising: code that retrieves data attributed to a biological sample from an individual, wherein the data comprises a biomarker value corresponding to at least one biomarker in the biological sample selected from the biomarkers provided in Table 1 and code that executes a classification method that indicates a sample quality status as a function of the biomarker levels.

[00148] While various embodiments have been described as methods or apparatuses, it should be understood that embodiments can be implemented through code coupled with a computer, e.g., code resident on a computer or accessible by the computer. For example, software and databases could be utilized to implement many of the methods discussed above. Thus, in addition to embodiments accomplished by hardware, it is also noted that these embodiments can be accomplished through the use of an article of manufacture comprised of a computer usable medium having a computer readable program code embodied therein, which causes the enablement of the functions disclosed in this description. Therefore, it is desired that embodiments also be considered protected by this patent in their program code means as well. Furthermore, the embodiments may be embodied as code stored in a computer-readable memory of virtually any kind including, without limitation, RAM, ROM, magnetic media, optical media, or magneto-optical media. Even more generally, the embodiments could be implemented in software, or in hardware, or any combination thereof including, but not limited to, software running on a general purpose processor, microcode, programmable logic arrays (PLAs), or application-specific integrated circuits (ASICs).

[00149] It is also envisioned that embodiments could be accomplished as computer signals embodied in a carrier wave, as well as signals (e.g., electrical and optical) propagated through a transmission medium. Thus, the various types of information discussed above

could be formatted in a structure, such as a data structure, and transmitted as an electrical signal through a transmission medium or stored on a computer readable medium.

[00150] It is also noted that many of the structures, materials, and acts recited herein can be recited as means for performing a function or step for performing a function. Therefore, it should be understood that such language is entitled to cover all such structures, materials, or acts disclosed within this specification and their equivalents, including the matter incorporated by reference.

[00151] The utilization of the biomarkers disclosed herein, and the various methods for determining biomarker values are described in detail above with respect to evaluation of sample quality and suitability for further analysis, such as diagnostic analysis. In some embodiments, the biomarkers, methods, and kits described herein are used to assess the absolute sample quality of one or more samples or the relative consistency of sample quality across a plurality of samples. In some such embodiments, the methods comprise identifying samples that pass or fail a quality assessment. In some embodiments, samples that pass quality assessment are analyzed and samples that fail quality assessment are discarded. In some embodiments, information obtained using the biomarkers, methods, and kits herein can be used to determine whether a sample collection and processing method or facility is suitable.

EXAMPLES

[00152] The following examples are provided for illustrative purposes only and are not intended to limit the scope of the application as defined by the appended claims. Routine molecular biology techniques described in the following examples can be carried out as described in standard laboratory manuals, such as Sambrook et al., *Molecular Cloning: A Laboratory Manual*, 3rd ed., Cold Spring Harbor Laboratory Press, Cold Spring Harbor, N.Y., (2001).

Example 1: Exemplary Biomarker Detection Using Aptamers

[00153] An exemplary method of detecting one or more biomarker proteins in a sample is described, e.g., in Kraemer et al., *PloS One* 6(10): e26332, and is described below. Three different methods of quantification: microarray-based hybridization, a Luminex bead-based method, and qPCR, are described.

Reagents

[00154] HEPES, NaCl, KCl, EDTA, EGTA, MgCl₂ and Tween-20 may be purchased, e.g., from Fisher Biosciences. Dextran sulfate sodium salt (DxSO₄), nominally 8000 molecular weight, may be purchased, e.g., from AIC and is dialyzed against deionized water for at least 20 hours with one exchange. KOD EX DNA polymerase may be purchased, e.g., from VWR. Tetramethylammonium chloride and CAPSO may be purchased, e.g., from Sigma-Aldrich and streptavidin-phycoerythrin (SAPE) may be purchased, e.g., from Moss Inc. 4-(2-Aminoethyl)-benzenesulfonyl fluoride hydrochloride (AEBSF) may be purchased, e.g., from Gold Biotechnology. Streptavidin-coated 96-well plates may be purchased, e.g., from Thermo Scientific (Pierce Streptavidin Coated Plates HBC, clear, 96-well, product number 15500 or 15501). NHS-PEO₄-biotin may be purchased, e.g., from Thermo Scientific (EZ-Link NHS-PEO₄-Biotin, product number 21329), dissolved in anhydrous DMSO, and may be stored frozen in single-use aliquots. IL-8, MIP-4, Lipocalin-2, RANTES, MMP-7, and MMP-9 may be purchased, e.g., from R&D Systems. Resistin and MCP-1 may be purchased, e.g., from PeproTech, and tPA may be purchased, e.g., from VWR.

Nucleic acids

[00155] Conventional (including amine- and biotin-substituted) oligodeoxynucleotides may be purchased, e.g., from Integrated DNA Technologies (IDT). Z-Block is a single-stranded oligodeoxynucleotide of sequence 5'-(AC-BnBn)₇-AC-3', where Bn indicates a benzyl-substituted deoxyuridine residue. Z-block may be synthesized using conventional phosphoramidite chemistry. Aptamer capture reagents may also be synthesized by conventional phosphoramidite chemistry, and may be purified, for example, on a 21.5×75 mm PRP-3 column, operating at 80°C on a Waters Autopurification 2767 system (or Waters 600 series semi-automated system), using, for example, a timberline TL-600 or TL-150 heater and a gradient of triethylammonium bicarbonate (TEAB) / I to elute product. Detection is performed at 260 nm and fractions are collected across the main peak prior to pooling best fractions.

Buffers

[00156] Buffer SB18 is composed of 40 mM HEPES, 101 mM NaCl, 5 mM KCl, 5 mM MgCl₂, and 0.05% (v/v) Tween 20 adjusted to pH 7.5 with NaOH. Buffer SB17 is SB18 supplemented with 1 mM trisodium EDTA. Buffer PB1 is composed of 10 mM HEPES, 101 mM NaCl, 5 mM KCl, 5 mM MgCl₂, 1 mM trisodium EDTA and 0.05% (v/v) Tween-20 adjusted to pH 7.5 with NaOH. CAPSO elution buffer consists of 100 mM CAPSO pH 10.0 and 1 M NaCl. Neutralization buffer contains of 500 mM HEPES, 500 mM HCl, and 0.05%

(v/v) Tween-20. Agilent Hybridization Buffer is a proprietary formulation that is supplied as part of a kit (Oligo aCGH/ChIP-on-chip Hybridization Kit). Agilent Wash Buffer 1 is a proprietary formulation (Oligo aCGH/ChIP-on-chip Wash Buffer 1, Agilent). Agilent Wash Buffer 2 is a proprietary formulation (Oligo aCGH/ChIP-on-chip Wash Buffer 2, Agilent). TMAC hybridization solution consists of 4.5 M tetramethylammonium chloride, 6 mM trisodium EDTA, 75 mM Tris-HCl (pH 8.0), and 0.15% (v/v) Sarkosyl. KOD buffer (10-fold concentrated) consists of 1200 mM Tris-HCl, 15 mM MgSO₄, 100 mM KCl, 60 mM (NH₄)₂SO₄, 1% v/v Triton-X 100 and 1 mg/mL BSA.

Sample preparation

[00157] Serum (stored at -80°C in 100 µL aliquots) is thawed in a 25°C water bath for 10 minutes, then stored on ice prior to sample dilution. Samples are mixed by gentle vortexing for 8 seconds. A 6% serum sample solution is prepared by dilution into 0.94× SB17 supplemented with 0.6 mM MgCl₂, 1 mM trisodium EGTA, 0.8 mM AEBSF, and 2 µM Z-Block. A portion of the 6% serum stock solution is diluted 10-fold in SB17 to create a 0.6% serum stock. 6% and 0.6% stocks are used, in some embodiments, to detect high- and low-abundance analytes, respectively.

Capture reagent (aptamer) and streptavidin plate preparation

[00158] Aptamers are grouped into 2 mixes according to the relative abundance of their cognate analytes (or biomarkers). Stock concentrations are 4 nM for each aptamer, and the final concentration of each aptamer is 0.5 nM. Aptamer stock mixes are diluted 4-fold in SB17 buffer, heated to 95 °C for 5 min and cooled to 37 °C over a 15-minute period prior to use. This denaturation-renaturation cycle is intended to normalize aptamer conformer distributions and thus ensure reproducible aptamer activity in spite of variable histories. Streptavidin plates are washed twice with 150 µL buffer PB1 prior to use.

Incubation and plate capture

[00159] Heat-cooled 2× Aptamer mixes (55 µL) are combined with an equal volume of 6% or 0.6% serum dilutions, producing mixes containing 3% and 0.3% serum. The plates are sealed with a Silicone Sealing Mat (AxyMat Silicone sealing mat, VWR) and incubated for 1.5 h at 37 °C. Mixes are then transferred to the wells of a washed 96-well streptavidin plate and further incubated on an Eppendorf Thermomixer set at 37 °C, with shaking at 800 rpm, for two hours.

Manual Assay

[00160] Unless otherwise specified, liquid is removed by dumping, followed by two taps onto layered paper towels. Wash volumes are 150 µL and all shaking incubations are

done on an Eppendorf Thermomixer set at 25°C, 800 rpm. Mixes are removed by pipetting, and plates are washed twice for 1 minute with buffer PB1 supplemented with 1 mM dextran sulfate and 500 μ M biotin, then 4 times for 15 seconds with buffer PB1. A freshly made solution of 1 mM NHS-PEO4-biotin in buffer PB1 (150 μ L/well) is added, and plates are incubated for 5 minutes with shaking. The NHS-biotin solution is removed, and plates washed 3 times with buffer PB1 supplemented with 20 mM glycine, and 3 times with buffer PB1. Eighty-five μ L of buffer PB1 supplemented with 1 mM DxSO_4 is then added to each well, and plates are irradiated under a BlackRay UV lamp (nominal wavelength 365 nm) at a distance of 5 cm for 20 minutes with shaking. Samples are transferred to a fresh, washed streptavidin-coated plate, or an unused well of the existing washed streptavidin plate, combining high and low sample dilution mixtures into a single well. Samples are incubated at room temperature with shaking for 10 minutes. Unabsorbed material is removed and the plates washed 8 times for 15 seconds each with buffer PB1 supplemented with 30% glycerol. Plates are then washed once with buffer PB1. Aptamers are eluted for 5 minutes at room temperature with 100 μ L CAPSO elution buffer. 90 μ L of the eluate is transferred to a 96-well HybAid plate and 10 μ L neutralization buffer is added.

Semi-Automated Assay

[00161] Streptavidin plates bearing adsorbed equilibration mixes are placed on the deck of a BioTek EL406 plate washer, which is programmed to perform the following steps: unadsorbed material is removed by aspiration, and wells are washed 4 times with 300 μ L of buffer PB1 supplemented with 1 mM dextran sulfate and 500 μ M biotin. Wells are then washed 3 times with 300 μ L buffer PB1. One hundred fifty μ L of a freshly prepared (from a 100 mM stock in DMSO) solution of 1 mM NHS-PEO4-biotin in buffer PB1 is added. Plates are incubated for 5 minutes with shaking. Liquid is aspirated, and wells are washed 8 times with 300 μ L buffer PB1 supplemented with 10 mM glycine. One hundred μ L of buffer PB1 supplemented with 1 mM dextran sulfate are added. After these automated steps, plates are removed from the plate washer and placed on a thermoshaker mounted under a UV light source (BlackRay, nominal wavelength 365 nm) at a distance of 5 cm for 20 minutes. The thermoshaker is set at 800 rpm and 25 °C. After 20 minutes irradiation, samples are manually transferred to a fresh, washed streptavidin plate (or to an unused well of the existing washed plate). High-abundance (3% serum+3% aptamer mix) and low-abundance reaction mixes (0.3% serum+0.3% aptamer mix) are combined into a single well at this point. This “Catch-2” plate is placed on the deck of BioTek EL406 plate washer, which is programmed to perform the following steps: the plate is incubated for 10 minutes with shaking. Liquid is

aspirated, and wells are washed 21 times with 300 μ L buffer PB1 supplemented with 30% glycerol. Wells are washed 5 times with 300 μ L buffer PB1, and the final wash is aspirated. One hundred μ L CAPSO elution buffer are added, and aptamers are eluted for 5 minutes with shaking. Following these automated steps, the plate is then removed from the deck of the plate washer, and 90 μ L aliquots of the samples are transferred manually to the wells of a HybAid 96-well plate that contains 10 μ L neutralization buffer.

Hybridization to custom Agilent 8 $\times$ 15k microarrays

[00162] 24 μ L of the neutralized eluate is transferred to a new 96-well plate and 6 μ L of 10 $\times$ Agilent Block (Oligo aCGH/ChIP-on-chip Hybridization Kit, Large Volume, Agilent 5188–5380), containing a set of hybridization controls composed of 10 Cy3 aptamers is added to each well. Thirty μ L 2 $\times$ Agilent Hybridization buffer is added to each sample and mixed. Forty μ L of the resulting hybridization solution is manually pipetted into each “well” of the hybridization gasket slide (Hybridization Gasket Slide, 8-microarray per slide format, Agilent). Custom Agilent microarray slides, bearing 10 probes per array complementary to 40 nucleotide random region of each aptamer with a 20 $\times$ dT linker, are placed onto the gasket slides according to the manufacturers’ protocol. The assembly (Hybridization Chamber Kit – SureHyb-enabled, Agilent) is clamped and incubated for 19 hours at 60 $^{\circ}$ C while rotating at 20 rpm.

Post Hybridization Washing

[00163] Approximately 400 mL Agilent Wash Buffer 1 is placed into each of two separate glass staining dishes. Slides (no more than two at a time) are disassembled and separated while submerged in Wash Buffer 1, then transferred to a slide rack in a second staining dish also containing Wash Buffer 1. Slides are incubated for an additional 5 minutes in Wash Buffer 1 with stirring. Slides are transferred to Wash Buffer 2 pre-equilibrated to 37 $^{\circ}$ C and incubated for 5 minutes with stirring. Slides are transferred to a fourth staining dish containing acetonitrile, and incubated for 5 minutes with stirring.

Microarray Imaging

[00164] Microarray slides are imaged with an Agilent G2565CA Microarray Scanner System, using the Cy3-channel at 5 μ m resolution at 100% PMT setting, and the XRD option enabled at 0.05. The resulting TIFF images are processed using Agilent feature extraction software version 10.5.1.1 with the GE1_105_Dec08 protocol.

Luminex probe design

[00165] Probes immobilized to beads have 40 deoxynucleotides complementary to the 3’ end of the 40 nucleotide random region of the target aptamer. The aptamer complementary

region is coupled to Luminex Microspheres through a hexaethyleneglycol (HEG) linker bearing a 5' amino terminus. Biotinylated detection deoxyoligonucleotides comprise 17–21 deoxynucleotides complementary to the 5' primer region of target aptamers. Biotin moieties are appended to the 3' ends of detection oligos.

Coupling of probes to Luminex Microspheres

[00166] Probes are coupled to Luminex Microplex Microspheres essentially per the manufacturer's instructions, but with the following modifications: amino-terminal oligonucleotide amounts are 0.08 nMol per 2.5×10^6 microspheres, and the second EDC addition is 5 μ L at 10 mg/mL. Coupling reactions are performed in an Eppendorf ThermoShaker set at 25 °C and 600 rpm.

Microsphere hybridization

[00167] Microsphere stock solutions (about 40000 microspheres/ μ L) are vortexed and sonicated in a Health Sonics ultrasonic cleaner (Model: T1.9C) for 60 seconds to suspend the microspheres. Suspended microspheres are diluted to 2000 microspheres per reaction in $1.5 \times$ TMAC hybridization solutions and mixed by vortexing and sonication. Thirty-three μ L per reaction of the bead mixture are transferred into a 96-well HybAid plate. Seven μ L of 15 nM biotinylated detection oligonucleotide stock in $1 \times$ TE buffer are added to each reaction and mixed. Ten μ L of neutralized assay sample are added and the plate is sealed with a silicon cap mat seal. The plate is first incubated at 96 °C for 5 minutes and incubated at 50°C without agitation overnight in a conventional hybridization oven. A filter plate (Dura pore, Millipore part number MSBVN1250, 1.2 μ m pore size) is prewetted with 75 μ L $1 \times$ TMAC hybridization solution supplemented with 0.5% (w/v) BSA. The entire sample volume from the hybridization reaction is transferred to the filter plate. The hybridization plate is rinsed with 75 μ L $1 \times$ TMAC hybridization solution containing 0.5% BSA and any remaining material is transferred to the filter plate. Samples are filtered under slow vacuum, with 150 μ L buffer evacuated over about 8 seconds. The filter plate is washed once with 75 μ L $1 \times$ TMAC hybridization solution containing 0.5% BSA and the microspheres in the filter plate are resuspended in 75 μ L $1 \times$ TMAC hybridization solution containing 0.5% BSA. The filter plate is protected from light and incubated on an Eppendorf Thermalmixer R for 5 minutes at 1000 rpm. The filter plate is then washed once with 75 μ L $1 \times$ TMAC hybridization solution containing 0.5% BSA. 75 μ L of 10 μ g/mL streptavidin phycoerythrin (SAPE-100, MOSS, Inc.) in $1 \times$ TMAC hybridization solution is added to each reaction and incubated on Eppendorf Thermalmixer R at 25 °C at 1000 rpm for 60 minutes. The filter plate is washed twice with 75 μ L $1 \times$ TMAC hybridization solution containing 0.5% BSA and the

microspheres in the filter plate are resuspended in 75 μ L 1 $\times$ TMAC hybridization solution containing 0.5% BSA. The filter plate is then incubated protected from light on an Eppendorf Thermalmixer R for 5 minutes, 1000 rpm. The filter plate is then washed once with 75 μ L 1 $\times$ TMAC hybridization solution containing 0.5% BSA. Microspheres are resuspended in 75 μ L 1 $\times$ TMAC hybridization solution supplemented with 0.5% BSA, and analyzed on a Luminex 100 instrument running Xponent 3.0 software. At least 100 microspheres are counted per bead type, under high PMT calibration and a doublet discriminator setting of 7500 to 18000.

qPCR read-out

[00168] Standard curves for qPCR are prepared in water ranging from 108 to 102 copies with 10-fold dilutions and a no-template control. Neutralized assay samples are diluted 40-fold into diH₂O. The qPCR master mix is prepared at 2 $\times$ final concentration (2 $\times$ KOD buffer, 400 μ M dNTP mix, 400 nM forward and reverse primer mix, 2 $\times$ SYBR Green I and 0.5 U KOD EX). Ten μ L of 2 $\times$ qPCR master mix is added to 10 μ L of diluted assay sample. qPCR is run on a BioRad MyIQ iCycler with 2 minutes at 96 °C followed by 40 cycles of 96 °C for 5 seconds and 72 °C for 30 seconds.

Example 2. Freeze-Thaw Cycles Plasma Model

[00169] Plasma samples obtained from a subject may be initially obtained as a whole blood sample, then centrifuged. The resulting plasma supernatant can then be collected by decanting or aspirating it from the precipitate. A plasma sample must be analyzed or frozen at or less than -20 °C after collection. The plasma sample may be frozen and thawed multiple times for testing. Multiple freeze-thaw cycles can be a source of sample variability, potentially resulting in denatured protein or lysed cells.

[00170] In order to assess the quality of a plasma sample, a linear regression elastic net model containing a panel of the 11 biomarker proteins listed in Table 1 was developed. The model provides a predicted value that is the number of freeze-thaw events a plasma sample has undergone. The training and verification datasets were obtained from analysis of samples from adult human volunteers, as described in Model Development below. Table 2 shows the performance metrics for the model. “CCC” is Concordance Correlation Coefficient. “R²” is the degree of linear correlation, or the goodness-of-fit. CCC and R² are indicative of predictive performance of the model.

Table 2

Model	Dataset	# of Analytes	Predictive Performance	
			CCC (95% Conf)	R ² (95% Conf)
Freeze-thaw cycles (plasma)	Training	11	0.962 (0.949, 0.970)	0.929 (0.902, 0.944)
	Verification		0.943 (0.923, 0.960)	0.901 (0.878, 0.934)

[00171] The freeze-thaw cycles plasma model is an elastic net linear regression model. This model has 11 aptamers as its features, which bind the 11 different biomarker proteins listed in Table 1. The output of this model is the prediction of the number of times the sample was frozen and then thawed. Thus, the output is a number, 1 or higher, with 1 being immediate transfer of decanted or aspirated plasma samples after sample collection to freezing conditions.

Model Development

[00172] Multiple K2-EDTA Plasma tubes (purple-topped, BD#367863) of blood were collected from each of fourteen adult human volunteers by applying a tourniquet and using a 21G butterfly needle set. The tubes were inverted 8x-10x after collection and immediately centrifuged at 2,200xg for 30 minutes in a Beckman Coulter Allegra X-15R centrifuge. While the recommended centrifugation time is 15 minutes, the longer spin time minimizes the impact of platelet and other cell contamination on repeated freeze/thaw cycles. The resulting plasma was carefully aspirated from each tube and pooled across a given donor. 1.2mL aliquots of plasma were made in Eppendorf tubes from each donor's pool, and two "day 0" 70μL aliquots transferred from the Eppendorf tubes to matrix tubes for storage at -80°C. The remaining Eppendorf aliquot was also placed at -80°C, and successively thawed each day for 9 days. On days 1, 2, 3, 4, 7, and 9 of thaw, two 70μL aliquots were again transferred to matrix tubes for storage at -80°C until thawed on the day that analysis with the aptamers was performed, for example, according to a protocol described in Example 1. On the day of analysis, all matrix aliquots were thawed an additional time such that the final number of freeze-thaw cycles tested in the assay was 1x, 2x, 3x, 4x, 5x, 7x, and 10x.

[00173] For this test, the data were split 80%/20% into training/verification datasets such that 3 samples were randomly selected from six of the 7 treatments for the verification set (18 samples in the verification set) and the rest of the samples for the training set (72 samples in the training).

[00174] Due to low sample numbers, a hold-out test dataset was not used for model development. The model was developed on the training dataset and then assessed on the verification set, but it was not used as a holdout validation or test set. The sample numbers are shown in Table 3 below.

Table 3: Sample numbers for freeze-thaw plasma analysis

Dataset	Total Samples	Number of Cycles						
		1	2	3	4	5	7	10
Training	72	11	11	11	11	11	6	11
Verification	18	3	3	3	3	3	0	3

[00175] After the aptamer assay was performed, the data was normalized. Control samples were internally median normalized, plate scaled, calibrated, and samples normalized using adaptive normalization by maximum likelihood (ANML). All samples were within normalization scale factor pass/fail criteria and subsequently, no samples were removed from analysis. Normalization scale factors were not significantly correlated with freeze-thaw cycles.

POC Results

[00176] The Proof of Concept (POC) results showed that a number of analytes were significant at different false-discovery rate (FDR) levels. Table 4 below shows those numbers and percentages (after removal of redlisted analytes) of analytes significant at different Type I error cut-offs for freeze-thaw univariate results using the Wald test of the linear model regression coefficient.

Table 4: Number and percentage of analytes significant at different Type I error cut-offs for freeze-thaw univariate results

FDR	# analytes (%) < FDR level
0.10	301 (4.0 %)
0.05	240 (3.2 %)
0.01	165 (2.2 %)

Refinement and Validation

[00177] For the models developed in refinement, the training and verification sets described above were used.

[00178] Best subset selection was used to test various combinations of aptamers from 1 to 20 features. Results showed that model performance on the training set plateaus with 10 or more features and that performance on the verification set deteriorates with more than 10 features, suggestive of overfitting as more features are added. Thus, a series of elastic net models were generated with the number of features ranging from 5 to 20 analytes with 5 repeats of 10-fold cross-validation. Further selection was accomplished by testing performance on the other sample handling studies. The final model chosen had the best tradeoff with performance on the training set and low CV with the other sample handling studies to ensure freeze-thaw predictions are independent of other sample handling conditions.

[00179] The final model is an elastic net linear regression model with 11 features, trained on the training dataset and evaluated on the verification set. Any predictions below zero are mapped to zero, as negative time-to-freeze is not meaningful. Lin's correlation coefficient was calculated for the training and verification data. The model performs well on the verification set with an R^2 of 0.929 and a root mean square error (RMSE) of 0.914 and Concordance Correlation Coefficient (CCC) of 0.943 (Table 5).

Table 5: Performance of freeze-thaw plasma model on training and verification data sets

Data set	R^2	RMSE	CCC
Training	0.929 (0.902, 0.944)	0.774 (0.715, 0.821)	0.962 (0.949, 0.970)
Verification	0.901 (0.878, 0.934)	0.914 (0.717, 1.142)	0.943 (0.923, 0.960)

[00180] The effect of winsorization and dropping features were evaluated to correct for outlier values in other datasets. For the original data the RMSE was 0.832, with winsorization it was 1.462 and for feature removal it was 1.018. Outlier values were therefore replaced with zero for this model. These results are shown in Tables 6 and 7 below.

Table 6: RMSE Values

Model		RMSE		Final Selection
	Original (training)	Winsorized	Replacement with Zero	
Freeze-thaw cycles (plasma)	0.832	1.462	1.018	Replacement with zero

Table 7: Predictive variation due to assay noise

Model	Bound	Error Bounds (95%)	Error Bounds (99%)
Freeze-Thaw (plasma)	Upper Bound	0.472	0.647
	Lower Bound	-1.279	-1.519

Example 3: Use of the Sample Handling Model

[00181] The sample handling model may be used to censor individual samples for specific output that is important to the test. In one embodiment, samples that are identified as failing the quality assessment for the number of freeze-thaw cycles may be removed if the specific output of the number of freeze-thaw cycles is important to the test being conducted. In other embodiments, samples that are identified as failing the quality assessment for the number of freeze-thaw cycles may be included if the specific output of the time to decant is not important to the test being conducted. In some embodiments, a panel of biomarker proteins may be modified in a subsequent or simultaneous analysis such as protein biomarker discovery analysis, protein expression level analysis, diagnostic method or prognostic method based on the determined approximate times for each of the plurality of samples. In some embodiments, the panel of biomarker proteins is reduced in number of biomarker proteins measured.

[00182] The sample handling model may be used to identify biases within a plurality of samples collected. In one embodiment, the sample handling model may be used to identify biases between experimental samples and controls.

[00183] The sample handling model may be used to assess adherence to a clinical study protocol for sample collection and processing.

[00184] The sample handling model may be used to identify outlier samples in a plurality of samples. In one embodiment, the outlier sample may be 1 or 2 or 3 or more

standard deviations from the other samples in the model. The outlier sample may have better or worse quality relative to the other samples in the model.

[00185] The sampling model may be used to compare a plurality of samples from a first site to one or more additional sites for sample collection and processing.

Example 4: Analysis of Freeze-Thaw Plasma Model Biomarker Panels

[00186] Model biomarker panels comprising various combinations of the biomarkers listed in Table 1 were analyzed to determine the coefficient of determination (R^2) value for the various combinations. Tables 8-17 below shows the model results when various combinations comprising 1 to 11 biomarker proteins were measured. The results are shown in in Tables 8-17.

Table 8: Freeze-Thaw Plasma Model 1 Biomarker

Train Rsquared	Train RMSE	Train MAE	Test RMSE	Test Rsquared	Sample Handling _CV	KRT1	KRT5	ADSL	TEX29	RIC8A	LANCL2	GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.783	1.446	1.197	1.66	0.676	1.618	KRT1										
0.786	1.45	1.184	1.25	0.848	0.497		KRT5									
0.692	1.698	1.353	2.24	0.545	0.245			ADSL								
0.622	1.803	1.518	1.92	0.787	0.29				TEX29							
0.521	2.074	1.714	2.54	0.515	0.239					RIC8A						
0.502	2.145	1.8	1.76	0.898	0.69						LANCL2					
0.579	2.015	1.601	2.63	0.464	0.396							GLO1				
0.816	1.364	1.122	1.08	0.868	0.693								PGP			
0.416	2.45	2.044	2.57	0.342	0.339									FBXL4		
0.444	2.287	1.952	2.46	0.814	0.584										SLAMF1	
0.489	2.219	1.812	2.14	0.687	0.283											CASQ1

Table 9: Freeze-Thaw Plasma Model 2 Biomarkers

Train Rsquared	Train RMSE	Train MAE	Test RMSE	Test Rsquared	Sample Handling _CV	KRT1	KRT5	ADSL	TEX29	RIC8A	LANCL2	GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.8	1.418	1.184	1.44	0.78	0.356	KRT1	KRT5									
0.858	1.208	0.987	1.46	0.783	0.237	KRT1		ADSL								
0.825	1.266	1.005	1.39	0.813	0.328	KRT1			TEX29							
0.782	1.425	1.172	1.48	0.8	0.274	KRT1				RIC8A						
0.858	1.218	1.047	1.37	0.83	1.391	KRT1					LANCL2					
0.864	1.223	1.01	1.55	0.86	0.925	KRT1						GLO1				
0.883	1.113	0.931	1.08	0.881	0.48	KRT1							PGP			
0.824	1.347	1.107	1.68	0.676	0.685	KRT1								FBXL4		
0.876	1.173	0.918	1.6	0.735	1.924	KRT1									SLAMF1	

Train Rsquared	Train RMSE	Train MAE	Test RMSE	Test Rsquared	Sample Handling - CV	KRT1	KRT5	ADSL	TEX29	RIC8A	LANCL2	GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.856	1.262	1.033	1.44	0.816	0.617	KRT1										CASQ1
0.853	1.221	0.973	1.35	0.855	0.214		KRT5	ADSL								
0.834	1.254	1.026	1.3	0.877	0.289		KRT5		TEX29							
0.803	1.388	1.161	1.41	0.873	0.229		KRT5			RIC8A						
0.815	1.354	1.137	1.18	0.893	1.686		KRT5				LANCL2					
0.855	1.24	0.993	1.45	0.876	0.393		KRT5					GLO1				
0.855	1.216	1	1.06	0.889	0.438		KRT5						PGP			
0.814	1.419	1.171	1.41	0.857	1.031		KRT5							FBXL4		
0.831	1.348	1.053	1.42	0.868	0.505		KRT5								SLAMF1	
0.839	1.317	1.065	1.27	0.881	0.328		KRT5									CASQ1
0.788	1.44	1.179	1.87	0.805	0.221			ADSL	TEX29							
0.775	1.481	1.224	2.34	0.606	0.189			ADSL		RIC8A						
0.816	1.366	1.077	1.32	0.812	0.351			ADSL			LANCL2					
0.779	1.49	1.198	1.86	0.599	0.226			ADSL				GLO1				
0.874	1.151	0.923	1.14	0.874	0.453			ADSL					PGP			
0.735	1.527	1.192	2.27	0.527	0.232			ADSL						FBXL4		
0.704	1.699	1.344	2.14	0.665	0.187			ADSL							SLAMF1	
0.745	1.596	1.259	1.81	0.631	0.222			ADSL								CASQ1
0.62	1.806	1.498	2.06	0.767	0.245				TEX29	RIC8A						
0.775	1.47	1.177	1.18	0.863	0.532				TEX29		LANCL2					
0.804	1.434	1.15	1.37	0.845	0.373				TEX29			GLO1				
0.882	1.121	0.893	1.11	0.883	1.053				TEX29				PGP			
0.745	1.566	1.303	1.88	0.84	0.5				TEX29					FBXL4		
0.738	1.619	1.303	2.06	0.825	0.31				TEX29						SLAMF1	
0.703	1.711	1.393	1.46	0.838	0.27				TEX29							CASQ1

Train Rsquared	Train RMSE	Train MAE	Test RMSE	Test Rsquared	Sample Handling - CV	KRT1	KRT5	ADSL	TEX29	RIC8A	LANCL2	GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.757	1.511	1.226	1.32	0.83	0.401					RIC8A	LANCL2					
0.8	1.416	1.136	1.93	0.56	0.316					RIC8A		GLO1				
0.891	1.078	0.894	1.1	0.906	0.386					RIC8A			PGP			
0.627	1.849	1.511	2.41	0.578	0.235					RIC8A				FBXL4		
0.725	1.623	1.305	2.47	0.749	0.261					RIC8A					SLAMF1	
0.708	1.666	1.349	1.85	0.623	0.237					RIC8A						CASQ1
0.594	1.99	1.648	2.19	0.795	0.525						LANCL2	GLO1				
0.812	1.422	1.152	1.23	0.85	0.57						LANCL2		PGP			
0.544	2.101	1.76	1.69	0.938	0.463						LANCL2			FBXL4		
0.552	2.065	1.72	1.64	0.892	0.442						LANCL2				SLAMF1	
0.61	1.988	1.647	1.83	0.912	0.623						LANCL2					CASQ1
0.802	1.448	1.174	1.28	0.861	0.512							GLO1	PGP			
0.587	2.012	1.629	2.3	0.572	0.302							GLO1		FBXL4		
0.575	1.996	1.628	2.08	0.715	0.3							GLO1			SLAMF1	
0.574	2.032	1.614	2.43	0.554	0.285							GLO1				CASQ1
0.807	1.433	1.178	1.2	0.867	0.488								PGP	FBXL4		
0.805	1.436	1.164	1.23	0.851	0.509								PGP		SLAMF1	
0.821	1.42	1.141	1.2	0.877	0.605								PGP			CASQ1
0.508	2.182	1.843	2.41	0.761	0.318									FBXL4	SLAMF1	
0.546	2.144	1.76	2.04	0.714	1.872									FBXL4		CASQ1
0.54	2.111	1.698	1.88	0.895	0.231										SLAMF1	CASQ1

Table 10: Freeze-Thaw Plasma Model 3 Biomarkers

Train Rsquared	Train RMSE	Train MAE	Test RMSE	Test Rsquared	Sample Handling_CV	KRT1	KRT5	ADSL	TEX29	RIC8A	LANCL2	GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.866	1.174	0.954	1.3	0.839	0.23	KRT1	KRT5	ADSL								
0.838	1.218	0.979	1.26	0.852	0.326	KRT1	KRT5		TEX29							
0.806	1.357	1.14	1.31	0.855	0.27	KRT1	KRT5			RIC8A						
0.85	1.222	1.059	1.24	0.856	1.634	KRT1	KRT5				LANCL2					
0.87	1.18	0.973	1.37	0.884	0.511	KRT1	KRT5					GLO1				
0.874	1.136	0.951	1.06	0.883	0.448	KRT1	KRT5						PGP			
0.832	1.322	1.106	1.46	0.774	0.567	KRT1	KRT5							FBXL4		
0.868	1.186	0.926	1.44	0.794	1.321	KRT1	KRT5								SLAMF1	
0.858	1.231	1.016	1.28	0.857	1.231	KRT1	KRT5									CASQ1
0.878	1.087	0.873	1.35	0.858	0.229	KRT1		ADSL	TEX29							
0.864	1.156	0.957	1.52	0.81	0.196	KRT1		ADSL		RIC8A						
0.919	0.93	0.759	1.01	0.89	0.404	KRT1		ADSL			LANCL2					
0.901	1.027	0.83	1.25	0.851	0.256	KRT1		ADSL				GLO1				
0.914	0.957	0.782	0.97	0.905	0.506	KRT1		ADSL					PGP			
0.882	1.072	0.83	1.58	0.743	0.268	KRT1		ADSL						FBXL4		
0.892	1.087	0.876	1.46	0.814	0.228	KRT1		ADSL							SLAMF1	
0.891	1.078	0.851	1.24	0.834	0.259	KRT1		ADSL								CASQ1
0.817	1.286	1.024	1.38	0.83	0.297	KRT1			TEX29	RIC8A						
0.892	1.041	0.863	1.05	0.876	1.008	KRT1					LANCL2					
0.898	1.054	0.857	1.06	0.92	0.654	KRT1						GLO1				
0.905	0.971	0.802	0.97	0.901	0.544	KRT1							PGP			
0.867	1.101	0.905	1.43	0.818	0.417	KRT1								FBXL4		
0.894	1.045	0.862	1.5	0.822	0.466	KRT1									SLAMF1	
0.865	1.179	0.957	1.15	0.865	0.378	KRT1										CASQ1

Train Rsquared	Train RMSE	Train MAE	Test RMSE	Test Rsquared	Sample Handling_CV	KRT1	KRT5	ADSL	TEX29	RIC8A	LANCL2	GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.877	1.112	0.944	0.96	0.914	0.46	KRT1				RIC8A	LANCL2					
0.885	1.109	0.92	1.25	0.874	0.548	KRT1				RIC8A		GLO1				
0.902	0.994	0.84	0.86	0.939	0.375	KRT1				RIC8A			PGP			
0.822	1.284	1.07	1.55	0.779	0.318	KRT1				RIC8A				FBXL4		
0.885	1.088	0.921	1.56	0.846	0.384	KRT1				RIC8A					SLAMF1	
0.862	1.204	0.991	1.19	0.865	0.272	KRT1				RIC8A						CASQ1
0.872	1.183	0.997	1.41	0.89	1.877	KRT1					LANCL2	GLO1				
0.878	1.127	0.963	1.08	0.887	0.513	KRT1					LANCL2		PGP			
0.866	1.19	1.019	1.35	0.815	2.126	KRT1					LANCL2			FBXL4		
0.883	1.109	0.896	1.3	0.809	0.949	KRT1					LANCL2				SLAMF1	
0.874	1.169	0.935	1.03	0.899	0.497	KRT1					LANCL2					CASQ1
0.817	1.374	1.108	1.34	0.902	0.384	KRT1						GLO1	PGP			
0.878	1.148	0.934	1.12	0.906	0.462	KRT1								FBXL4		
0.883	1.112	0.934	1.08	0.889	0.398	KRT1									SLAMF1	
0.884	1.104	0.915	1.13	0.888	0.394	KRT1										CASQ1
0.887	1.106	0.929	1.05	0.894	0.402	KRT1							PGP	FBXL4		
0.817	1.328	1.087	1.49	0.773	0.365	KRT1							PGP		SLAMF1	
0.814	1.364	1.129	1.48	0.753	0.661	KRT1							PGP			CASQ1
0.82	1.328	1.087	1.45	0.77	0.368	KRT1								FBXL4	SLAMF1	
0.879	1.119	0.921	1.18	0.918	0.379	KRT1								FBXL4		CASQ1
0.885	1.143	0.966	1.33	0.875	47.824	KRT1									SLAMF1	CASQ1
0.887	1.108	0.932	1.01	0.909	0.395		KRT5	ADSL	TEX29							
0.887	1.103	0.922	1.08	0.905	0.389		KRT5	ADSL		RIC8A						
0.807	1.379	1.128	1.4	0.825	0.345		KRT5	ADSL			LANCL2					
0.883	1.102	0.92	1.15	0.891	0.395		KRT5	ADSL				GLO1				

Train Rsquared	Train RMSE	Train MAE	Test RMSE	Test Rsquared	Sample Handling_CV	KRT1	KRT5	ADSL	TEX29	RIC8A	LANCL2	GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.887	1.101	0.93	1.07	0.89	0.393		KRT5	ADSL					PGP			
0.886	1.098	0.923	1.12	0.888	0.393		KRT5	ADSL						FBXL4		
0.803	1.36	1.091	1.74	0.69	0.291		KRT5	ADSL							SLAMF1	
0.887	1.097	0.924	1.13	0.907	0.376		KRT5	ADSL								CASQ1
0.786	1.486	1.216	1.22	0.876	0.469		KRT5		TEX29	RIC8A						
0.803	1.466	1.186	1.2	0.883	0.505		KRT5		TEX29		LANCL2					
0.885	1.115	0.936	1.11	0.907	0.469		KRT5		TEX29			GLO1				
0.804	1.465	1.175	1.21	0.874	0.519		KRT5		TEX29				PGP			
0.614	1.967	1.641	1.71	0.903	0.77		KRT5		TEX29					FBXL4		
0.805	1.463	1.185	1.17	0.882	0.492		KRT5		TEX29						SLAMF1	
0.797	1.483	1.2	1.19	0.882	0.488		KRT5		TEX29							CASQ1
0.933	0.822	0.695	0.92	0.92	0.36		KRT5			RIC8A	LANCL2					
0.927	0.864	0.7	1.07	0.886	0.272		KRT5			RIC8A		GLO1				
0.926	0.853	0.715	1.01	0.93	0.348		KRT5			RIC8A			PGP			
0.904	0.95	0.772	1.43	0.858	0.239		KRT5			RIC8A				FBXL4		
0.905	0.984	0.819	1.42	0.894	0.237		KRT5			RIC8A					SLAMF1	
0.903	1	0.828	1.14	0.882	0.222		KRT5			RIC8A						CASQ1
0.866	1.203	0.996	1.48	0.835	0.544		KRT5				LANCL2	GLO1				
0.932	0.838	0.676	0.83	0.931	0.386		KRT5				LANCL2		PGP			
0.928	0.848	0.693	0.85	0.926	0.389		KRT5				LANCL2			FBXL4		
0.936	0.809	0.665	0.99	0.906	0.375		KRT5				LANCL2				SLAMF1	
0.927	0.854	0.705	0.94	0.915	0.375		KRT5				LANCL2					CASQ1
0.93	0.853	0.691	0.85	0.923	0.388		KRT5					GLO1	PGP			
0.926	0.866	0.703	0.85	0.932	0.352		KRT5					GLO1		FBXL4		
0.928	0.85	0.691	1.05	0.9	0.291		KRT5					GLO1			SLAMF1	

Train Rsquared	Train RMSE	Train MAE	Test RMSE	Test Rsquared	Sample Handling_CV	KRT1	KRT5	ADSL	TEX29	RIC8A	LANCL2	GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.922	0.897	0.718	0.98	0.919	0.289		KRT5					GLO1				CASQ1
0.921	0.901	0.73	0.97	0.914	0.288		KRT5						PGP	FBXL4		
0.927	0.856	0.711	1.05	0.917	0.334		KRT5						PGP		SLAMF1	
0.886	1.127	0.878	1.31	0.846	0.469		KRT5						PGP			CASQ1
0.921	0.89	0.731	1.01	0.924	0.362		KRT5							FBXL4	SLAMF1	
0.922	0.891	0.72	0.89	0.926	0.36		KRT5							FBXL4		CASQ1
0.917	0.916	0.756	1.4	0.873	0.259		KRT5								SLAMF1	CASQ1
0.913	0.928	0.753	1.22	0.872	0.256			ADSL	TEX29	RIC8A						
0.908	0.985	0.799	1.15	0.896	0.249			ADSL	TEX29		LANCL2					
0.938	0.808	0.669	0.97	0.9	0.339			ADSL	TEX29			GLO1				
0.933	0.823	0.696	0.9	0.923	0.347			ADSL	TEX29				PGP			
0.934	0.821	0.684	1.06	0.894	0.333			ADSL	TEX29					FBXL4		
0.931	0.838	0.695	1.01	0.911	0.33			ADSL	TEX29						SLAMF1	
0.938	0.813	0.665	0.92	0.908	0.339			ADSL	TEX29							CASQ1
0.869	1.208	1	1.5	0.867	0.642			ADSL		RIC8A	LANCL2					
0.933	0.832	0.689	0.98	0.906	0.311			ADSL		RIC8A		GLO1				
0.926	0.868	0.716	1.23	0.843	0.25			ADSL		RIC8A			PGP			
0.927	0.874	0.712	1.16	0.874	0.252			ADSL		RIC8A				FBXL4		
0.925	0.889	0.734	1.17	0.854	0.249			ADSL		RIC8A					SLAMF1	
0.926	0.86	0.729	1.1	0.912	0.305			ADSL		RIC8A						CASQ1
0.926	0.867	0.737	1.09	0.928	0.313			ADSL			LANCL2	GLO1				
0.931	0.849	0.693	0.96	0.916	0.312			ADSL			LANCL2		PGP			
0.908	0.964	0.803	1.53	0.853	0.215			ADSL			LANCL2			FBXL4		
0.91	0.951	0.784	1.31	0.841	0.216			ADSL			LANCL2				SLAMF1	
0.914	0.961	0.808	1.25	0.879	0.215			ADSL			LANCL2					CASQ1

Train Rsquared	Train RMSE	Train MAE	Test RMSE	Test Rsquared	Sample Handling_CV	KRT1	KRT5	ADSL	TEX29	RIC8A	LANCL2	GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.885	1.113	0.924	1.09	0.877	0.432			ADSL				GLO1	PGP			
0.913	0.954	0.785	0.91	0.917	0.371			ADSL				GLO1		FBXL4		
0.918	0.936	0.76	1.02	0.893	0.361			ADSL				GLO1			SLAMF1	
0.912	0.957	0.782	0.97	0.91	0.362			ADSL				GLO1				CASQ1
0.917	0.942	0.757	0.97	0.911	0.382			ADSL					PGP	FBXL4		
0.916	0.94	0.772	0.97	0.899	0.358			ADSL					PGP		SLAMF1	
0.911	0.96	0.79	0.92	0.911	0.366			ADSL					PGP			CASQ1
0.917	0.939	0.76	0.89	0.916	0.373			ADSL						FBXL4	SLAMF1	
0.916	0.941	0.76	1.06	0.88	0.347			ADSL						FBXL4		CASQ1
0.921	0.925	0.738	1	0.891	0.369			ADSL							SLAMF1	CASQ1
0.917	0.941	0.748	0.95	0.906	0.367				TEX29	RIC8A	LANCL2					
0.891	1.077	0.866	1.13	0.863	0.436				TEX29	RIC8A		GLO1				
0.913	0.965	0.786	1	0.9	0.313				TEX29	RIC8A			PGP			
0.909	0.979	0.793	0.95	0.914	0.323				TEX29	RIC8A				FBXL4		
0.912	0.97	0.784	0.94	0.911	0.329				TEX29	RIC8A					SLAMF1	
0.909	0.988	0.777	1.18	0.865	0.245				TEX29	RIC8A						CASQ1
0.908	0.989	0.783	1.17	0.86	0.255				TEX29		LANCL2	GLO1				
0.905	1.006	0.786	1.09	0.887	0.238				TEX29		LANCL2		PGP			
0.91	0.976	0.781	1.07	0.895	0.305				TEX29		LANCL2			FBXL4		
0.914	0.964	0.768	0.99	0.898	0.312				TEX29		LANCL2				SLAMF1	
0.911	0.975	0.77	0.94	0.91	0.323				TEX29		LANCL2					CASQ1
0.905	1.016	0.776	1.25	0.847	0.238				TEX29			GLO1	PGP			
0.895	1.085	0.899	1.06	0.9	0.496				TEX29			GLO1		FBXL4		
0.909	0.983	0.816	0.89	0.93	0.446				TEX29			GLO1			SLAMF1	
0.902	0.977	0.832	0.85	0.925	0.428				TEX29			GLO1				CASQ1

Train Rsquared	Train RMSE	Train MAE	Test RMSE	Test Rsquared	Sample Handling_CV	KRT1	KRT5	ADSL	TEX29	RIC8A	LANCL2	GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.897	1.002	0.855	0.98	0.901	1.105				TEX29				PGP	FBXL4		
0.904	0.973	0.834	1.07	0.899	0.456				TEX29				PGP		SLAMF1	
0.901	1.013	0.87	0.88	0.921	0.478				TEX29				PGP			CASQ1
0.912	0.951	0.791	0.84	0.935	0.417				TEX29					FBXL4	SLAMF1	
0.906	0.978	0.809	1.01	0.913	0.361				TEX29					FBXL4		CASQ1
0.913	0.962	0.798	1.02	0.918	0.343				TEX29						SLAMF1	CASQ1
0.902	1.016	0.83	1.02	0.909	0.347					RIC8A	LANCL2	GLO1				
0.904	0.962	0.827	0.96	0.928	0.383					RIC8A	LANCL2		PGP			
0.884	1.143	0.888	1.61	0.733	0.668					RIC8A	LANCL2			FBXL4		
0.909	0.946	0.817	1.07	0.923	0.373					RIC8A	LANCL2				SLAMF1	
0.908	0.967	0.826	0.85	0.93	0.383					RIC8A	LANCL2					CASQ1
0.899	1.004	0.862	1.45	0.872	0.363					RIC8A		GLO1	PGP			
0.881	1.081	0.904	1.12	0.885	0.341					RIC8A		GLO1		FBXL4		
0.898	1.041	0.881	1.2	0.893	0.31					RIC8A		GLO1			SLAMF1	
0.906	0.987	0.818	0.87	0.923	0.512					RIC8A		GLO1				CASQ1
0.909	0.973	0.808	0.92	0.921	0.6					RIC8A			PGP	FBXL4		
0.909	0.979	0.799	0.94	0.912	0.555					RIC8A			PGP		SLAMF1	
0.904	1.009	0.834	0.94	0.924	1.332					RIC8A			PGP			CASQ1
0.905	0.972	0.831	0.93	0.908	0.535					RIC8A				FBXL4	SLAMF1	
0.863	1.217	1.01	1.44	0.791	0.588					RIC8A				FBXL4		CASQ1
0.905	0.974	0.815	1.01	0.896	0.469					RIC8A					SLAMF1	CASQ1
0.903	0.996	0.843	0.89	0.91	0.517						LANCL2	GLO1	PGP			
0.91	0.956	0.814	1.13	0.877	0.659						LANCL2	GLO1		FBXL4		
0.903	0.996	0.848	0.96	0.899	0.889						LANCL2	GLO1			SLAMF1	
0.905	0.996	0.838	1.02	0.888	0.58						LANCL2	GLO1				CASQ1

Train Rsquared	Train RMSE	Train MAE	Test RMSE	Test Rsquared	Sample Handling_CV	KRT1	KRT5	ADSL	TEX29	RIC8A	LANCL2	GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.91	0.96	0.8	0.87	0.929	0.508						LANCL2		PGP	FBXL4		
0.91	0.969	0.791	0.91	0.92	0.446						LANCL2		PGP		SLAMF1	
0.906	0.985	0.815	0.87	0.925	0.455						LANCL2		PGP			CASQ1
0.913	0.958	0.785	1.04	0.91	0.417						LANCL2			FBXL4	SLAMF1	
0.905	0.987	0.808	0.99	0.916	0.492						LANCL2			FBXL4		CASQ1
0.89	1.133	0.88	1.34	0.807	0.776						LANCL2				SLAMF1	CASQ1
0.907	0.993	0.804	1	0.913	0.409							GLO1	PGP	FBXL4		
0.911	0.95	0.804	1.1	0.901	0.423							GLO1	PGP		SLAMF1	
0.906	0.975	0.826	0.93	0.915	0.438							GLO1	PGP			CASQ1
0.906	0.982	0.812	0.99	0.904	0.426							GLO1		FBXL4	SLAMF1	
0.903	1.007	0.84	1.26	0.87	0.41							GLO1		FBXL4		CASQ1
0.905	0.996	0.841	0.85	0.935	0.674							GLO1			SLAMF1	CASQ1
0.899	1.029	0.857	0.99	0.919	0.416								PGP	FBXL4	SLAMF1	
0.908	0.983	0.81	0.96	0.921	0.497								PGP	FBXL4		CASQ1
0.904	1.022	0.844	0.99	0.922	0.422								PGP		SLAMF1	CASQ1
0.895	1.021	0.873	0.83	0.938	0.407									FBXL4	SLAMF1	CASQ1

Table 11: Freeze-Thaw Plasma Model 4 Biomarkers

Train Rsquared	Train RMSE	Train MAE	Test RMSE	Test Rsquared	Sample Handling_CV	KRT1	KRT5	ADSL	TEX29	RIC8A	LANCL2	GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.88	1.095	0.891	1.32	0.896	0.216	KRT1	KRT5	ADSL	TEX29							
0.904	0.98	0.832	0.94	0.933	0.441	KRT1	KRT5	ADSL		RIC8A						
0.908	0.986	0.835	0.81	0.934	0.497	KRT1	KRT5	ADSL			LANCL2					
0.899	1.008	0.847	1.1	0.9	0.391	KRT1	KRT5	ADSL				GLO1				
0.9	1.032	0.859	0.93	0.919	0.478	KRT1	KRT5	ADSL					PGP			

Train Rsquared	Train RMSE	Train MAE	Test RMSE	Test Rsquared	Sample Handling_CV	KRT1	KRT5	ADSL	TEX29	RIC8A	LANCL2	GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.909	0.988	0.84	0.95	0.913	0.382	KRT1	KRT5	ADSL								
0.905	0.99	0.831	0.88	0.934	0.523	KRT1	KRT5	ADSL						FBXL4		
0.911	0.96	0.798	0.91	0.938	0.446	KRT1	KRT5	ADSL							SLAMF1	
0.909	0.982	0.82	0.87	0.93	0.42	KRT1	KRT5		TEX29	RIC8A						CASQ1
0.907	0.991	0.801	1.11	0.904	0.322	KRT1	KRT5		TEX29		LANCL2					
0.895	1.05	0.857	1.13	0.884	0.316	KRT1	KRT5		TEX29			GLO1				
0.872	1.131	0.903	1.54	0.835	0.184	KRT1	KRT5		TEX29				PGP			
0.908	0.997	0.82	1.07	0.903	0.312	KRT1	KRT5		TEX29					FBXL4		
0.905	0.978	0.832	1.06	0.933	0.369	KRT1	KRT5		TEX29						SLAMF1	
0.906	0.989	0.834	0.85	0.935	0.369	KRT1	KRT5		TEX29							CASQ1
0.912	0.963	0.82	0.92	0.934	0.401	KRT1	KRT5			RIC8A	LANCL2					
0.899	1.04	0.879	1.23	0.884	0.332	KRT1	KRT5			RIC8A		GLO1				
0.877	1.139	0.969	1.08	0.905	0.482	KRT1	KRT5			RIC8A			PGP			
0.881	1.115	0.912	1.05	0.896	0.471	KRT1	KRT5			RIC8A				FBXL4		
0.882	1.125	0.944	1.09	0.909	0.535	KRT1	KRT5			RIC8A					SLAMF1	
0.882	1.121	0.91	1.16	0.875	0.824	KRT1	KRT5			RIC8A						CASQ1
0.878	1.151	0.977	1.22	0.897	1.039	KRT1	KRT5				LANCL2	GLO1				
0.892	1.058	0.873	0.98	0.905	0.346	KRT1	KRT5				LANCL2		PGP			
0.884	1.119	0.906	1.14	0.886	2.223	KRT1	KRT5				LANCL2			FBXL4		
0.882	1.109	0.911	1.09	0.873	0.449	KRT1	KRT5				LANCL2				SLAMF1	
0.885	1.117	0.946	1.06	0.9	0.533	KRT1	KRT5				LANCL2					CASQ1
0.888	1.096	0.896	1.04	0.89	0.549	KRT1	KRT5					GLO1	PGP			
0.888	1.107	0.911	1.15	0.863	0.985	KRT1	KRT5					GLO1		FBXL4		
0.886	1.103	0.889	1.06	0.895	0.417	KRT1	KRT5					GLO1			SLAMF1	
0.885	1.118	0.93	1.07	0.907	0.443	KRT1	KRT5					GLO1				CASQ1

Train Rsquared	Train RMSE	Train MAE	Test RMSE	Test Rsquared	Sample Handling_CV	KRT1	KRT5	ADSL	TEX29	RIC8A	LANCL2	GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.888	1.099	0.884	1.04	0.899	0.44	KRT1	KRT5									
0.887	1.12	0.881	1.2	0.87	0.626	KRT1	KRT5						PGP	FBXL4		
0.891	1.091	0.881	1.05	0.889	0.417	KRT1	KRT5						PGP		SLAMF1	
0.895	1.054	0.842	1.23	0.852	0.232	KRT1	KRT5							FBXL4	SLAMF1	CASQ1
0.941	0.792	0.645	0.89	0.917	0.363	KRT1	KRT5							FBXL4		CASQ1
0.937	0.796	0.663	0.88	0.93	0.366	KRT1	KRT5								SLAMF1	CASQ1
0.942	0.773	0.633	1.05	0.9	0.357	KRT1		ADSL	TEX29	RIC8A						
0.937	0.802	0.664	1.01	0.914	0.352	KRT1		ADSL	TEX29		LANCL2					
0.94	0.796	0.641	0.89	0.915	0.361	KRT1		ADSL	TEX29			GLO1				
0.935	0.815	0.667	0.92	0.925	0.336	KRT1		ADSL	TEX29				PGP			
0.928	0.845	0.687	1.19	0.867	0.276	KRT1		ADSL	TEX29					FBXL4		
0.927	0.875	0.719	1.12	0.896	0.274	KRT1		ADSL	TEX29						SLAMF1	
0.922	0.903	0.738	1.11	0.876	0.272	KRT1		ADSL	TEX29							CASQ1
0.932	0.819	0.676	1.1	0.92	0.327	KRT1		ADSL		RIC8A	LANCL2					
0.895	1.041	0.835	1	0.91	0.362	KRT1		ADSL		RIC8A		GLO1				
0.931	0.836	0.701	1.08	0.933	0.341	KRT1		ADSL		RIC8A			PGP			
0.933	0.832	0.673	0.94	0.926	0.339	KRT1		ADSL		RIC8A				FBXL4		
0.917	0.902	0.747	1.57	0.855	0.25	KRT1		ADSL		RIC8A					SLAMF1	
0.91	0.923	0.745	1.36	0.842	0.243	KRT1		ADSL		RIC8A						CASQ1
0.913	0.962	0.803	1.3	0.882	0.238	KRT1		ADSL			LANCL2	GLO1				
0.933	0.834	0.67	0.81	0.932	0.395	KRT1		ADSL			LANCL2		PGP			
0.941	0.788	0.63	0.94	0.911	0.384	KRT1		ADSL			LANCL2			FBXL4		
0.934	0.834	0.657	0.87	0.925	0.387	KRT1		ADSL			LANCL2				SLAMF1	
0.935	0.834	0.661	0.84	0.927	0.399	KRT1		ADSL			LANCL2					CASQ1
0.938	0.802	0.647	0.95	0.915	0.379	KRT1		ADSL				GLO1	PGP			

Train Rsquared	Train RMSE	Train MAE	Test RMSE	Test Rsquared	Sample Handling_CV	KRT1	KRT5	ADSL	TEX29	RIC8A	LANCL2	GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.87	1.131	0.865	1.47	0.819	0.238	KRT1		ADSL				GLO1		FBXL4		
0.931	0.836	0.669	0.89	0.924	0.39	KRT1		ADSL				GLO1			SLAMF1	
0.933	0.836	0.665	0.83	0.926	0.396	KRT1		ADSL				GLO1				CASQ1
0.94	0.789	0.636	1.06	0.895	0.373	KRT1		ADSL					PGP	FBXL4		
0.94	0.791	0.626	0.98	0.902	0.386	KRT1		ADSL					PGP		SLAMF1	
0.934	0.838	0.655	0.91	0.914	0.385	KRT1		ADSL					PGP			CASQ1
0.933	0.831	0.68	0.94	0.923	0.345	KRT1		ADSL						FBXL4	SLAMF1	
0.928	0.863	0.693	0.88	0.933	0.362	KRT1		ADSL						FBXL4		CASQ1
0.928	0.863	0.696	0.85	0.932	0.37	KRT1		ADSL							SLAMF1	CASQ1
0.929	0.851	0.677	1.15	0.89	0.292	KRT1			TEX29	RIC8A	LANCL2					
0.927	0.852	0.681	1.12	0.884	0.294	KRT1			TEX29	RIC8A		GLO1				
0.863	1.2	0.953	1.37	0.883	0.191	KRT1			TEX29	RIC8A			PGP			
0.921	0.913	0.727	1.03	0.912	0.292	KRT1			TEX29	RIC8A				FBXL4		
0.931	0.841	0.687	1.1	0.914	0.338	KRT1			TEX29	RIC8A					SLAMF1	
0.931	0.844	0.683	1.01	0.916	0.344	KRT1			TEX29	RIC8A						CASQ1
0.926	0.878	0.697	0.95	0.924	0.369	KRT1			TEX29		LANCL2	GLO1				
0.92	0.901	0.725	1.36	0.859	0.265	KRT1			TEX29		LANCL2		PGP			
0.939	0.799	0.666	0.9	0.916	0.347	KRT1			TEX29		LANCL2			FBXL4		
0.941	0.789	0.647	1.04	0.885	0.339	KRT1			TEX29		LANCL2				SLAMF1	
0.939	0.803	0.653	0.98	0.904	0.336	KRT1			TEX29		LANCL2					CASQ1
0.941	0.797	0.646	0.96	0.898	0.347	KRT1			TEX29			GLO1	PGP			
0.938	0.8	0.669	0.98	0.912	0.341	KRT1			TEX29			GLO1		FBXL4		
0.879	1.132	0.881	1.19	0.859	0.221	KRT1			TEX29			GLO1			SLAMF1	
0.936	0.809	0.672	0.94	0.926	0.343	KRT1			TEX29			GLO1				CASQ1
0.941	0.792	0.647	0.88	0.92	0.347	KRT1			TEX29				PGP	FBXL4		

Train Rsquared	Train RMSE	Train MAE	Test RMSE	Test Rsquared	Sample Handling_CV	KRT1	KRT5	ADSL	TEX29	RIC8A	LANCL2	GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.938	0.8	0.647	1.13	0.888	0.328	KRT1			TEX29				PGP		SLAMF1	
0.942	0.783	0.634	1.02	0.889	0.339	KRT1			TEX29				PGP			CASQ1
0.941	0.797	0.636	0.96	0.906	0.334	KRT1			TEX29					FBXL4	SLAMF1	
0.934	0.823	0.683	1.03	0.902	0.311	KRT1			TEX29					FBXL4		CASQ1
0.934	0.828	0.685	0.99	0.918	0.314	KRT1			TEX29						SLAMF1	CASQ1
0.935	0.826	0.675	0.96	0.909	0.319	KRT1				RIC8A	LANCL2	GLO1				
0.926	0.87	0.715	1.3	0.847	0.251	KRT1				RIC8A	LANCL2		PGP			
0.921	0.89	0.742	1.29	0.823	0.25	KRT1				RIC8A	LANCL2			FBXL4		
0.829	1.268	1.038	1.34	0.884	0.267	KRT1				RIC8A	LANCL2				SLAMF1	
0.925	0.894	0.742	1.2	0.865	0.251	KRT1				RIC8A	LANCL2					CASQ1
0.93	0.842	0.705	1.16	0.917	0.305	KRT1				RIC8A		GLO1	PGP			
0.933	0.83	0.679	1.03	0.908	0.309	KRT1				RIC8A		GLO1		FBXL4		
0.934	0.836	0.678	1	0.923	0.313	KRT1				RIC8A		GLO1			SLAMF1	
0.917	0.923	0.76	1.42	0.839	0.222	KRT1				RIC8A		GLO1				CASQ1
0.919	0.931	0.757	0.98	0.898	0.368	KRT1				RIC8A			PGP	FBXL4		
0.915	0.947	0.775	0.93	0.912	0.376	KRT1				RIC8A			PGP		SLAMF1	
0.92	0.931	0.75	0.92	0.913	0.386	KRT1				RIC8A			PGP			CASQ1
0.92	0.923	0.74	1.08	0.876	0.361	KRT1				RIC8A				FBXL4	SLAMF1	
0.924	0.911	0.721	1.06	0.88	0.383	KRT1				RIC8A				FBXL4		CASQ1
0.872	1.118	0.953	1	0.895	0.552	KRT1				RIC8A					SLAMF1	CASQ1
0.92	0.93	0.738	1	0.899	0.38	KRT1					LANCL2	GLO1	PGP			
0.919	0.928	0.756	1	0.892	0.36	KRT1					LANCL2	GLO1		FBXL4		
0.922	0.918	0.736	0.96	0.899	0.37	KRT1					LANCL2	GLO1			SLAMF1	
0.92	0.928	0.746	0.91	0.911	0.378	KRT1					LANCL2	GLO1				CASQ1
0.924	0.907	0.714	1.06	0.876	0.368	KRT1					LANCL2		PGP	FBXL4		

Train Rsquared	Train RMSE	Train MAE	Test RMSE	Test Rsquared	Sample Handling_CV	KRT1	KRT5	ADSL	TEX29	RIC8A	LANCL2	GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.915	0.96	0.769	1.03	0.896	0.322	KRT1					LANCL2		PGP		SLAMF1	
0.917	0.953	0.762	1	0.895	0.329	KRT1					LANCL2		PGP			CASQ1
0.914	0.964	0.764	0.95	0.91	0.342	KRT1					LANCL2			FBXL4	SLAMF1	
0.908	0.992	0.771	1.25	0.838	0.249	KRT1					LANCL2			FBXL4		CASQ1
0.917	0.953	0.753	1.02	0.894	0.321	KRT1					LANCL2				SLAMF1	CASQ1
0.898	1.045	0.856	1.05	0.907	0.397	KRT1						GLO1	PGP	FBXL4		
0.913	0.958	0.796	0.79	0.94	0.458	KRT1						GLO1	PGP		SLAMF1	
0.911	0.976	0.812	0.9	0.927	0.469	KRT1						GLO1	PGP			CASQ1
0.917	0.95	0.792	0.93	0.923	0.422	KRT1						GLO1		FBXL4	SLAMF1	
0.909	1.004	0.834	0.89	0.934	0.458	KRT1						GLO1		FBXL4		CASQ1
0.909	0.951	0.799	0.87	0.929	0.452	KRT1						GLO1			SLAMF1	CASQ1
0.914	0.932	0.79	0.97	0.924	0.434	KRT1							PGP	FBXL4	SLAMF1	
0.912	0.957	0.812	0.79	0.933	0.439	KRT1							PGP	FBXL4		CASQ1
0.915	0.934	0.793	1.15	0.888	0.432	KRT1							PGP		SLAMF1	CASQ1
0.907	0.987	0.829	0.93	0.91	0.694	KRT1								FBXL4	SLAMF1	CASQ1
0.915	0.958	0.818	0.98	0.905	0.451		KRT5	ADSL	TEX29	RIC8A						
0.892	1.028	0.858	1.01	0.901	0.478		KRT5	ADSL	TEX29		LANCL2					
0.914	0.941	0.779	0.83	0.943	0.449		KRT5	ADSL	TEX29			GLO1				
0.918	0.928	0.775	0.89	0.94	0.452		KRT5	ADSL	TEX29				PGP			
0.914	0.954	0.788	0.81	0.94	0.402		KRT5	ADSL	TEX29					FBXL4		
0.914	0.952	0.778	1.12	0.91	0.348		KRT5	ADSL	TEX29						SLAMF1	
0.899	1.015	0.821	1.05	0.907	0.359		KRT5	ADSL	TEX29							CASQ1
0.912	0.983	0.811	1.05	0.916	0.341		KRT5	ADSL		RIC8A	LANCL2					
0.916	0.92	0.789	1.1	0.924	0.4		KRT5	ADSL		RIC8A		GLO1				
0.912	0.946	0.796	0.87	0.934	0.391		KRT5	ADSL		RIC8A			PGP			

Train Rsquared	Train RMSE	Train MAE	Test RMSE	Test Rsquared	Sample Handling_CV	KRT1	KRT5	ADSL	TEX29	RIC8A	LANCL2	GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.917	0.934	0.799	0.96	0.931	0.381		KRT5	ADSL		RIC8A				FBXL4		
0.905	0.997	0.84	1.35	0.869	0.337		KRT5	ADSL		RIC8A					SLAMF1	
0.867	1.143	0.962	1.33	0.892	1.343		KRT5	ADSL		RIC8A						CASQ1
0.912	0.962	0.795	0.86	0.924	0.556		KRT5	ADSL			LANCL2	GLO1				
0.913	0.966	0.785	0.91	0.914	0.489		KRT5	ADSL			LANCL2		PGP			
0.909	0.988	0.812	0.87	0.922	0.519		KRT5	ADSL			LANCL2			FBXL4		
0.918	0.945	0.773	1.02	0.897	0.602		KRT5	ADSL			LANCL2				SLAMF1	
0.911	0.984	0.807	0.95	0.914	0.733		KRT5	ADSL			LANCL2					CASQ1
0.913	0.982	0.795	0.97	0.903	0.569		KRT5	ADSL				GLO1	PGP			
0.916	0.936	0.782	1.04	0.897	0.544		KRT5	ADSL				GLO1		FBXL4		
0.911	0.964	0.809	0.9	0.911	0.55		KRT5	ADSL				GLO1			SLAMF1	
0.912	0.967	0.799	0.96	0.9	0.485		KRT5	ADSL				GLO1				CASQ1
0.916	0.949	0.794	1.1	0.873	1.266		KRT5	ADSL					PGP	FBXL4		
0.871	1.151	0.946	1.44	0.883	0.34		KRT5	ADSL					PGP		SLAMF1	
0.917	0.941	0.772	0.96	0.918	0.5		KRT5	ADSL					PGP			CASQ1
0.912	0.959	0.788	0.87	0.928	0.461		KRT5	ADSL						FBXL4	SLAMF1	
0.913	0.966	0.784	0.92	0.917	0.445		KRT5	ADSL						FBXL4		CASQ1
0.915	0.959	0.771	1.12	0.896	0.421		KRT5	ADSL							SLAMF1	CASQ1
0.915	0.944	0.784	1.05	0.902	0.431		KRT5		TEX29	RIC8A	LANCL2					
0.906	0.995	0.836	0.82	0.944	0.505		KRT5		TEX29	RIC8A		GLO1				
0.913	0.959	0.798	0.85	0.943	0.537		KRT5		TEX29	RIC8A			PGP			
0.911	0.982	0.821	0.82	0.94	0.481		KRT5		TEX29	RIC8A				FBXL4		
0.91	0.978	0.797	1.01	0.914	1.262		KRT5		TEX29	RIC8A					SLAMF1	
0.902	1.032	0.851	1	0.921	0.435		KRT5		TEX29	RIC8A						CASQ1
0.861	1.198	1.015	1.08	0.894	0.316		KRT5		TEX29		LANCL2	GLO1				

Train Rsquared	Train RMSE	Train MAE	Test RMSE	Test Rsquared	Sample Handling_CV	KRT1	KRT5	ADSL	TEX29	RIC8A	LANCL2	GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.913	0.979	0.806	0.95	0.919	0.503		KRT5		TEX29		LANCL2		PGP			
0.909	0.963	0.81	0.96	0.934	0.69		KRT5		TEX29		LANCL2			FBXL4		
0.91	0.979	0.82	0.8	0.939	0.523		KRT5		TEX29		LANCL2				SLAMF1	
0.916	0.949	0.799	0.85	0.937	0.514		KRT5		TEX29		LANCL2		PGP			CASQ1
0.913	0.973	0.805	1.02	0.901	0.388		KRT5		TEX29			GLO1	PGP			
0.913	0.954	0.79	0.92	0.943	0.615		KRT5		TEX29			GLO1		FBXL4		
0.91	0.98	0.815	0.84	0.94	0.399		KRT5		TEX29			GLO1			SLAMF1	
0.916	0.952	0.797	0.88	0.942	0.558		KRT5		TEX29			GLO1				CASQ1
0.906	1.004	0.821	1.15	0.892	0.315		KRT5		TEX29				PGP	FBXL4		
0.915	0.95	0.798	0.94	0.937	0.442		KRT5		TEX29				PGP		SLAMF1	
0.862	1.173	0.996	0.99	0.909	0.412		KRT5		TEX29				PGP			CASQ1
0.887	1.099	0.892	1.09	0.882	0.461		KRT5		TEX29					FBXL4	SLAMF1	
0.887	1.116	0.935	1.09	0.903	0.527		KRT5		TEX29					FBXL4		CASQ1
0.892	1.092	0.884	1.06	0.889	0.514		KRT5		TEX29						SLAMF1	CASQ1
0.891	1.104	0.903	1.22	0.853	0.692		KRT5			RIC8A	LANCL2	GLO1				
0.895	1.081	0.882	1.07	0.882	0.492		KRT5			RIC8A	LANCL2		PGP			
0.894	1.086	0.874	1.07	0.888	0.434		KRT5			RIC8A	LANCL2			FBXL4		
0.935	0.835	0.669	1.04	0.886	0.335		KRT5			RIC8A	LANCL2				SLAMF1	
0.928	0.856	0.717	1.02	0.918	0.348		KRT5			RIC8A	LANCL2					CASQ1
0.93	0.858	0.712	1.16	0.893	0.33		KRT5			RIC8A		GLO1	PGP			
0.923	0.892	0.737	1.11	0.905	0.33		KRT5			RIC8A		GLO1		FBXL4		
0.897	1.059	0.85	1.3	0.825	0.325		KRT5			RIC8A		GLO1			SLAMF1	
0.929	0.872	0.703	1.03	0.896	0.331		KRT5			RIC8A		GLO1				CASQ1
0.932	0.842	0.683	1.05	0.899	0.321		KRT5			RIC8A			PGP	FBXL4		
0.929	0.856	0.693	1.25	0.854	0.268		KRT5			RIC8A			PGP		SLAMF1	

Train Rsquared	Train RMSE	Train MAE	Test RMSE	Test Rsquared	Sample Handling_CV	KRT1	KRT5	ADSL	TEX29	RIC8A	LANCL2	GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.925	0.887	0.715	1.21	0.865	0.267		KRT5			RIC8A			PGP			CASQ1
0.925	0.886	0.716	1.2	0.85	0.267		KRT5			RIC8A				FBXL4	SLAMF1	
0.925	0.868	0.725	1.2	0.915	0.316		KRT5			RIC8A				FBXL4		CASQ1
0.922	0.888	0.743	1.17	0.922	0.328		KRT5			RIC8A			PGP		SLAMF1	CASQ1
0.926	0.876	0.712	1.07	0.911	0.322		KRT5				LANCL2	GLO1				
0.906	0.979	0.793	1.6	0.877	0.233		KRT5				LANCL2	GLO1		FBXL4		
0.907	0.966	0.778	1.4	0.855	0.228		KRT5				LANCL2	GLO1			SLAMF1	
0.893	1.034	0.88	0.98	0.925	0.365		KRT5				LANCL2	GLO1				CASQ1
0.904	1.021	0.832	1.36	0.88	0.221		KRT5				LANCL2		PGP	FBXL4		
0.922	0.901	0.726	0.87	0.926	0.367		KRT5				LANCL2		PGP		SLAMF1	
0.929	0.872	0.704	0.98	0.912	0.35		KRT5				LANCL2		PGP			CASQ1
0.923	0.906	0.727	0.91	0.919	0.359		KRT5				LANCL2			FBXL4	SLAMF1	
0.924	0.903	0.722	0.9	0.918	0.361		KRT5				LANCL2			FBXL4		CASQ1
0.924	0.888	0.727	1	0.923	0.356		KRT5				LANCL2				SLAMF1	CASQ1
0.918	0.918	0.747	0.92	0.927	0.373		KRT5					GLO1	PGP	FBXL4		
0.919	0.92	0.742	0.89	0.926	0.37		KRT5					GLO1	PGP		SLAMF1	
0.924	0.897	0.728	1.07	0.91	0.348		KRT5					GLO1	PGP			CASQ1
0.925	0.898	0.722	1.03	0.909	0.35		KRT5					GLO1		FBXL4	SLAMF1	
0.829	1.306	1.103	1.46	0.87	0.256		KRT5					GLO1		FBXL4		CASQ1
0.917	0.944	0.759	0.92	0.918	0.354		KRT5					GLO1			SLAMF1	CASQ1
0.925	0.885	0.721	0.99	0.922	0.331		KRT5						PGP	FBXL4	SLAMF1	
0.92	0.91	0.736	0.92	0.924	0.347		KRT5						PGP	FBXL4		CASQ1
0.921	0.906	0.733	0.92	0.924	0.348		KRT5						PGP		SLAMF1	CASQ1
0.922	0.9	0.733	1.11	0.899	0.282		KRT5							FBXL4	SLAMF1	CASQ1
0.924	0.887	0.724	1.11	0.894	0.284			ADSL	TEX29	RIC8A	LANCL2					

Train Rsquared	Train RMSE	Train MAE	Test RMSE	Test Rsquared	Sample Handling_CV	KRT1	KRT5	ADSL	TEX29	RIC8A	LANCL2	GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.916	0.942	0.766	1.04	0.907	0.281			ADSL	TEX29	RIC8A		GLO1				
0.919	0.909	0.741	1.11	0.922	0.331			ADSL	TEX29	RIC8A			PGP			
0.92	0.91	0.74	1.06	0.921	0.33			ADSL	TEX29	RIC8A				FBXL4		
0.914	0.944	0.764	0.98	0.924	0.352			ADSL	TEX29	RIC8A					SLAMF1	
0.863	1.189	0.984	1.58	0.896	0.28			ADSL	TEX29	RIC8A						CASQ1
0.907	0.988	0.786	1.33	0.891	0.244			ADSL	TEX29		LANCL2	GLO1				
0.933	0.84	0.688	1.06	0.885	0.328			ADSL	TEX29		LANCL2		PGP			
0.933	0.84	0.678	1.18	0.854	0.313			ADSL	TEX29		LANCL2			FBXL4		
0.932	0.851	0.685	1.14	0.862	0.317			ADSL	TEX29		LANCL2				SLAMF1	
0.934	0.847	0.671	1.12	0.861	0.319			ADSL	TEX29		LANCL2					CASQ1
0.928	0.861	0.714	1.11	0.901	0.325			ADSL	TEX29			GLO1	PGP			
0.926	0.872	0.724	1.07	0.91	0.332			ADSL	TEX29			GLO1		FBXL4		
0.932	0.851	0.69	1.02	0.898	0.328			ADSL	TEX29			GLO1			SLAMF1	
0.924	0.889	0.724	1.24	0.875	0.307			ADSL	TEX29			GLO1				CASQ1
0.93	0.865	0.697	1.15	0.87	0.311			ADSL	TEX29				PGP	FBXL4		
0.866	1.202	1.017	1.2	0.859	0.26			ADSL	TEX29				PGP		SLAMF1	
0.929	0.878	0.701	1.09	0.881	0.313			ADSL	TEX29				PGP			CASQ1
0.93	0.851	0.695	1.15	0.876	0.3			ADSL	TEX29					FBXL4	SLAMF1	
0.93	0.857	0.696	1.12	0.883	0.305			ADSL	TEX29					FBXL4		CASQ1
0.931	0.854	0.688	1.1	0.878	0.306			ADSL	TEX29						SLAMF1	CASQ1
0.924	0.889	0.702	1.36	0.82	0.246			ADSL		RIC8A	LANCL2	GLO1				
0.923	0.889	0.711	1.35	0.805	0.244			ADSL		RIC8A	LANCL2		PGP			
0.923	0.905	0.721	1.3	0.825	0.246			ADSL		RIC8A	LANCL2			FBXL4		
0.921	0.893	0.742	1.25	0.905	0.299			ADSL		RIC8A	LANCL2				SLAMF1	
0.926	0.876	0.715	1.15	0.893	0.298			ADSL		RIC8A	LANCL2					CASQ1

Train Rsquared	Train RMSE	Train MAE	Test RMSE	Test Rsquared	Sample Handling_CV	KRT1	KRT5	ADSL	TEX29	RIC8A	LANCL2	GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.926	0.883	0.714	1.11	0.901	0.304			ADSL		RIC8A		GLO1	PGP			
0.847	1.262	1.043	1.36	0.902	0.603			ADSL		RIC8A		GLO1		FBXL4		
0.907	0.989	0.781	1.48	0.837	0.206			ADSL		RIC8A		GLO1			SLAMF1	
0.897	1.038	0.838	0.99	0.904	0.329			ADSL		RIC8A		GLO1				CASQ1
0.896	1.039	0.845	0.96	0.91	0.344			ADSL		RIC8A			PGP	FBXL4		
0.898	1.039	0.828	0.95	0.909	0.341			ADSL		RIC8A			PGP		SLAMF1	
0.897	1.037	0.829	1.09	0.883	0.321			ADSL		RIC8A			PGP			CASQ1
0.898	1.04	0.818	1.07	0.886	0.321			ADSL		RIC8A				FBXL4	SLAMF1	
0.897	1.044	0.829	1.04	0.896	0.336			ADSL		RIC8A				FBXL4		CASQ1
0.895	1.039	0.84	0.99	0.908	0.334			ADSL		RIC8A					SLAMF1	CASQ1
0.898	1.037	0.823	0.96	0.907	0.331			ADSL			LANCL2	GLO1	PGP			
0.899	1.033	0.82	0.92	0.912	0.345			ADSL			LANCL2	GLO1		FBXL4		
0.849	1.235	1.024	1.05	0.893	0.45			ADSL			LANCL2	GLO1			SLAMF1	
0.897	1.041	0.819	1.04	0.889	0.323			ADSL			LANCL2	GLO1				CASQ1
0.897	1.038	0.83	1.04	0.898	0.306			ADSL			LANCL2		PGP	FBXL4		
0.898	1.042	0.823	1.02	0.899	0.304			ADSL			LANCL2		PGP		SLAMF1	
0.898	1.04	0.824	0.99	0.903	0.319			ADSL			LANCL2		PGP			CASQ1
0.891	1.071	0.826	1.23	0.85	0.231			ADSL			LANCL2			FBXL4	SLAMF1	
0.897	1.043	0.817	1.02	0.902	0.305			ADSL			LANCL2			FBXL4		CASQ1
0.908	0.982	0.827	0.91	0.918	0.555			ADSL			LANCL2				SLAMF1	CASQ1
0.906	1.002	0.837	0.99	0.907	0.457			ADSL				GLO1	PGP	FBXL4		
0.907	1.004	0.842	1.02	0.904	0.392			ADSL				GLO1	PGP		SLAMF1	
0.904	1.02	0.853	1	0.9	0.424			ADSL				GLO1	PGP			CASQ1
0.825	1.337	1.128	1.15	0.902	0.508			ADSL				GLO1		FBXL4	SLAMF1	
0.899	1.004	0.867	0.96	0.928	0.455			ADSL				GLO1		FBXL4		CASQ1

Train Rsquared	Train RMSE	Train MAE	Test RMSE	Test Rsquared	Sample Handling_CV	KRT1	KRT5	ADSL	TEX29	RIC8A	LANCL2	GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.899	1.005	0.867	1.05	0.922	0.419			ADSL				GLO1			SLAMF1	CASQ1
0.902	1.004	0.87	0.9	0.922	0.439			ADSL					PGP	FBXL4	SLAMF1	
0.894	1.048	0.903	1.18	0.912	0.38			ADSL					PGP	FBXL4		CASQ1
0.894	1.057	0.911	0.97	0.91	0.513			ADSL					PGP		SLAMF1	CASQ1
0.895	1.057	0.916	1.04	0.907	0.37			ADSL						FBXL4	SLAMF1	CASQ1
0.91	0.967	0.814	0.94	0.922	0.414				TEX29	RIC8A	LANCL2	GLO1				
0.91	0.97	0.818	0.98	0.919	0.424				TEX29	RIC8A	LANCL2		PGP			
0.909	0.975	0.818	0.93	0.915	0.575				TEX29	RIC8A	LANCL2			FBXL4		
0.908	0.992	0.823	1.14	0.903	0.329				TEX29	RIC8A	LANCL2				SLAMF1	
0.829	1.315	1.078	1.15	0.892	0.496				TEX29	RIC8A	LANCL2					CASQ1
0.904	1.005	0.823	1.09	0.891	0.34				TEX29	RIC8A		GLO1	PGP			
0.906	1.007	0.832	1.12	0.893	0.327				TEX29	RIC8A		GLO1		FBXL4		
0.903	0.99	0.857	1.15	0.929	0.422				TEX29	RIC8A		GLO1			SLAMF1	
0.904	0.991	0.86	0.96	0.927	0.403				TEX29	RIC8A		GLO1				CASQ1
0.904	0.994	0.86	1.04	0.923	0.39				TEX29	RIC8A			PGP	FBXL4		
0.889	1.089	0.926	1.35	0.903	0.292				TEX29	RIC8A			PGP		SLAMF1	
0.902	1.011	0.841	0.89	0.928	0.927				TEX29	RIC8A			PGP			CASQ1
0.898	1.034	0.854	0.92	0.918	0.466				TEX29	RIC8A				FBXL4	SLAMF1	
0.898	1.032	0.851	0.9	0.918	0.474				TEX29	RIC8A				FBXL4		CASQ1
0.902	1.029	0.856	0.96	0.925	0.519				TEX29	RIC8A					SLAMF1	CASQ1
0.848	1.274	1.047	1.2	0.907	0.602				TEX29		LANCL2	GLO1	PGP			
0.901	1.028	0.855	0.94	0.925	0.485				TEX29		LANCL2	GLO1		FBXL4		
0.897	1.056	0.878	0.96	0.917	0.479				TEX29		LANCL2	GLO1			SLAMF1	
0.897	1.026	0.86	1.04	0.916	0.468				TEX29		LANCL2	GLO1				CASQ1
0.896	1.032	0.875	0.92	0.919	0.537				TEX29		LANCL2		PGP	FBXL4		

Train Rsquared	Train RMSE	Train MAE	Test RMSE	Test Rsquared	Sample Handling_CV	KRT1	KRT5	ADSL	TEX29	RIC8A	LANCL2	GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.892	1.054	0.888	0.97	0.908	0.449				TEX29		LANCL2		PGP		SLAMF1	
0.892	1.07	0.912	1.05	0.91	0.444				TEX29		LANCL2		PGP			CASQ1
0.903	1.007	0.831	0.93	0.928	0.548				TEX29		LANCL2			FBXL4	SLAMF1	
0.904	1.001	0.83	0.9	0.928	0.554				TEX29		LANCL2			FBXL4		CASQ1
0.9	1.025	0.844	0.93	0.919	0.443				TEX29		LANCL2				SLAMF1	CASQ1
0.903	1.019	0.84	1.04	0.924	0.412				TEX29			GLO1	PGP	FBXL4		
0.86	1.203	0.994	1.12	0.905	0.434				TEX29			GLO1	PGP		SLAMF1	
0.898	1.026	0.863	1.03	0.918	0.428				TEX29			GLO1	PGP			CASQ1
0.901	1.021	0.852	0.97	0.91	0.437				TEX29			GLO1		FBXL4	SLAMF1	
0.904	1.008	0.827	0.99	0.913	0.395				TEX29			GLO1		FBXL4		CASQ1
0.904	1.015	0.845	0.96	0.908	0.436				TEX29			GLO1			SLAMF1	CASQ1
0.899	1.041	0.839	1.11	0.888	0.357				TEX29				PGP	FBXL4	SLAMF1	
0.898	1.061	0.864	1.12	0.874	0.399				TEX29				PGP	FBXL4		CASQ1
0.901	1.042	0.854	1.09	0.883	0.357				TEX29				PGP		SLAMF1	CASQ1
0.894	1.043	0.875	1.05	0.934	0.502				TEX29					FBXL4	SLAMF1	CASQ1
0.901	1.029	0.866	0.9	0.922	0.709					RIC8A	LANCL2	GLO1	PGP			
0.903	1.021	0.861	0.95	0.923	0.453					RIC8A	LANCL2	GLO1		FBXL4		
0.856	1.247	1.001	1.37	0.89	0.415					RIC8A	LANCL2	GLO1			SLAMF1	
0.894	1.082	0.908	1.07	0.904	0.342					RIC8A	LANCL2	GLO1				CASQ1
0.905	1.002	0.822	1.02	0.915	0.376					RIC8A	LANCL2		PGP	FBXL4		
0.905	1.008	0.838	0.98	0.906	0.433					RIC8A	LANCL2		PGP		SLAMF1	
0.906	1	0.827	1	0.91	0.383					RIC8A	LANCL2		PGP			CASQ1
0.899	1.041	0.833	1.22	0.867	0.299					RIC8A	LANCL2			FBXL4	SLAMF1	
0.903	1.017	0.859	1.01	0.926	1.548					RIC8A	LANCL2			FBXL4		CASQ1
0.856	1.224	0.991	1.05	0.917	0.406					RIC8A	LANCL2				SLAMF1	CASQ1

Train Rsquared	Train RMSE	Train MAE	Test RMSE	Test Rsquared	Sample Handling_CV	KRT1	KRT5	ADSL	TEX29	RIC8A	LANCL2	GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.86	1.222	0.997	1.07	0.915	0.437					RIC8A		GLO1	PGP	FBXL4		
0.859	1.219	0.975	1.05	0.911	0.422					RIC8A		GLO1	PGP		SLAMF1	
0.85	1.265	1.012	1.17	0.916	0.644					RIC8A		GLO1	PGP			CASQ1
0.855	1.233	0.956	1.26	0.902	0.372					RIC8A		GLO1		FBXL4	SLAMF1	
0.86	1.224	0.983	1	0.914	0.416					RIC8A		GLO1		FBXL4		CASQ1
0.86	1.219	0.978	1.04	0.917	0.41					RIC8A		GLO1			SLAMF1	CASQ1
0.921	0.909	0.72	1.13	0.884	0.353					RIC8A			PGP	FBXL4	SLAMF1	
0.906	0.977	0.773	1.37	0.816	0.333					RIC8A			PGP	FBXL4		CASQ1
0.903	1.003	0.789	1.32	0.82	0.339					RIC8A			PGP		SLAMF1	CASQ1
0.903	1.001	0.787	1.31	0.818	0.34					RIC8A				FBXL4	SLAMF1	CASQ1
0.92	0.91	0.736	1.23	0.895	0.348						LANCL2	GLO1	PGP	FBXL4		
0.919	0.915	0.734	1.17	0.899	0.361						LANCL2	GLO1	PGP		SLAMF1	
0.921	0.914	0.719	1.13	0.894	0.355						LANCL2	GLO1	PGP			CASQ1
0.899	1.013	0.792	1.47	0.84	0.33						LANCL2	GLO1		FBXL4	SLAMF1	
0.856	1.241	0.991	1.42	0.878	0.376						LANCL2	GLO1		FBXL4		CASQ1
0.901	1.004	0.778	1.4	0.829	0.33						LANCL2	GLO1			SLAMF1	CASQ1
0.897	1.036	0.791	1.32	0.837	0.333						LANCL2		PGP	FBXL4	SLAMF1	
0.92	0.907	0.736	1.24	0.877	0.332						LANCL2		PGP	FBXL4		CASQ1
0.92	0.912	0.732	1.19	0.877	0.343						LANCL2		PGP		SLAMF1	CASQ1
0.921	0.911	0.732	1.19	0.877	0.343						LANCL2			FBXL4	SLAMF1	CASQ1
0.882	1.066	0.872	1.66	0.756	0.267							GLO1	PGP	FBXL4	SLAMF1	
0.885	1.052	0.857	1.65	0.741	0.269							GLO1	PGP	FBXL4		CASQ1
0.878	1.112	0.914	1.61	0.749	0.268							GLO1	PGP		SLAMF1	CASQ1
0.917	0.918	0.746	1.34	0.897	0.336							GLO1		FBXL4	SLAMF1	CASQ1
0.918	0.916	0.739	1.29	0.891	0.333								PGP	FBXL4	SLAMF1	CASQ1

Table 12: Freeze-Thaw Plasma Model 5 Biomarkers

Train Rsquared	Train RMSE	Train MAE	Test RMSE	Test Rsquared	Sample Handling _CV	KRT1	KRT5	ADSL	TEX29	RIC8A	LANCL2	GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.856	1.221	1.011	1.04	0.903	0.41	KRT1	KRT5	ADSL	TEX29	RIC8A						
0.919	0.925	0.737	1.23	0.893	0.347	KRT1	KRT5	ADSL	TEX29		LANCL2					
0.849	1.199	0.952	1.95	0.767	0.231	KRT1	KRT5	ADSL	TEX29			GLO1				
0.905	0.995	0.79	1.07	0.91	0.374	KRT1	KRT5	ADSL	TEX29				PGP			
0.904	1.01	0.782	0.98	0.913	0.396	KRT1	KRT5	ADSL	TEX29					FBXL4		
0.903	1.013	0.783	0.98	0.913	0.396	KRT1	KRT5	ADSL	TEX29						SLAMF1	
0.888	1.066	0.846	1.2	0.868	0.357	KRT1	KRT5	ADSL	TEX29							CASQ1
0.888	1.066	0.846	1.2	0.868	0.357	KRT1	KRT5	ADSL		RIC8A	LANCL2					
0.88	1.12	0.873	1.08	0.882	0.37	KRT1	KRT5	ADSL		RIC8A		GLO1				
0.908	0.982	0.775	1.12	0.911	0.376	KRT1	KRT5	ADSL		RIC8A			PGP			
0.906	0.988	0.778	1.11	0.911	0.376	KRT1	KRT5	ADSL		RIC8A				FBXL4		
0.855	1.218	0.988	1.07	0.894	0.408	KRT1	KRT5	ADSL		RIC8A					SLAMF1	
0.904	1.008	0.774	1.01	0.912	0.401	KRT1	KRT5	ADSL		RIC8A						CASQ1
0.885	1.079	0.841	1.26	0.868	0.356	KRT1	KRT5	ADSL			LANCL2	GLO1				
0.907	0.986	0.794	1.11	0.908	0.364	KRT1	KRT5	ADSL			LANCL2		PGP			
0.907	0.986	0.794	1.11	0.908	0.364	KRT1	KRT5	ADSL			LANCL2			FBXL4		
0.905	1.003	0.787	1.03	0.908	0.398	KRT1	KRT5	ADSL			LANCL2				SLAMF1	
0.869	1.134	0.918	1.45	0.822	0.282	KRT1	KRT5	ADSL			LANCL2					CASQ1
0.907	0.982	0.784	1.19	0.909	0.367	KRT1	KRT5	ADSL				GLO1	PGP			
0.919	0.917	0.751	1.25	0.853	0.335	KRT1	KRT5	ADSL				GLO1		FBXL4		
0.92	0.912	0.744	1.2	0.859	0.342	KRT1	KRT5	ADSL				GLO1			SLAMF1	
0.921	0.915	0.735	1.19	0.86	0.34	KRT1	KRT5	ADSL				GLO1				CASQ1
0.867	1.19	0.969	1.04	0.904	0.442	KRT1	KRT5	ADSL					PGP	FBXL4		
0.899	1.004	0.803	1.52	0.755	0.318	KRT1	KRT5	ADSL					PGP		SLAMF1	

Train Rsquared	Train RMSE	Train MAE	Test RMSE	Test Rsquared	Sample Handling CV	KRT1	KRT5	ADSL	TEX29	RIC8A	LANCL2	GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.9	1.003	0.788	1.5	0.758	0.318	KRT1	KRT5	ADSL					PGP			CASQ1
0.9	1.016	0.799	1.44	0.769	0.324	KRT1	KRT5	ADSL						FBXL4	SLAMF1	
0.917	0.92	0.753	1.26	0.874	0.339	KRT1	KRT5	ADSL						FBXL4		CASQ1
0.919	0.918	0.741	1.23	0.867	0.335	KRT1	KRT5	ADSL							SLAMF1	CASQ1
0.922	0.91	0.726	1.17	0.874	0.343	KRT1	KRT5		TEX29	RIC8A	LANCL2					
0.896	1.025	0.79	1.49	0.783	0.315	KRT1	KRT5		TEX29	RIC8A		GLO1				
0.917	0.919	0.758	1.31	0.846	0.322	KRT1	KRT5		TEX29	RIC8A			PGP			
0.918	0.921	0.752	1.29	0.846	0.321	KRT1	KRT5		TEX29	RIC8A				FBXL4		
0.92	0.919	0.743	1.25	0.851	0.329	KRT1	KRT5		TEX29	RIC8A					SLAMF1	
0.841	1.328	1.05	1.43	0.876	0.432	KRT1	KRT5		TEX29	RIC8A						CASQ1
0.869	1.111	0.915	1.84	0.66	0.245	KRT1	KRT5		TEX29		LANCL2	GLO1				
0.917	0.926	0.753	1.3	0.867	0.322	KRT1	KRT5		TEX29		LANCL2		PGP			
0.855	1.209	0.973	1.14	0.868	0.363	KRT1	KRT5		TEX29		LANCL2			FBXL4		
0.858	1.211	0.963	1.12	0.871	0.361	KRT1	KRT5		TEX29		LANCL2				SLAMF1	
0.865	1.202	0.956	1.08	0.877	0.383	KRT1	KRT5		TEX29		LANCL2					CASQ1
0.81	1.368	1.076	1.45	0.763	0.327	KRT1	KRT5		TEX29			GLO1	PGP			
0.86	1.2	0.954	1.11	0.871	0.364	KRT1	KRT5		TEX29			GLO1		FBXL4		
0.86	1.203	0.954	1.16	0.864	0.356	KRT1	KRT5		TEX29			GLO1			SLAMF1	
0.888	1.08	0.894	1.02	0.911	0.433	KRT1	KRT5		TEX29			GLO1				CASQ1
0.888	1.083	0.887	1.08	0.904	0.416	KRT1	KRT5		TEX29				PGP	FBXL4		
0.846	1.304	1.067	1.24	0.886	0.713	KRT1	KRT5		TEX29				PGP		SLAMF1	
0.889	1.084	0.89	1	0.911	0.418	KRT1	KRT5		TEX29				PGP			CASQ1
0.84	1.258	1.039	1.3	0.855	0.382	KRT1	KRT5		TEX29					FBXL4	SLAMF1	
0.838	1.275	1.06	1.23	0.847	0.713	KRT1	KRT5		TEX29					FBXL4		CASQ1
0.837	1.274	1.038	1.28	0.841	0.441	KRT1	KRT5		TEX29						SLAMF1	CASQ1

Train Rsquared	Train RMSE	Train MAE	Test RMSE	Test Rsquared	Sample Handling _CV	KRT1	KRT5	ADSL	TEX29	RIC8A	LANCL2	GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.884	1.086	0.902	1.19	0.918	0.404	KRT1	KRT5			RIC8A	LANCL2	GLO1				
0.887	1.085	0.905	1.03	0.917	0.414	KRT1	KRT5			RIC8A	LANCL2		PGP			
0.886	1.089	0.9	1.1	0.911	0.403	KRT1	KRT5			RIC8A	LANCL2			FBXL4		
0.823	1.32	1.109	1.36	0.872	0.37	KRT1	KRT5			RIC8A	LANCL2				SLAMF1	
0.888	1.075	0.894	1.11	0.909	0.438	KRT1	KRT5			RIC8A	LANCL2					CASQ1
0.89	1.071	0.888	1.04	0.909	0.417	KRT1	KRT5			RIC8A		GLO1	PGP			
0.851	1.281	1.01	1.2	0.895	0.337	KRT1	KRT5			RIC8A		GLO1		FBXL4		
0.889	1.076	0.886	1.09	0.903	0.407	KRT1	KRT5			RIC8A		GLO1			SLAMF1	
0.832	1.276	1.038	1.53	0.818	0.318	KRT1	KRT5			RIC8A		GLO1				CASQ1
0.888	1.077	0.911	1.17	0.917	0.392	KRT1	KRT5			RIC8A			PGP	FBXL4		
0.874	1.163	0.938	1.02	0.914	0.465	KRT1	KRT5			RIC8A			PGP		SLAMF1	
0.877	1.153	0.927	0.99	0.913	0.477	KRT1	KRT5			RIC8A			PGP			CASQ1
0.872	1.177	0.942	1.03	0.9	0.496	KRT1	KRT5			RIC8A				FBXL4	SLAMF1	
0.822	1.365	1.109	1.15	0.91	0.474	KRT1	KRT5			RIC8A				FBXL4		CASQ1
0.874	1.162	0.943	1.1	0.906	0.466	KRT1	KRT5			RIC8A					SLAMF1	CASQ1
0.876	1.158	0.934	1.02	0.914	0.465	KRT1	KRT5				LANCL2	GLO1	PGP			
0.88	1.113	0.929	1.14	0.891	0.401	KRT1	KRT5				LANCL2	GLO1		FBXL4		
0.793	1.414	1.16	2.08	0.747	0.216	KRT1	KRT5				LANCL2	GLO1			SLAMF1	
0.884	1.117	0.941	1.05	0.894	0.404	KRT1	KRT5				LANCL2	GLO1				CASQ1
0.884	1.111	0.932	1.1	0.89	0.402	KRT1	KRT5				LANCL2		PGP	FBXL4		
0.816	1.339	1.101	1.46	0.775	0.356	KRT1	KRT5				LANCL2		PGP		SLAMF1	
0.883	1.115	0.935	1.09	0.906	0.391	KRT1	KRT5				LANCL2		PGP			CASQ1
0.883	1.108	0.935	1.12	0.889	0.4	KRT1	KRT5				LANCL2			FBXL4	SLAMF1	
0.796	1.483	1.2	1.19	0.882	0.488	KRT1	KRT5				LANCL2			FBXL4		CASQ1
0.939	0.799	0.655	0.89	0.918	0.353	KRT1	KRT5				LANCL2				SLAMF1	CASQ1

Train Rsquared	Train RMSE	Train MAE	Test RMSE	Test Rsquared	Sample Handling - CV	KRT1	KRT5	ADSL	TEX29	RIC8A	LANCL2	GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.934	0.813	0.686	0.89	0.929	0.359	KRT1	KRT5					GLO1	PGP	FBXL4		
0.938	0.795	0.671	1.03	0.907	0.349	KRT1	KRT5					GLO1	PGP		SLAMF1	
0.932	0.824	0.694	0.99	0.918	0.345	KRT1	KRT5					GLO1	PGP			CASQ1
0.878	1.118	0.857	1.13	0.886	0.371	KRT1	KRT5					GLO1		FBXL4	SLAMF1	
0.936	0.815	0.669	0.89	0.918	0.351	KRT1	KRT5					GLO1		FBXL4		CASQ1
0.933	0.824	0.674	0.93	0.921	0.324	KRT1	KRT5					GLO1			SLAMF1	CASQ1
0.93	0.835	0.68	1.13	0.882	0.273	KRT1	KRT5						PGP	FBXL4	SLAMF1	
0.928	0.863	0.697	1.08	0.9	0.271	KRT1	KRT5						PGP	FBXL4		CASQ1
0.926	0.875	0.708	1.07	0.885	0.269	KRT1	KRT5						PGP		SLAMF1	CASQ1
0.929	0.839	0.71	1.1	0.921	0.318	KRT1	KRT5							FBXL4	SLAMF1	CASQ1
0.926	0.857	0.724	1.08	0.932	0.328	KRT1		ADSL	TEX29	RIC8A	LANCL2					
0.929	0.851	0.697	0.95	0.925	0.325	KRT1		ADSL	TEX29	RIC8A		GLO1				
0.916	0.918	0.769	1.48	0.875	0.245	KRT1		ADSL	TEX29	RIC8A			PGP			
0.912	0.928	0.763	1.28	0.866	0.238	KRT1		ADSL	TEX29	RIC8A				FBXL4		
0.863	1.195	0.971	1.36	0.814	0.284	KRT1		ADSL	TEX29	RIC8A					SLAMF1	
0.912	0.963	0.798	1.23	0.894	0.232	KRT1		ADSL	TEX29	RIC8A						CASQ1
0.93	0.846	0.682	0.81	0.932	0.384	KRT1		ADSL	TEX29		LANCL2	GLO1				
0.937	0.807	0.652	0.91	0.918	0.373	KRT1		ADSL	TEX29		LANCL2		PGP			
0.93	0.848	0.681	0.85	0.929	0.376	KRT1		ADSL	TEX29		LANCL2			FBXL4		
0.931	0.846	0.679	0.83	0.93	0.386	KRT1		ADSL	TEX29		LANCL2				SLAMF1	
0.934	0.821	0.675	0.94	0.917	0.371	KRT1		ADSL	TEX29		LANCL2					CASQ1
0.927	0.855	0.698	0.89	0.925	0.38	KRT1		ADSL	TEX29			GLO1	PGP			
0.929	0.855	0.686	0.83	0.927	0.385	KRT1		ADSL	TEX29			GLO1		FBXL4		
0.935	0.817	0.677	1.03	0.904	0.365	KRT1		ADSL	TEX29			GLO1			SLAMF1	
0.936	0.818	0.664	0.95	0.91	0.376	KRT1		ADSL	TEX29			GLO1				CASQ1

Train Rsquared	Train RMSE	Train MAE	Test RMSE	Test Rsquared	Sample Handling - CV	KRT1	KRT5	ADSL	TEX29	RIC8A	LANCL2	GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.908	0.983	0.77	1.12	0.909	0.737	KRT1		ADSL	TEX29				PGP	FBXL4		
0.928	0.861	0.695	0.88	0.92	0.375	KRT1		ADSL	TEX29				PGP		SLAMF1	
0.931	0.843	0.692	0.93	0.924	0.333	KRT1		ADSL	TEX29				PGP			CASQ1
0.925	0.875	0.707	0.88	0.933	0.345	KRT1		ADSL	TEX29					FBXL4	SLAMF1	
0.925	0.873	0.707	0.85	0.931	0.351	KRT1		ADSL	TEX29					FBXL4		CASQ1
0.928	0.857	0.694	1.07	0.904	0.289	KRT1		ADSL	TEX29						SLAMF1	CASQ1
0.928	0.852	0.692	1.05	0.9	0.291	KRT1		ADSL		RIC8A	LANCL2	GLO1				
0.921	0.903	0.724	0.98	0.918	0.289	KRT1		ADSL		RIC8A	LANCL2		PGP			
0.927	0.862	0.72	1.09	0.917	0.327	KRT1		ADSL		RIC8A	LANCL2			FBXL4		
0.927	0.865	0.712	1	0.918	0.331	KRT1		ADSL		RIC8A	LANCL2				SLAMF1	
0.921	0.899	0.727	0.94	0.925	0.348	KRT1		ADSL		RIC8A	LANCL2					CASQ1
0.84	1.215	0.944	1.94	0.78	0.244	KRT1		ADSL		RIC8A		GLO1	PGP			
0.918	0.919	0.747	1.28	0.879	0.259	KRT1		ADSL		RIC8A		GLO1		FBXL4		
0.936	0.811	0.678	0.91	0.914	0.339	KRT1		ADSL		RIC8A		GLO1			SLAMF1	
0.938	0.803	0.665	1.02	0.892	0.329	KRT1		ADSL		RIC8A		GLO1				CASQ1
0.936	0.815	0.663	0.97	0.906	0.328	KRT1		ADSL		RIC8A			PGP	FBXL4		
0.938	0.809	0.656	0.95	0.901	0.336	KRT1		ADSL		RIC8A			PGP		SLAMF1	
0.934	0.819	0.692	0.98	0.913	0.335	KRT1		ADSL		RIC8A			PGP			CASQ1
0.932	0.829	0.696	0.95	0.926	0.336	KRT1		ADSL		RIC8A				FBXL4	SLAMF1	
0.937	0.809	0.664	0.88	0.92	0.339	KRT1		ADSL		RIC8A				FBXL4		CASQ1
0.933	0.825	0.683	1.1	0.897	0.321	KRT1		ADSL		RIC8A					SLAMF1	CASQ1
0.938	0.807	0.662	1	0.897	0.33	KRT1		ADSL			LANCL2	GLO1	PGP			
0.808	1.403	1.146	1.92	0.85	0.232	KRT1		ADSL			LANCL2	GLO1		FBXL4		
0.936	0.819	0.663	0.95	0.91	0.327	KRT1		ADSL			LANCL2	GLO1			SLAMF1	
0.932	0.834	0.692	1.04	0.9	0.301	KRT1		ADSL			LANCL2	GLO1				CASQ1

Train Rsquared	Train RMSE	Train MAE	Test RMSE	Test Rsquared	Sample Handling - CV	KRT1	KRT5	ADSL	TEX29	RIC8A	LANCL2	GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.932	0.839	0.69	1	0.914	0.304	KRT1		ADSL			LANCL2		PGP	FBXL4		
0.933	0.837	0.684	0.97	0.905	0.308	KRT1		ADSL			LANCL2		PGP		SLAMF1	
0.927	0.865	0.703	1.23	0.863	0.249	KRT1		ADSL			LANCL2		PGP			CASQ1
0.925	0.875	0.717	1.22	0.846	0.247	KRT1		ADSL			LANCL2			FBXL4	SLAMF1	
0.926	0.883	0.72	1.15	0.874	0.248	KRT1		ADSL			LANCL2			FBXL4		CASQ1
0.926	0.864	0.731	1.15	0.917	0.296	KRT1		ADSL			LANCL2				SLAMF1	CASQ1
0.93	0.85	0.701	1.03	0.908	0.299	KRT1		ADSL				GLO1	PGP	FBXL4		
0.93	0.856	0.701	1	0.921	0.302	KRT1		ADSL				GLO1	PGP		SLAMF1	
0.814	1.388	1.107	1.56	0.807	0.229	KRT1		ADSL				GLO1	PGP			CASQ1
0.916	0.933	0.77	1.34	0.86	0.217	KRT1		ADSL				GLO1		FBXL4	SLAMF1	
0.916	0.947	0.777	0.96	0.905	0.355	KRT1		ADSL				GLO1		FBXL4		CASQ1
0.911	0.963	0.792	0.91	0.916	0.362	KRT1		ADSL				GLO1			SLAMF1	CASQ1
0.915	0.949	0.769	0.91	0.917	0.371	KRT1		ADSL					PGP	FBXL4	SLAMF1	
0.916	0.946	0.769	1.02	0.893	0.349	KRT1		ADSL					PGP	FBXL4		CASQ1
0.919	0.935	0.749	1.01	0.895	0.365	KRT1		ADSL					PGP		SLAMF1	CASQ1
0.915	0.952	0.761	0.96	0.91	0.366	KRT1		ADSL						FBXL4	SLAMF1	CASQ1
0.914	0.95	0.777	0.98	0.898	0.349	KRT1			TEX29	RIC8A	LANCL2	GLO1				
0.919	0.937	0.758	0.94	0.905	0.359	KRT1			TEX29	RIC8A	LANCL2		PGP			
0.915	0.948	0.765	0.9	0.915	0.365	KRT1			TEX29	RIC8A	LANCL2			FBXL4		
0.896	1.04	0.816	1.44	0.802	0.333	KRT1			TEX29	RIC8A	LANCL2				SLAMF1	
0.919	0.935	0.742	1.01	0.891	0.355	KRT1			TEX29	RIC8A	LANCL2					CASQ1
0.912	0.974	0.786	1.01	0.901	0.305	KRT1			TEX29	RIC8A		GLO1	PGP			
0.913	0.969	0.78	0.99	0.9	0.311	KRT1			TEX29	RIC8A		GLO1		FBXL4		
0.91	0.979	0.783	0.94	0.913	0.32	KRT1			TEX29	RIC8A		GLO1			SLAMF1	
0.909	0.994	0.773	1.16	0.867	0.243	KRT1			TEX29	RIC8A		GLO1				CASQ1

Train Rsquared	Train RMSE	Train MAE	Test RMSE	Test Rsquared	Sample Handling - CV	KRT1	KRT5	ADSL	TEX29	RIC8A	LANCL2	GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.913	0.973	0.77	1.01	0.899	0.304	KRT1			TEX29	RIC8A			PGP	FBXL4		
0.911	0.96	0.804	0.81	0.935	0.761	KRT1			TEX29	RIC8A			PGP		SLAMF1	
0.911	0.965	0.806	0.89	0.928	0.462	KRT1			TEX29	RIC8A			PGP			CASQ1
0.915	0.951	0.799	0.92	0.924	0.451	KRT1			TEX29	RIC8A				FBXL4	SLAMF1	
0.909	0.988	0.823	0.89	0.929	0.444	KRT1			TEX29	RIC8A				FBXL4		CASQ1
0.879	1.108	0.915	1.84	0.622	0.253	KRT1			TEX29	RIC8A					SLAMF1	CASQ1
0.905	0.964	0.822	0.88	0.927	0.53	KRT1			TEX29		LANCL2	GLO1	PGP			
0.909	0.949	0.816	0.97	0.922	0.499	KRT1			TEX29		LANCL2	GLO1		FBXL4		
0.908	0.968	0.831	0.81	0.93	0.47	KRT1			TEX29		LANCL2	GLO1			SLAMF1	
0.91	0.951	0.825	1.11	0.897	0.418	KRT1			TEX29		LANCL2	GLO1				CASQ1
0.904	0.99	0.847	0.91	0.915	0.85	KRT1			TEX29		LANCL2		PGP	FBXL4		
0.91	0.97	0.839	0.97	0.91	0.41	KRT1			TEX29		LANCL2		PGP		SLAMF1	
0.913	0.944	0.791	0.85	0.938	0.45	KRT1			TEX29		LANCL2		PGP			CASQ1
0.916	0.936	0.789	0.9	0.936	0.444	KRT1			TEX29		LANCL2			FBXL4	SLAMF1	
0.912	0.957	0.797	0.83	0.934	0.429	KRT1			TEX29		LANCL2			FBXL4		CASQ1
0.914	0.946	0.786	1.06	0.917	0.345	KRT1			TEX29		LANCL2				SLAMF1	CASQ1
0.922	0.903	0.737	1.29	0.882	0.357	KRT1			TEX29			GLO1	PGP	FBXL4		
0.905	0.986	0.813	1	0.912	0.357	KRT1			TEX29			GLO1	PGP		SLAMF1	
0.912	0.97	0.804	1.02	0.917	0.339	KRT1			TEX29			GLO1	PGP			CASQ1
0.912	0.937	0.818	1.1	0.924	0.48	KRT1			TEX29			GLO1		FBXL4	SLAMF1	
0.908	0.96	0.825	0.88	0.932	0.396	KRT1			TEX29			GLO1		FBXL4		CASQ1
0.912	0.95	0.824	0.96	0.929	0.39	KRT1			TEX29			GLO1			SLAMF1	CASQ1
0.903	1.006	0.858	1.27	0.887	0.327	KRT1			TEX29				PGP	FBXL4	SLAMF1	
0.909	0.968	0.813	0.86	0.926	0.584	KRT1			TEX29				PGP	FBXL4		CASQ1
0.908	0.976	0.802	0.9	0.917	0.574	KRT1			TEX29				PGP		SLAMF1	CASQ1

Train Rsquared	Train RMSE	Train MAE	Test RMSE	Test Rsquared	Sample Handling - CV	KRT1	KRT5	ADSL	TEX29	RIC8A	LANCL2	GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.905	0.993	0.825	0.87	0.923	0.52	KRT1			TEX29					FBXL4	SLAMF1	CASQ1
0.914	0.954	0.792	0.97	0.909	0.578	KRT1				RIC8A	LANCL2	GLO1	PGP			
0.811	1.291	1.009	2.38	0.599	0.203	KRT1				RIC8A	LANCL2	GLO1		FBXL4		
0.909	0.979	0.814	0.92	0.921	0.614	KRT1				RIC8A	LANCL2	GLO1			SLAMF1	
0.908	0.986	0.807	0.94	0.912	0.599	KRT1				RIC8A	LANCL2	GLO1				CASQ1
0.911	0.953	0.808	1.03	0.9	0.562	KRT1				RIC8A	LANCL2		PGP	FBXL4		
0.907	0.977	0.834	0.9	0.913	0.693	KRT1				RIC8A	LANCL2		PGP		SLAMF1	
0.906	0.983	0.822	0.95	0.903	0.49	KRT1				RIC8A	LANCL2		PGP			CASQ1
0.91	0.967	0.821	1.06	0.885	0.867	KRT1				RIC8A	LANCL2			FBXL4	SLAMF1	
0.913	0.951	0.79	0.94	0.921	0.464	KRT1				RIC8A	LANCL2			FBXL4		CASQ1
0.909	0.965	0.805	0.87	0.929	0.513	KRT1				RIC8A	LANCL2				SLAMF1	CASQ1
0.909	0.975	0.796	0.91	0.92	0.446	KRT1				RIC8A		GLO1	PGP	FBXL4		
0.913	0.959	0.786	1.04	0.91	0.417	KRT1				RIC8A		GLO1	PGP		SLAMF1	
0.81	1.374	1.081	2.35	0.707	0.202	KRT1				RIC8A		GLO1	PGP			CASQ1
0.91	0.962	0.812	1.04	0.905	0.453	KRT1				RIC8A		GLO1		FBXL4	SLAMF1	
0.904	1	0.843	0.85	0.936	0.438	KRT1				RIC8A		GLO1		FBXL4		CASQ1
0.91	0.97	0.808	0.87	0.938	0.392	KRT1				RIC8A		GLO1			SLAMF1	CASQ1
0.908	0.989	0.828	0.85	0.932	0.447	KRT1				RIC8A			PGP	FBXL4	SLAMF1	
0.908	0.983	0.808	0.98	0.918	0.397	KRT1				RIC8A			PGP	FBXL4		CASQ1
0.903	1.022	0.838	0.98	0.92	0.43	KRT1				RIC8A			PGP		SLAMF1	CASQ1
0.91	0.983	0.815	0.95	0.919	0.398	KRT1				RIC8A				FBXL4	SLAMF1	CASQ1
0.904	0.982	0.837	0.96	0.932	0.448	KRT1					LANCL2	GLO1	PGP	FBXL4		
0.906	0.992	0.836	0.81	0.935	0.452	KRT1					LANCL2	GLO1	PGP		SLAMF1	
0.912	0.966	0.82	0.86	0.933	0.392	KRT1					LANCL2	GLO1	PGP			CASQ1
0.831	1.309	1.038	1.93	0.648	0.206	KRT1					LANCL2	GLO1		FBXL4	SLAMF1	

Train Rsquared	Train RMSE	Train MAE	Test RMSE	Test Rsquared	Sample Handling CV	KRT1	KRT5	ADSL	TEX29	RIC8A	LANCL2	GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.908	0.989	0.832	0.99	0.908	0.376	KRT1					LANCL2	GLO1		FBXL4		CASQ1
0.91	0.965	0.8	0.93	0.938	0.367	KRT1					LANCL2	GLO1			SLAMF1	CASQ1
0.907	0.988	0.824	0.87	0.932	0.533	KRT1					LANCL2		PGP	FBXL4	SLAMF1	
0.913	0.963	0.804	0.89	0.935	0.382	KRT1					LANCL2		PGP	FBXL4		CASQ1
0.907	0.997	0.808	1.09	0.901	0.312	KRT1					LANCL2		PGP		SLAMF1	CASQ1
0.911	0.968	0.82	0.95	0.934	0.44	KRT1					LANCL2			FBXL4	SLAMF1	CASQ1
0.882	1.115	0.912	1.06	0.894	0.461	KRT1						GLO1	PGP	FBXL4	SLAMF1	
0.882	1.129	0.951	1.08	0.906	0.523	KRT1						GLO1	PGP	FBXL4		CASQ1
0.885	1.109	0.902	1.04	0.898	0.515	KRT1						GLO1	PGP		SLAMF1	CASQ1
0.885	1.118	0.915	1.14	0.879	0.68	KRT1						GLO1		FBXL4	SLAMF1	CASQ1
0.817	1.377	1.092	1.43	0.778	0.347	KRT1							PGP	FBXL4	SLAMF1	CASQ1
0.888	1.1	0.902	1.04	0.889	0.499		KRT5	ADSL	TEX29	RIC8A	LANCL2					
0.889	1.102	0.889	1.04	0.897	0.426		KRT5	ADSL	TEX29	RIC8A		GLO1				
0.939	0.793	0.652	0.86	0.927	0.36		KRT5	ADSL	TEX29	RIC8A			PGP			
0.943	0.769	0.624	0.98	0.906	0.353		KRT5	ADSL	TEX29	RIC8A				FBXL4		
0.94	0.796	0.645	0.92	0.919	0.351		KRT5	ADSL	TEX29	RIC8A					SLAMF1	
0.941	0.797	0.644	0.89	0.915	0.36		KRT5	ADSL	TEX29	RIC8A						CASQ1
0.94	0.782	0.651	0.97	0.92	0.353		KRT5	ADSL	TEX29		LANCL2	GLO1				
0.937	0.801	0.666	0.93	0.931	0.356		KRT5	ADSL	TEX29		LANCL2		PGP			
0.939	0.794	0.645	0.86	0.927	0.358		KRT5	ADSL	TEX29		LANCL2			FBXL4		
0.941	0.777	0.64	1.1	0.9	0.344		KRT5	ADSL	TEX29		LANCL2				SLAMF1	
0.868	1.173	0.953	1.08	0.881	0.413		KRT5	ADSL	TEX29		LANCL2					CASQ1
0.943	0.774	0.628	1	0.902	0.353		KRT5	ADSL	TEX29			GLO1	PGP			
0.939	0.8	0.648	0.94	0.915	0.347		KRT5	ADSL	TEX29			GLO1		FBXL4		
0.936	0.806	0.657	0.99	0.918	0.323		KRT5	ADSL	TEX29			GLO1			SLAMF1	

Train Rsquared	Train RMSE	Train MAE	Test RMSE	Test Rsquared	Sample Handling - CV	KRT1	KRT5	ADSL	TEX29	RIC8A	LANCL2	GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.934	0.822	0.673	0.95	0.93	0.327		KRT5	ADSL	TEX29			GLO1				CASQ1
0.935	0.823	0.67	0.91	0.923	0.333		KRT5	ADSL	TEX29				PGP	FBXL4		
0.93	0.84	0.678	1.21	0.882	0.274		KRT5	ADSL	TEX29				PGP		SLAMF1	
0.927	0.852	0.69	1.19	0.867	0.275		KRT5	ADSL	TEX29				PGP			CASQ1
0.926	0.884	0.726	1.12	0.894	0.272		KRT5	ADSL	TEX29					FBXL4	SLAMF1	
0.933	0.823	0.69	1.15	0.922	0.318		KRT5	ADSL	TEX29					FBXL4		CASQ1
0.933	0.822	0.671	1.04	0.919	0.321		KRT5	ADSL	TEX29						SLAMF1	CASQ1
0.808	1.335	1.062	1.46	0.77	0.328		KRT5	ADSL		RIC8A	LANCL2	GLO1				
0.932	0.838	0.688	1	0.93	0.327		KRT5	ADSL		RIC8A	LANCL2		PGP			
0.919	0.901	0.742	1.41	0.862	0.246		KRT5	ADSL		RIC8A	LANCL2			FBXL4		
0.938	0.807	0.655	0.9	0.92	0.378		KRT5	ADSL		RIC8A	LANCL2				SLAMF1	
0.932	0.842	0.672	0.83	0.931	0.388		KRT5	ADSL		RIC8A	LANCL2					CASQ1
0.932	0.841	0.673	0.81	0.931	0.394		KRT5	ADSL		RIC8A		GLO1	PGP			
0.94	0.796	0.634	0.96	0.909	0.375		KRT5	ADSL		RIC8A		GLO1		FBXL4		
0.94	0.792	0.633	0.94	0.911	0.384		KRT5	ADSL		RIC8A		GLO1			SLAMF1	
0.934	0.841	0.66	0.86	0.924	0.386		KRT5	ADSL		RIC8A		GLO1				CASQ1
0.937	0.808	0.655	0.97	0.914	0.373		KRT5	ADSL		RIC8A			PGP	FBXL4		
0.937	0.81	0.651	0.92	0.916	0.379		KRT5	ADSL		RIC8A			PGP		SLAMF1	
0.81	1.383	1.094	1.32	0.816	0.345		KRT5	ADSL		RIC8A			PGP			CASQ1
0.931	0.844	0.669	0.85	0.925	0.388		KRT5	ADSL		RIC8A				FBXL4	SLAMF1	
0.939	0.798	0.634	1.02	0.899	0.375		KRT5	ADSL		RIC8A				FBXL4		CASQ1
0.932	0.838	0.682	0.97	0.923	0.34		KRT5	ADSL		RIC8A					SLAMF1	CASQ1
0.933	0.833	0.682	0.94	0.923	0.345		KRT5	ADSL			LANCL2	GLO1	PGP			
0.927	0.87	0.697	0.88	0.933	0.361		KRT5	ADSL			LANCL2	GLO1		FBXL4		
0.929	0.852	0.678	1.15	0.89	0.292		KRT5	ADSL			LANCL2	GLO1			SLAMF1	

Train Rsquared	Train RMSE	Train MAE	Test RMSE	Test Rsquared	Sample Handling _CV	KRT1	KRT5	ADSL	TEX29	RIC8A	LANCL2	GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.93	0.851	0.69	1.05	0.915	0.337		KRT5	ADSL			LANCL2	GLO1				CASQ1
0.939	0.798	0.663	0.96	0.908	0.338		KRT5	ADSL			LANCL2		PGP	FBXL4		
0.938	0.806	0.665	0.92	0.92	0.339		KRT5	ADSL			LANCL2		PGP		SLAMF1	
0.94	0.798	0.652	0.89	0.916	0.345		KRT5	ADSL			LANCL2		PGP			CASQ1
0.825	1.356	1.058	1.32	0.807	0.346		KRT5	ADSL			LANCL2			FBXL4	SLAMF1	
0.939	0.794	0.646	1.05	0.891	0.328		KRT5	ADSL			LANCL2			FBXL4		CASQ1
0.941	0.789	0.64	1.02	0.887	0.337		KRT5	ADSL			LANCL2				SLAMF1	CASQ1
0.94	0.802	0.645	0.97	0.904	0.334		KRT5	ADSL				GLO1	PGP	FBXL4		
0.937	0.806	0.668	1.01	0.915	0.333		KRT5	ADSL				GLO1	PGP		SLAMF1	
0.94	0.793	0.651	0.94	0.912	0.338		KRT5	ADSL				GLO1	PGP			CASQ1
0.939	0.799	0.648	0.9	0.921	0.339		KRT5	ADSL				GLO1		FBXL4	SLAMF1	
0.941	0.79	0.631	1.05	0.893	0.328		KRT5	ADSL				GLO1		FBXL4		CASQ1
0.934	0.829	0.687	1.05	0.909	0.304		KRT5	ADSL				GLO1			SLAMF1	CASQ1
0.934	0.827	0.682	1.02	0.902	0.309		KRT5	ADSL					PGP	FBXL4	SLAMF1	
0.934	0.833	0.678	0.98	0.916	0.311		KRT5	ADSL					PGP	FBXL4		CASQ1
0.867	1.181	0.95	1.14	0.866	0.429		KRT5	ADSL					PGP		SLAMF1	CASQ1
0.925	0.877	0.724	1.28	0.848	0.248		KRT5	ADSL						FBXL4	SLAMF1	CASQ1
0.933	0.838	0.683	1.07	0.913	0.301		KRT5		TEX29	RIC8A	LANCL2	GLO1				
0.917	0.94	0.762	0.99	0.897	0.36		KRT5		TEX29	RIC8A	LANCL2		PGP			
0.921	0.927	0.743	0.96	0.9	0.37		KRT5		TEX29	RIC8A	LANCL2			FBXL4		
0.918	0.939	0.754	0.92	0.912	0.377		KRT5		TEX29	RIC8A	LANCL2				SLAMF1	
0.922	0.92	0.725	1.06	0.879	0.367		KRT5		TEX29	RIC8A	LANCL2					CASQ1
0.921	0.927	0.741	0.97	0.898	0.364		KRT5		TEX29	RIC8A		GLO1	PGP			
0.915	0.962	0.764	1.01	0.896	0.321		KRT5		TEX29	RIC8A		GLO1		FBXL4		
0.914	0.949	0.789	0.8	0.941	0.504		KRT5		TEX29	RIC8A		GLO1			SLAMF1	

Train Rsquared	Train RMSE	Train MAE	Test RMSE	Test Rsquared	Sample Handling - CV	KRT1	KRT5	ADSL	TEX29	RIC8A	LANCL2	GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.917	0.935	0.781	0.85	0.938	0.489		KRT5		TEX29	RIC8A		GLO1				CASQ1
0.775	1.443	1.154	1.86	0.598	0.232		KRT5		TEX29	RIC8A			PGP	FBXL4		
0.913	0.961	0.802	0.79	0.939	0.489		KRT5		TEX29	RIC8A			PGP		SLAMF1	
0.918	0.935	0.775	0.98	0.917	0.479		KRT5		TEX29	RIC8A			PGP			CASQ1
0.91	0.981	0.814	0.9	0.927	0.474		KRT5		TEX29	RIC8A				FBXL4	SLAMF1	
0.917	0.956	0.799	0.92	0.923	0.426		KRT5		TEX29	RIC8A				FBXL4		CASQ1
0.916	0.924	0.789	1.01	0.923	0.458		KRT5		TEX29	RIC8A					SLAMF1	CASQ1
0.913	0.95	0.802	0.82	0.933	3.156		KRT5		TEX29		LANCL2	GLO1	PGP			
0.917	0.936	0.799	0.89	0.929	1.66		KRT5		TEX29		LANCL2	GLO1		FBXL4		
0.916	0.941	0.8	1.05	0.898	0.42		KRT5		TEX29		LANCL2	GLO1			SLAMF1	
0.919	0.922	0.772	0.93	0.939	0.414		KRT5		TEX29		LANCL2	GLO1				CASQ1
0.914	0.946	0.783	0.82	0.942	0.468		KRT5		TEX29		LANCL2		PGP	FBXL4		
0.77	1.515	1.227	1.8	0.632	0.219		KRT5		TEX29		LANCL2		PGP		SLAMF1	
0.918	0.935	0.781	0.88	0.94	0.483		KRT5		TEX29		LANCL2		PGP			CASQ1
0.913	0.956	0.781	1.11	0.91	0.347		KRT5		TEX29		LANCL2			FBXL4	SLAMF1	
0.917	0.928	0.794	1.01	0.929	0.534		KRT5		TEX29		LANCL2			FBXL4		CASQ1
0.916	0.947	0.781	0.94	0.914	0.559		KRT5		TEX29		LANCL2				SLAMF1	CASQ1
0.912	0.968	0.801	0.86	0.924	0.57		KRT5		TEX29			GLO1	PGP	FBXL4		
0.912	0.973	0.793	0.91	0.914	0.492		KRT5		TEX29			GLO1	PGP		SLAMF1	
0.917	0.949	0.778	1.02	0.897	0.606		KRT5		TEX29			GLO1	PGP			CASQ1
0.915	0.947	0.792	1	0.901	1.093		KRT5		TEX29			GLO1		FBXL4	SLAMF1	
0.916	0.944	0.775	0.96	0.918	0.499		KRT5		TEX29			GLO1		FBXL4		CASQ1
0.912	0.963	0.799	0.88	0.942	0.403		KRT5		TEX29			GLO1			SLAMF1	CASQ1
0.775	1.502	1.214	1.82	0.618	0.227		KRT5		TEX29				PGP	FBXL4	SLAMF1	
0.909	0.988	0.824	0.82	0.94	0.551		KRT5		TEX29				PGP	FBXL4		CASQ1

Train Rsquared	Train RMSE	Train MAE	Test RMSE	Test Rsquared	Sample Handling - CV	KRT1	KRT5	ADSL	TEX29	RIC8A	LANCL2	GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.915	0.959	0.801	0.84	0.94	0.413		KRT5		TEX29				PGP		SLAMF1	CASQ1
0.912	0.98	0.8	0.98	0.912	0.402		KRT5		TEX29					FBXL4	SLAMF1	CASQ1
0.915	0.955	0.8	0.87	0.936	0.396		KRT5			RIC8A	LANCL2	GLO1	PGP			
0.914	0.957	0.796	0.9	0.941	0.423		KRT5			RIC8A	LANCL2	GLO1		FBXL4		
0.892	1.094	0.891	1.07	0.886	0.49		KRT5			RIC8A	LANCL2	GLO1			SLAMF1	
0.933	0.836	0.679	1	0.903	0.34		KRT5			RIC8A	LANCL2	GLO1				CASQ1
0.936	0.827	0.667	1.09	0.884	0.327		KRT5			RIC8A	LANCL2		PGP	FBXL4		
0.933	0.846	0.678	1.05	0.887	0.331		KRT5			RIC8A	LANCL2		PGP		SLAMF1	
0.934	0.843	0.671	1.04	0.885	0.333		KRT5			RIC8A	LANCL2		PGP			CASQ1
0.865	1.162	0.936	1.2	0.868	0.373		KRT5			RIC8A	LANCL2			FBXL4	SLAMF1	
0.93	0.849	0.715	1.09	0.914	0.336		KRT5			RIC8A	LANCL2			FBXL4		CASQ1
0.926	0.866	0.725	1.04	0.919	0.344		KRT5			RIC8A	LANCL2				SLAMF1	CASQ1
0.93	0.855	0.697	0.99	0.911	0.34		KRT5			RIC8A		GLO1	PGP	FBXL4		
0.928	0.87	0.721	1.19	0.896	0.324		KRT5			RIC8A		GLO1	PGP		SLAMF1	
0.931	0.859	0.699	1.11	0.891	0.325		KRT5			RIC8A		GLO1	PGP			CASQ1
0.927	0.884	0.715	1.05	0.897	0.325		KRT5			RIC8A		GLO1		FBXL4	SLAMF1	
0.932	0.839	0.685	1.1	0.899	0.312		KRT5			RIC8A		GLO1		FBXL4		CASQ1
0.93	0.853	0.69	1.06	0.902	0.318		KRT5			RIC8A		GLO1			SLAMF1	CASQ1
0.931	0.849	0.687	1.05	0.899	0.32		KRT5			RIC8A			PGP	FBXL4	SLAMF1	
0.927	0.869	0.701	1.26	0.864	0.267		KRT5			RIC8A			PGP	FBXL4		CASQ1
0.873	1.154	0.926	1.14	0.874	0.453		KRT5			RIC8A			PGP		SLAMF1	CASQ1
0.928	0.859	0.695	1.25	0.854	0.268		KRT5			RIC8A				FBXL4	SLAMF1	CASQ1
0.924	0.894	0.72	1.21	0.864	0.266		KRT5				LANCL2	GLO1	PGP	FBXL4		
0.924	0.879	0.735	1.23	0.917	0.312		KRT5				LANCL2	GLO1	PGP		SLAMF1	
0.926	0.872	0.714	1.14	0.91	0.31		KRT5				LANCL2	GLO1	PGP			CASQ1

Train Rsquared	Train RMSE	Train MAE	Test RMSE	Test Rsquared	Sample Handling - CV	KRT1	KRT5	ADSL	TEX29	RIC8A	LANCL2	GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.924	0.888	0.725	1.1	0.914	0.317		KRT5				LANCL2	GLO1		FBXL4	SLAMF1	
0.909	0.973	0.783	1.45	0.871	0.229		KRT5				LANCL2	GLO1		FBXL4		CASQ1
0.926	0.883	0.714	0.94	0.923	0.353		KRT5				LANCL2	GLO1			SLAMF1	CASQ1
0.922	0.904	0.728	0.87	0.926	0.367		KRT5				LANCL2		PGP	FBXL4	SLAMF1	
0.922	0.905	0.728	0.87	0.926	0.367		KRT5				LANCL2		PGP	FBXL4		CASQ1
0.928	0.875	0.707	0.98	0.912	0.35		KRT5				LANCL2		PGP		SLAMF1	CASQ1
0.873	1.166	0.921	1.11	0.873	0.43		KRT5				LANCL2			FBXL4	SLAMF1	CASQ1
0.929	0.873	0.705	0.98	0.912	0.35		KRT5					GLO1	PGP	FBXL4	SLAMF1	
0.922	0.911	0.73	0.91	0.919	0.359		KRT5					GLO1	PGP	FBXL4		CASQ1
0.924	0.891	0.729	1	0.923	0.356		KRT5					GLO1	PGP		SLAMF1	CASQ1
0.923	0.898	0.73	0.98	0.923	0.355		KRT5					GLO1		FBXL4	SLAMF1	CASQ1
0.918	0.924	0.746	0.89	0.926	0.37		KRT5						PGP	FBXL4	SLAMF1	CASQ1
0.923	0.904	0.73	1.03	0.909	0.349			ADSL	TEX29	RIC8A	LANCL2	GLO1				
0.924	0.888	0.724	0.99	0.922	0.331			ADSL	TEX29	RIC8A	LANCL2		PGP			
0.925	0.886	0.722	0.99	0.922	0.331			ADSL	TEX29	RIC8A	LANCL2			FBXL4		
0.92	0.913	0.739	0.92	0.924	0.347			ADSL	TEX29	RIC8A	LANCL2				SLAMF1	
0.922	0.9	0.734	1.11	0.899	0.282			ADSL	TEX29	RIC8A	LANCL2					CASQ1
0.727	1.557	1.235	2.22	0.592	0.215			ADSL	TEX29	RIC8A		GLO1	PGP			
0.919	0.917	0.747	1.07	0.922	0.329			ADSL	TEX29	RIC8A		GLO1		FBXL4		
0.932	0.844	0.694	1.09	0.881	0.321			ADSL	TEX29	RIC8A		GLO1			SLAMF1	
0.931	0.848	0.695	1.06	0.886	0.326			ADSL	TEX29	RIC8A		GLO1				CASQ1
0.932	0.846	0.685	1.05	0.885	0.326			ADSL	TEX29	RIC8A			PGP	FBXL4		
0.932	0.85	0.686	1.18	0.856	0.31			ADSL	TEX29	RIC8A			PGP		SLAMF1	
0.933	0.848	0.678	1.16	0.856	0.312			ADSL	TEX29	RIC8A			PGP			CASQ1
0.932	0.857	0.68	1.13	0.862	0.315			ADSL	TEX29	RIC8A				FBXL4	SLAMF1	

Train Rsquared	Train RMSE	Train MAE	Test RMSE	Test Rsquared	Sample Handling _CV	KRT1	KRT5	ADSL	TEX29	RIC8A	LANCL2	GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.926	0.872	0.72	1.12	0.902	0.323			ADSL	TEX29	RIC8A				FBXL4		CASQ1
0.93	0.858	0.701	1.07	0.894	0.321			ADSL	TEX29	RIC8A					SLAMF1	CASQ1
0.93	0.859	0.695	1.03	0.899	0.327			ADSL	TEX29		LANCL2	GLO1	PGP			
0.756	1.494	1.189	1.93	0.602	0.234			ADSL	TEX29		LANCL2	GLO1		FBXL4		
0.928	0.876	0.704	1.16	0.872	0.307			ADSL	TEX29		LANCL2	GLO1			SLAMF1	
0.929	0.861	0.702	1.16	0.879	0.298			ADSL	TEX29		LANCL2	GLO1				CASQ1
0.929	0.859	0.698	1.14	0.876	0.299			ADSL	TEX29		LANCL2		PGP	FBXL4		
0.929	0.864	0.695	1.11	0.881	0.303			ADSL	TEX29		LANCL2		PGP		SLAMF1	
0.922	0.899	0.708	1.35	0.82	0.243			ADSL	TEX29		LANCL2		PGP			CASQ1
0.925	0.888	0.725	1.16	0.896	0.295			ADSL	TEX29		LANCL2			FBXL4	SLAMF1	
0.897	1.039	0.84	0.99	0.904	0.329			ADSL	TEX29		LANCL2			FBXL4		CASQ1
0.897	1.045	0.833	0.98	0.904	0.329			ADSL	TEX29		LANCL2				SLAMF1	CASQ1
0.898	1.04	0.83	0.95	0.909	0.341			ADSL	TEX29			GLO1	PGP	FBXL4		
0.897	1.042	0.821	1.07	0.886	0.321			ADSL	TEX29			GLO1	PGP		SLAMF1	
0.738	1.616	1.292	1.77	0.682	0.205			ADSL	TEX29			GLO1	PGP			CASQ1
0.898	1.038	0.824	0.96	0.907	0.331			ADSL	TEX29			GLO1		FBXL4	SLAMF1	
0.897	1.044	0.825	1.02	0.899	0.304			ADSL	TEX29			GLO1		FBXL4		CASQ1
0.908	0.98	0.827	0.91	0.923	0.406			ADSL	TEX29			GLO1			SLAMF1	CASQ1
0.908	0.983	0.83	0.96	0.92	0.404			ADSL	TEX29				PGP	FBXL4	SLAMF1	
0.907	0.989	0.834	0.91	0.919	0.473			ADSL	TEX29				PGP	FBXL4		CASQ1
0.908	0.998	0.843	1.03	0.911	0.378			ADSL	TEX29				PGP		SLAMF1	CASQ1
0.905	1.009	0.844	0.99	0.905	0.436			ADSL	TEX29					FBXL4	SLAMF1	CASQ1
0.906	1.011	0.851	1.02	0.904	0.387			ADSL		RIC8A	LANCL2	GLO1	PGP			
0.901	1.001	0.864	1.08	0.928	0.464			ADSL		RIC8A	LANCL2	GLO1		FBXL4		
0.902	1.002	0.866	0.91	0.926	0.487			ADSL		RIC8A	LANCL2	GLO1			SLAMF1	

Train Rsquared	Train RMSE	Train MAE	Test RMSE	Test Rsquared	Sample Handling _CV	KRT1	KRT5	ADSL	TEX29	RIC8A	LANCL2	GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.788	1.387	1.148	1.21	0.867	0.422			ADSL		RIC8A	LANCL2	GLO1				CASQ1
0.903	1.005	0.871	0.98	0.922	0.703			ADSL		RIC8A	LANCL2		PGP	FBXL4		
0.897	1.047	0.906	1.08	0.912	0.372			ADSL		RIC8A	LANCL2		PGP		SLAMF1	
0.91	0.97	0.822	0.99	0.925	0.374			ADSL		RIC8A	LANCL2		PGP			CASQ1
0.909	0.972	0.819	0.93	0.922	0.409			ADSL		RIC8A	LANCL2			FBXL4	SLAMF1	
0.909	0.976	0.825	0.98	0.919	0.416			ADSL		RIC8A	LANCL2			FBXL4		CASQ1
0.907	0.994	0.825	1.14	0.903	0.329			ADSL		RIC8A	LANCL2				SLAMF1	CASQ1
0.904	0.994	0.864	1.06	0.928	0.606			ADSL		RIC8A		GLO1	PGP	FBXL4		
0.901	1.018	0.841	0.92	0.928	0.494			ADSL		RIC8A		GLO1	PGP		SLAMF1	
0.901	1.013	0.843	0.89	0.928	0.93			ADSL		RIC8A		GLO1	PGP			CASQ1
0.897	1.037	0.858	0.92	0.918	0.465			ADSL		RIC8A		GLO1		FBXL4	SLAMF1	
0.824	1.33	1.093	1.53	0.741	0.33			ADSL		RIC8A		GLO1		FBXL4		CASQ1
0.902	1.03	0.857	0.96	0.925	0.519			ADSL		RIC8A		GLO1			SLAMF1	CASQ1
0.896	1.037	0.872	0.99	0.918	0.512			ADSL		RIC8A			PGP	FBXL4	SLAMF1	
0.903	1.008	0.832	0.93	0.928	0.548			ADSL		RIC8A			PGP	FBXL4		CASQ1
0.902	1.015	0.834	1	0.916	0.374			ADSL		RIC8A			PGP		SLAMF1	CASQ1
0.903	1.022	0.85	0.96	0.908	0.396			ADSL		RIC8A				FBXL4	SLAMF1	CASQ1
0.904	1.014	0.838	0.98	0.912	0.375			ADSL			LANCL2	GLO1	PGP	FBXL4		
0.899	1.049	0.856	1.1	0.886	0.351			ADSL			LANCL2	GLO1	PGP		SLAMF1	
0.901	1.029	0.864	0.96	0.925	0.385			ADSL			LANCL2	GLO1	PGP			CASQ1
0.905	1.008	0.832	1	0.913	0.363			ADSL			LANCL2	GLO1		FBXL4	SLAMF1	
0.858	1.228	0.986	1.04	0.917	0.413			ADSL			LANCL2	GLO1		FBXL4		CASQ1
0.892	1.048	0.862	1.12	0.907	0.409			ADSL			LANCL2	GLO1			SLAMF1	CASQ1
0.92	0.912	0.733	1.19	0.881	0.345			ADSL			LANCL2		PGP	FBXL4	SLAMF1	
0.92	0.912	0.723	1.13	0.884	0.353			ADSL			LANCL2		PGP	FBXL4		CASQ1

Train Rsquared	Train RMSE	Train MAE	Test RMSE	Test Rsquared	Sample Handling CV	KRT1	KRT5	ADSL	TEX29	RIC8A	LANCL2	GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.92	0.916	0.722	1.13	0.884	0.352			ADSL			LANCL2		PGP		SLAMF1	CASQ1
0.905	0.984	0.779	1.37	0.816	0.332			ADSL			LANCL2			FBXL4	SLAMF1	CASQ1
0.905	0.982	0.776	1.37	0.816	0.333			ADSL				GLO1	PGP	FBXL4	SLAMF1	
0.901	1.011	0.796	1.31	0.82	0.338			ADSL				GLO1	PGP	FBXL4		CASQ1
0.919	0.913	0.739	1.23	0.895	0.348			ADSL				GLO1	PGP		SLAMF1	CASQ1
0.919	0.917	0.735	1.21	0.89	0.346			ADSL				GLO1		FBXL4	SLAMF1	CASQ1
0.92	0.917	0.723	1.13	0.894	0.355			ADSL					PGP	FBXL4	SLAMF1	CASQ1
0.899	1.014	0.789	1.41	0.831	0.329				TEX29	RIC8A	LANCL2	GLO1	PGP			
0.731	1.563	1.29	2.01	0.811	0.288				TEX29	RIC8A	LANCL2	GLO1		FBXL4		
0.919	0.911	0.74	1.24	0.877	0.332				TEX29	RIC8A	LANCL2	GLO1			SLAMF1	
0.919	0.91	0.739	1.24	0.877	0.332				TEX29	RIC8A	LANCL2	GLO1				CASQ1
0.919	0.918	0.737	1.19	0.877	0.342				TEX29	RIC8A	LANCL2		PGP	FBXL4		
0.882	1.067	0.873	1.66	0.756	0.267				TEX29	RIC8A	LANCL2		PGP		SLAMF1	
0.917	0.924	0.745	1.29	0.891	0.333				TEX29	RIC8A	LANCL2		PGP			CASQ1
0.905	0.996	0.791	1.07	0.91	0.374				TEX29	RIC8A	LANCL2			FBXL4	SLAMF1	
0.905	0.996	0.79	1.07	0.91	0.374				TEX29	RIC8A	LANCL2			FBXL4		CASQ1
0.903	1.013	0.784	0.98	0.913	0.396				TEX29	RIC8A	LANCL2				SLAMF1	CASQ1
0.888	1.066	0.847	1.2	0.868	0.357				TEX29	RIC8A		GLO1	PGP	FBXL4		
0.906	0.989	0.779	1.11	0.911	0.376				TEX29	RIC8A		GLO1	PGP		SLAMF1	
0.75	1.527	1.252	2.24	0.823	0.285				TEX29	RIC8A		GLO1	PGP			CASQ1
0.906	0.987	0.795	1.11	0.908	0.364				TEX29	RIC8A		GLO1		FBXL4	SLAMF1	
0.918	0.92	0.754	1.25	0.853	0.335				TEX29	RIC8A		GLO1		FBXL4		CASQ1
0.918	0.925	0.751	1.24	0.854	0.334				TEX29	RIC8A		GLO1			SLAMF1	CASQ1
0.92	0.918	0.738	1.19	0.86	0.34				TEX29	RIC8A			PGP	FBXL4	SLAMF1	
0.898	1.011	0.797	1.5	0.758	0.317				TEX29	RIC8A			PGP	FBXL4		CASQ1

Train Rsquared	Train RMSE	Train MAE	Test RMSE	Test Rsquared	Sample Handling - CV	KRT1	KRT5	ADSL	TEX29	RIC8A	LANCL2	GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.919	0.921	0.743	1.23	0.867	0.335				TEX29	RIC8A			PGP		SLAMF1	CASQ1
0.917	0.926	0.757	1.29	0.846	0.321				TEX29	RIC8A				FBXL4	SLAMF1	CASQ1
0.857	1.214	0.965	1.12	0.87	0.363				TEX29		LANCL2	GLO1	PGP	FBXL4		
0.886	1.087	0.904	1.09	0.91	0.463				TEX29		LANCL2	GLO1	PGP		SLAMF1	
0.887	1.087	0.902	1.02	0.912	0.435				TEX29		LANCL2	GLO1	PGP			CASQ1
0.72	1.619	1.33	1.62	0.761	0.247				TEX29		LANCL2	GLO1		FBXL4	SLAMF1	
0.886	1.09	0.896	1.07	0.905	0.417				TEX29		LANCL2	GLO1		FBXL4		CASQ1
0.839	1.263	1.044	1.3	0.855	0.382				TEX29		LANCL2	GLO1			SLAMF1	CASQ1
0.884	1.095	0.918	1.12	0.916	0.413				TEX29		LANCL2		PGP	FBXL4	SLAMF1	
0.887	1.079	0.899	1.1	0.909	0.437				TEX29		LANCL2		PGP	FBXL4		CASQ1
0.874	1.164	0.939	1.02	0.914	0.465				TEX29		LANCL2		PGP		SLAMF1	CASQ1
0.881	1.121	0.944	1.11	0.891	0.411				TEX29		LANCL2			FBXL4	SLAMF1	CASQ1
0.937	0.802	0.661	0.87	0.925	0.351				TEX29			GLO1	PGP	FBXL4	SLAMF1	
0.941	0.782	0.642	0.96	0.911	0.344				TEX29			GLO1	PGP	FBXL4		CASQ1
0.937	0.806	0.659	0.91	0.92	0.343				TEX29			GLO1	PGP		SLAMF1	CASQ1
0.938	0.805	0.653	0.89	0.917	0.35				TEX29			GLO1		FBXL4	SLAMF1	CASQ1
0.812	1.402	1.113	1.14	0.903	4.1				TEX29				PGP	FBXL4	SLAMF1	CASQ1
0.937	0.799	0.677	0.98	0.92	0.347					RIC8A	LANCL2	GLO1	PGP	FBXL4		
0.933	0.819	0.69	0.93	0.93	0.35					RIC8A	LANCL2	GLO1	PGP		SLAMF1	
0.936	0.81	0.664	0.86	0.926	0.351					RIC8A	LANCL2	GLO1	PGP			CASQ1
0.937	0.801	0.676	1.08	0.906	0.338					RIC8A	LANCL2	GLO1		FBXL4	SLAMF1	
0.939	0.796	0.662	0.98	0.908	0.344					RIC8A	LANCL2	GLO1		FBXL4		CASQ1
0.935	0.82	0.676	0.93	0.919	0.339					RIC8A	LANCL2	GLO1			SLAMF1	CASQ1
0.934	0.815	0.669	0.99	0.916	0.314					RIC8A	LANCL2		PGP	FBXL4	SLAMF1	
0.932	0.832	0.681	0.95	0.926	0.317					RIC8A	LANCL2		PGP	FBXL4		CASQ1

Train Rsquared	Train RMSE	Train MAE	Test RMSE	Test Rsquared	Sample Handling CV	KRT1	KRT5	ADSL	TEX29	RIC8A	LANCL2	GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.933	0.832	0.678	0.93	0.92	0.322					RIC8A	LANCL2		PGP		SLAMF1	CASQ1
0.931	0.838	0.681	1.15	0.892	0.271					RIC8A	LANCL2			FBXL4	SLAMF1	CASQ1
0.877	1.144	0.914	1.08	0.886	0.579					RIC8A		GLO1	PGP	FBXL4	SLAMF1	
0.929	0.84	0.685	1.13	0.881	0.272					RIC8A		GLO1	PGP	FBXL4		CASQ1
0.927	0.871	0.703	1.08	0.899	0.269					RIC8A		GLO1	PGP		SLAMF1	CASQ1
0.929	0.843	0.718	1.15	0.923	0.31					RIC8A		GLO1		FBXL4	SLAMF1	CASQ1
0.93	0.841	0.699	1.04	0.919	0.311					RIC8A			PGP	FBXL4	SLAMF1	CASQ1
0.928	0.857	0.711	1	0.928	0.316						LANCL2	GLO1	PGP	FBXL4	SLAMF1	
0.918	0.914	0.759	1.34	0.879	0.241						LANCL2	GLO1	PGP	FBXL4		CASQ1
0.935	0.822	0.669	0.88	0.923	0.37						LANCL2	GLO1	PGP		SLAMF1	CASQ1
0.929	0.855	0.688	0.82	0.932	0.378						LANCL2	GLO1		FBXL4	SLAMF1	CASQ1
0.929	0.853	0.686	0.81	0.932	0.383						LANCL2		PGP	FBXL4	SLAMF1	CASQ1
0.936	0.816	0.661	0.93	0.917	0.367							GLO1	PGP	FBXL4	SLAMF1	CASQ1

Table 13: Freeze-Thaw Plasma Model 6 Biomarkers

Train Rsquared	Train RMSE	Train MAE	Test RMSE	Test Rsquared	Sample Handling CV	KRT1	KRT5	ADSL	TEX29	RIC8A	LANCL2	GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.808	1.402	1.171	1.21	0.888	0.461	KRT1	KRT5	ADSL	TEX29	RIC8A	LANCL2					
0.937	0.811	0.654	0.91	0.918	0.373	KRT1	KRT5	ADSL	TEX29	RIC8A		GLO1				
0.93	0.855	0.684	0.84	0.929	0.376	KRT1	KRT5	ADSL	TEX29	RIC8A			PGP			
0.933	0.828	0.685	0.97	0.917	0.366	KRT1	KRT5	ADSL	TEX29	RIC8A				FBXL4		
0.934	0.83	0.677	0.92	0.918	0.371	KRT1	KRT5	ADSL	TEX29	RIC8A					SLAMF1	
0.927	0.863	0.695	0.85	0.926	0.378	KRT1	KRT5	ADSL	TEX29	RIC8A						CASQ1
0.934	0.826	0.675	0.98	0.908	0.367	KRT1	KRT5	ADSL	TEX29		LANCL2	GLO1				
0.929	0.852	0.699	0.96	0.924	0.329	KRT1	KRT5	ADSL	TEX29		LANCL2		PGP			

Train Rsquared	Train RMSE	Train MAE	Test RMSE	Test Rsquared	Sample Handling - CV	KRT1	KRT5	ADSL	TEX29	RIC8A	LANCL2	GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.93	0.846	0.694	0.93	0.924	0.333	KRT1	KRT5	ADSL	TEX29		LANCL2			FBXL4		
0.924	0.881	0.711	0.87	0.933	0.345	KRT1	KRT5	ADSL	TEX29		LANCL2				SLAMF1	
0.928	0.858	0.695	1.07	0.904	0.289	KRT1	KRT5	ADSL	TEX29		LANCL2					CASQ1
0.791	1.447	1.163	1.33	0.859	0.47	KRT1	KRT5	ADSL	TEX29			GLO1	PGP			
0.926	0.872	0.722	1.04	0.917	0.325	KRT1	KRT5	ADSL	TEX29			GLO1		FBXL4		
0.937	0.81	0.679	0.96	0.908	0.331	KRT1	KRT5	ADSL	TEX29			GLO1			SLAMF1	
0.935	0.818	0.678	0.92	0.916	0.332	KRT1	KRT5	ADSL	TEX29			GLO1				CASQ1
0.937	0.811	0.664	0.9	0.914	0.336	KRT1	KRT5	ADSL	TEX29				PGP	FBXL4		
0.937	0.81	0.664	1.03	0.896	0.321	KRT1	KRT5	ADSL	TEX29				PGP		SLAMF1	
0.938	0.805	0.657	1	0.893	0.328	KRT1	KRT5	ADSL	TEX29				PGP			CASQ1
0.937	0.816	0.654	0.96	0.906	0.326	KRT1	KRT5	ADSL	TEX29					FBXL4	SLAMF1	
0.933	0.825	0.692	1.01	0.916	0.327	KRT1	KRT5	ADSL	TEX29					FBXL4		CASQ1
0.937	0.811	0.67	0.94	0.912	0.331	KRT1	KRT5	ADSL	TEX29						SLAMF1	CASQ1
0.936	0.817	0.667	0.9	0.921	0.332	KRT1	KRT5	ADSL		RIC8A	LANCL2	GLO1				
0.783	1.475	1.173	1.09	0.89	1.259	KRT1	KRT5	ADSL		RIC8A	LANCL2		PGP			
0.937	0.815	0.663	1.02	0.899	0.32	KRT1	KRT5	ADSL		RIC8A	LANCL2			FBXL4		
0.931	0.841	0.694	1.05	0.907	0.295	KRT1	KRT5	ADSL		RIC8A	LANCL2				SLAMF1	
0.932	0.839	0.691	1.02	0.899	0.299	KRT1	KRT5	ADSL		RIC8A	LANCL2					CASQ1
0.932	0.845	0.685	0.98	0.912	0.301	KRT1	KRT5	ADSL		RIC8A		GLO1	PGP			
0.926	0.873	0.708	1.21	0.864	0.246	KRT1	KRT5	ADSL		RIC8A		GLO1		FBXL4		
0.929	0.858	0.707	1.07	0.913	0.292	KRT1	KRT5	ADSL		RIC8A		GLO1			SLAMF1	
0.914	0.956	0.783	0.96	0.904	0.349	KRT1	KRT5	ADSL		RIC8A		GLO1				CASQ1
0.917	0.947	0.765	0.94	0.906	0.357	KRT1	KRT5	ADSL		RIC8A			PGP	FBXL4		
0.914	0.958	0.774	0.9	0.917	0.364	KRT1	KRT5	ADSL		RIC8A			PGP		SLAMF1	
0.917	0.945	0.753	1.01	0.895	0.354	KRT1	KRT5	ADSL		RIC8A			PGP			CASQ1

Train Rsquared	Train RMSE	Train MAE	Test RMSE	Test Rsquared	Sample Handling - CV	KRT1	KRT5	ADSL	TEX29	RIC8A	LANCL2	GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.878	1.15	0.914	1	0.904	0.521	KRT1	KRT5	ADSL		RIC8A				FBXL4	SLAMF1	
0.917	0.946	0.762	0.95	0.904	0.353	KRT1	KRT5	ADSL		RIC8A				FBXL4		CASQ1
0.912	0.978	0.781	0.99	0.901	0.305	KRT1	KRT5	ADSL		RIC8A					SLAMF1	CASQ1
0.912	0.952	0.799	0.82	0.937	0.424	KRT1	KRT5	ADSL			LANCL2	GLO1	PGP			
0.915	0.943	0.795	0.86	0.935	0.408	KRT1	KRT5	ADSL			LANCL2	GLO1		FBXL4		
0.911	0.964	0.809	0.81	0.934	0.487	KRT1	KRT5	ADSL			LANCL2	GLO1			SLAMF1	
0.916	0.939	0.795	0.95	0.922	0.416	KRT1	KRT5	ADSL			LANCL2	GLO1				CASQ1
0.91	0.971	0.81	0.89	0.927	0.47	KRT1	KRT5	ADSL			LANCL2		PGP	FBXL4		
0.914	0.958	0.807	0.91	0.924	1.398	KRT1	KRT5	ADSL			LANCL2		PGP		SLAMF1	
0.912	0.939	0.817	1.01	0.923	0.409	KRT1	KRT5	ADSL			LANCL2		PGP			CASQ1
0.909	0.961	0.823	0.83	0.93	0.45	KRT1	KRT5	ADSL			LANCL2			FBXL4	SLAMF1	
0.815	1.372	1.13	1.3	0.883	1.317	KRT1	KRT5	ADSL			LANCL2			FBXL4		CASQ1
0.912	0.95	0.824	0.9	0.927	0.431	KRT1	KRT5	ADSL			LANCL2				SLAMF1	CASQ1
0.912	0.955	0.831	1.02	0.905	0.408	KRT1	KRT5	ADSL				GLO1	PGP	FBXL4		
0.916	0.93	0.791	0.93	0.937	0.372	KRT1	KRT5	ADSL				GLO1	PGP		SLAMF1	
0.912	0.949	0.797	0.84	0.937	0.43	KRT1	KRT5	ADSL				GLO1	PGP			CASQ1
0.915	0.942	0.796	0.89	0.936	0.421	KRT1	KRT5	ADSL				GLO1		FBXL4	SLAMF1	
0.914	0.95	0.79	1.06	0.917	0.345	KRT1	KRT5	ADSL				GLO1		FBXL4		CASQ1
0.913	0.944	0.821	1.01	0.928	0.429	KRT1	KRT5	ADSL				GLO1			SLAMF1	CASQ1
0.912	0.958	0.799	0.92	0.918	0.471	KRT1	KRT5	ADSL					PGP	FBXL4	SLAMF1	
0.909	0.973	0.819	0.86	0.926	0.579	KRT1	KRT5	ADSL					PGP	FBXL4		CASQ1
0.908	0.982	0.808	0.9	0.917	0.612	KRT1	KRT5	ADSL					PGP		SLAMF1	CASQ1
0.807	1.428	1.121	1.33	0.875	0.36	KRT1	KRT5	ADSL						FBXL4	SLAMF1	CASQ1
0.913	0.958	0.795	0.97	0.909	0.578	KRT1	KRT5		TEX29	RIC8A	LANCL2	GLO1				
0.91	0.963	0.817	0.99	0.904	0.496	KRT1	KRT5		TEX29	RIC8A	LANCL2		PGP			

Train Rsquared	Train RMSE	Train MAE	Test RMSE	Test Rsquared	Sample Handling - CV	KRT1	KRT5	ADSL	TEX29	RIC8A	LANCL2	GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.913	0.954	0.792	0.94	0.921	0.464	KRT1	KRT5		TEX29	RIC8A	LANCL2			FBXL4		
0.909	0.974	0.812	0.89	0.938	0.373	KRT1	KRT5		TEX29	RIC8A	LANCL2				SLAMF1	
0.906	0.995	0.832	0.85	0.933	0.401	KRT1	KRT5		TEX29	RIC8A	LANCL2					CASQ1
0.911	0.97	0.811	0.86	0.935	0.375	KRT1	KRT5		TEX29	RIC8A		GLO1	PGP			
0.909	0.986	0.813	0.97	0.915	0.379	KRT1	KRT5		TEX29	RIC8A		GLO1		FBXL4		
0.91	0.971	0.822	0.88	0.933	0.369	KRT1	KRT5		TEX29	RIC8A		GLO1			SLAMF1	
0.911	0.968	0.808	0.91	0.935	0.353	KRT1	KRT5		TEX29	RIC8A		GLO1				CASQ1
0.886	1.112	0.909	1.04	0.895	0.498	KRT1	KRT5		TEX29	RIC8A			PGP	FBXL4		
0.801	1.443	1.158	1.37	0.845	0.372	KRT1	KRT5		TEX29	RIC8A			PGP		SLAMF1	
0.941	0.781	0.641	0.93	0.92	0.35	KRT1	KRT5		TEX29	RIC8A			PGP			CASQ1
0.938	0.799	0.655	0.88	0.929	0.352	KRT1	KRT5		TEX29	RIC8A				FBXL4	SLAMF1	
0.939	0.797	0.65	0.85	0.926	0.357	KRT1	KRT5		TEX29	RIC8A				FBXL4		CASQ1
0.942	0.775	0.627	1	0.907	0.344	KRT1	KRT5		TEX29	RIC8A					SLAMF1	CASQ1
0.943	0.774	0.626	0.97	0.905	0.352	KRT1	KRT5		TEX29		LANCL2	GLO1	PGP			
0.94	0.801	0.644	0.92	0.918	0.349	KRT1	KRT5		TEX29		LANCL2	GLO1		FBXL4		
0.939	0.787	0.653	1.01	0.921	0.346	KRT1	KRT5		TEX29		LANCL2	GLO1			SLAMF1	
0.94	0.785	0.642	0.94	0.919	0.35	KRT1	KRT5		TEX29		LANCL2	GLO1				CASQ1
0.938	0.8	0.654	0.89	0.928	0.351	KRT1	KRT5		TEX29		LANCL2		PGP	FBXL4		
0.942	0.78	0.635	1.04	0.903	0.342	KRT1	KRT5		TEX29		LANCL2		PGP		SLAMF1	
0.883	1.118	0.909	1.1	0.904	0.476	KRT1	KRT5		TEX29		LANCL2		PGP			CASQ1
0.935	0.812	0.663	1.02	0.922	0.317	KRT1	KRT5		TEX29		LANCL2			FBXL4	SLAMF1	
0.935	0.811	0.661	0.99	0.918	0.322	KRT1	KRT5		TEX29		LANCL2			FBXL4		CASQ1
0.934	0.829	0.676	0.95	0.929	0.326	KRT1	KRT5		TEX29		LANCL2				SLAMF1	CASQ1
0.929	0.843	0.681	1.21	0.882	0.273	KRT1	KRT5		TEX29			GLO1	PGP	FBXL4		
0.933	0.828	0.685	1.09	0.921	0.314	KRT1	KRT5		TEX29			GLO1	PGP		SLAMF1	

Train Rsquared	Train RMSE	Train MAE	Test RMSE	Test Rsquared	Sample Handling - CV	KRT1	KRT5	ADSL	TEX29	RIC8A	LANCL2	GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.936	0.814	0.66	0.91	0.92	0.374	KRT1	KRT5		TEX29			GLO1	PGP			CASQ1
0.937	0.811	0.658	0.9	0.92	0.378	KRT1	KRT5		TEX29			GLO1		FBXL4	SLAMF1	
0.931	0.848	0.676	0.83	0.93	0.388	KRT1	KRT5		TEX29			GLO1		FBXL4		CASQ1
0.939	0.799	0.637	0.96	0.909	0.375	KRT1	KRT5		TEX29			GLO1			SLAMF1	CASQ1
0.936	0.817	0.658	0.95	0.915	0.374	KRT1	KRT5		TEX29				PGP	FBXL4	SLAMF1	
0.879	1.14	0.914	1.16	0.883	0.62	KRT1	KRT5		TEX29				PGP	FBXL4		CASQ1
0.932	0.84	0.684	0.97	0.923	0.34	KRT1	KRT5		TEX29				PGP		SLAMF1	CASQ1
0.938	0.804	0.666	0.98	0.911	0.332	KRT1	KRT5		TEX29					FBXL4	SLAMF1	CASQ1
0.939	0.799	0.657	0.94	0.909	0.337	KRT1	KRT5			RIC8A	LANCL2	GLO1	PGP			
0.939	0.805	0.655	0.9	0.918	0.338	KRT1	KRT5			RIC8A	LANCL2	GLO1		FBXL4		
0.94	0.796	0.64	1.03	0.892	0.328	KRT1	KRT5			RIC8A	LANCL2	GLO1			SLAMF1	
0.939	0.8	0.654	0.96	0.913	0.332	KRT1	KRT5			RIC8A	LANCL2	GLO1				CASQ1
0.933	0.834	0.685	1.04	0.908	0.303	KRT1	KRT5			RIC8A	LANCL2		PGP	FBXL4		
0.919	0.935	0.747	0.97	0.899	0.364	KRT1	KRT5			RIC8A	LANCL2		PGP		SLAMF1	
0.918	0.929	0.779	0.89	0.937	0.404	KRT1	KRT5			RIC8A	LANCL2		PGP			CASQ1
0.913	0.954	0.794	0.8	0.94	0.467	KRT1	KRT5			RIC8A	LANCL2			FBXL4	SLAMF1	
0.88	1.143	0.905	1.05	0.892	0.962	KRT1	KRT5			RIC8A	LANCL2			FBXL4		CASQ1
0.917	0.941	0.788	0.85	0.937	0.449	KRT1	KRT5			RIC8A	LANCL2				SLAMF1	CASQ1
0.918	0.941	0.782	0.97	0.917	0.449	KRT1	KRT5			RIC8A		GLO1	PGP	FBXL4		
0.917	0.93	0.796	0.94	0.927	0.41	KRT1	KRT5			RIC8A		GLO1	PGP		SLAMF1	
0.918	0.928	0.777	0.93	0.939	0.408	KRT1	KRT5			RIC8A		GLO1	PGP			CASQ1
0.915	0.951	0.785	0.94	0.914	0.556	KRT1	KRT5			RIC8A		GLO1		FBXL4	SLAMF1	
0.913	0.964	0.803	0.86	0.94	0.384	KRT1	KRT5			RIC8A		GLO1		FBXL4		CASQ1
0.934	0.833	0.684	1.04	0.902	0.332	KRT1	KRT5			RIC8A		GLO1			SLAMF1	CASQ1
0.932	0.843	0.685	1	0.904	0.339	KRT1	KRT5			RIC8A			PGP	FBXL4	SLAMF1	

Train Rsquared	Train RMSE	Train MAE	Test RMSE	Test Rsquared	Sample Handling - CV	KRT1	KRT5	ADSL	TEX29	RIC8A	LANCL2	GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.932	0.843	0.682	1	0.902	0.338	KRT1	KRT5			RIC8A			PGP	FBXL4		CASQ1
0.935	0.835	0.676	1.1	0.885	0.325	KRT1	KRT5			RIC8A			PGP		SLAMF1	CASQ1
0.783	1.485	1.225	1.99	0.858	0.331	KRT1	KRT5			RIC8A				FBXL4	SLAMF1	CASQ1
0.935	0.831	0.67	1.09	0.884	0.327	KRT1	KRT5				LANCL2	GLO1	PGP	FBXL4		
0.932	0.853	0.68	1.05	0.887	0.33	KRT1	KRT5				LANCL2	GLO1	PGP		SLAMF1	
0.929	0.857	0.721	1.1	0.914	0.335	KRT1	KRT5				LANCL2	GLO1	PGP			CASQ1
0.931	0.853	0.704	1.06	0.909	0.332	KRT1	KRT5				LANCL2	GLO1		FBXL4	SLAMF1	
0.929	0.863	0.704	1	0.912	0.338	KRT1	KRT5				LANCL2	GLO1		FBXL4		CASQ1
0.929	0.869	0.708	1.13	0.892	0.321	KRT1	KRT5				LANCL2	GLO1			SLAMF1	CASQ1
0.931	0.848	0.691	1.1	0.9	0.31	KRT1	KRT5				LANCL2		PGP	FBXL4	SLAMF1	
0.931	0.843	0.687	1.1	0.899	0.312	KRT1	KRT5				LANCL2		PGP	FBXL4		CASQ1
0.929	0.858	0.694	1.06	0.901	0.317	KRT1	KRT5				LANCL2		PGP		SLAMF1	CASQ1
0.927	0.871	0.702	1.26	0.864	0.267	KRT1	KRT5				LANCL2			FBXL4	SLAMF1	CASQ1
0.757	1.545	1.295	1.55	0.864	0.355	KRT1	KRT5					GLO1	PGP	FBXL4	SLAMF1	
0.924	0.883	0.726	1.17	0.912	0.307	KRT1	KRT5					GLO1	PGP	FBXL4		CASQ1
0.926	0.884	0.715	0.94	0.923	0.353	KRT1	KRT5					GLO1	PGP		SLAMF1	CASQ1
0.926	0.885	0.715	0.94	0.923	0.353	KRT1	KRT5					GLO1		FBXL4	SLAMF1	CASQ1
0.921	0.908	0.731	0.87	0.926	0.367	KRT1	KRT5						PGP	FBXL4	SLAMF1	CASQ1
0.928	0.876	0.708	0.98	0.912	0.35	KRT1		ADSL	TEX29	RIC8A	LANCL2	GLO1				
0.923	0.9	0.732	0.98	0.923	0.355	KRT1		ADSL	TEX29	RIC8A	LANCL2		PGP			
0.924	0.889	0.725	0.99	0.922	0.331	KRT1		ADSL	TEX29	RIC8A	LANCL2			FBXL4		
0.931	0.851	0.7	1.1	0.882	0.32	KRT1		ADSL	TEX29	RIC8A	LANCL2				SLAMF1	
0.931	0.851	0.695	1.08	0.881	0.319	KRT1		ADSL	TEX29	RIC8A	LANCL2					CASQ1
0.931	0.852	0.69	1.05	0.885	0.325	KRT1		ADSL	TEX29	RIC8A		GLO1	PGP			
0.75	1.614	1.28	1.66	0.861	0.296	KRT1		ADSL	TEX29	RIC8A		GLO1		FBXL4		

Train Rsquared	Train RMSE	Train MAE	Test RMSE	Test Rsquared	Sample Handling - CV	KRT1	KRT5	ADSL	TEX29	RIC8A	LANCL2	GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.931	0.857	0.686	1.16	0.857	0.309	KRT1		ADSL	TEX29	RIC8A		GLO1			SLAMF1	
0.929	0.864	0.706	1.07	0.894	0.321	KRT1		ADSL	TEX29	RIC8A		GLO1				CASQ1
0.928	0.868	0.705	1.14	0.878	0.297	KRT1		ADSL	TEX29	RIC8A			PGP	FBXL4		
0.897	1.046	0.834	0.98	0.904	0.329	KRT1		ADSL	TEX29	RIC8A			PGP		SLAMF1	
0.908	0.982	0.835	0.97	0.925	0.379	KRT1		ADSL	TEX29	RIC8A			PGP			CASQ1
0.907	0.986	0.834	0.91	0.922	0.402	KRT1		ADSL	TEX29	RIC8A				FBXL4	SLAMF1	
0.907	0.989	0.838	0.95	0.919	0.399	KRT1		ADSL	TEX29	RIC8A				FBXL4		CASQ1
0.907	1.002	0.848	1.03	0.911	0.378	KRT1		ADSL	TEX29	RIC8A					SLAMF1	CASQ1
0.903	1.005	0.871	1	0.927	0.394	KRT1		ADSL	TEX29		LANCL2	GLO1	PGP			
0.909	0.974	0.827	0.99	0.925	0.374	KRT1		ADSL	TEX29		LANCL2	GLO1		FBXL4		
0.819	1.356	1.114	1.54	0.734	0.398	KRT1		ADSL	TEX29		LANCL2	GLO1			SLAMF1	
0.901	1.019	0.843	0.92	0.928	0.494	KRT1		ADSL	TEX29		LANCL2	GLO1				CASQ1
0.903	1.021	0.843	0.98	0.914	0.364	KRT1		ADSL	TEX29		LANCL2		PGP	FBXL4		
0.919	0.914	0.734	1.19	0.881	0.345	KRT1		ADSL	TEX29		LANCL2		PGP		SLAMF1	
0.919	0.916	0.735	1.19	0.881	0.344	KRT1		ADSL	TEX29		LANCL2		PGP			CASQ1
0.919	0.919	0.725	1.13	0.884	0.352	KRT1		ADSL	TEX29		LANCL2			FBXL4	SLAMF1	
0.904	0.987	0.782	1.37	0.816	0.332	KRT1		ADSL	TEX29		LANCL2			FBXL4		CASQ1
0.919	0.919	0.737	1.21	0.89	0.346	KRT1		ADSL	TEX29		LANCL2				SLAMF1	CASQ1
0.919	0.914	0.742	1.24	0.877	0.332	KRT1		ADSL	TEX29			GLO1	PGP	FBXL4		
0.905	0.997	0.791	1.07	0.91	0.374	KRT1		ADSL	TEX29			GLO1	PGP		SLAMF1	
0.917	0.927	0.753	1.24	0.854	0.334	KRT1		ADSL	TEX29			GLO1	PGP			CASQ1
0.884	1.107	0.913	1.04	0.911	0.396	KRT1		ADSL	TEX29			GLO1		FBXL4	SLAMF1	
0.885	1.092	0.91	1.09	0.909	0.463	KRT1		ADSL	TEX29			GLO1		FBXL4		CASQ1
0.939	0.792	0.655	0.93	0.919	0.343	KRT1		ADSL	TEX29			GLO1			SLAMF1	CASQ1
0.936	0.81	0.667	0.89	0.926	0.345	KRT1		ADSL	TEX29				PGP	FBXL4	SLAMF1	

Train Rsquared	Train RMSE	Train MAE	Test RMSE	Test Rsquared	Sample Handling CV	KRT1	KRT5	ADSL	TEX29	RIC8A	LANCL2	GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.937	0.808	0.659	0.86	0.924	0.349	KRT1		ADSL	TEX29				PGP	FBXL4		CASQ1
0.94	0.79	0.649	0.98	0.912	0.337	KRT1		ADSL	TEX29				PGP		SLAMF1	CASQ1
0.94	0.788	0.645	0.95	0.91	0.343	KRT1		ADSL	TEX29					FBXL4	SLAMF1	CASQ1
0.937	0.812	0.66	0.91	0.919	0.341	KRT1		ADSL		RIC8A	LANCL2	GLO1	PGP			
0.936	0.805	0.683	1.01	0.921	0.341	KRT1		ADSL		RIC8A	LANCL2	GLO1		FBXL4		
0.937	0.801	0.665	0.94	0.919	0.344	KRT1		ADSL		RIC8A	LANCL2	GLO1			SLAMF1	
0.935	0.817	0.675	0.89	0.926	0.344	KRT1		ADSL		RIC8A	LANCL2	GLO1				CASQ1
0.767	1.501	1.221	1.38	0.831	0.652	KRT1		ADSL		RIC8A	LANCL2		PGP	FBXL4		
0.938	0.803	0.67	1.02	0.909	0.336	KRT1		ADSL		RIC8A	LANCL2		PGP		SLAMF1	
0.933	0.823	0.676	1.02	0.92	0.309	KRT1		ADSL		RIC8A	LANCL2		PGP			CASQ1
0.934	0.82	0.673	0.99	0.916	0.313	KRT1		ADSL		RIC8A	LANCL2			FBXL4	SLAMF1	
0.932	0.838	0.685	0.95	0.925	0.315	KRT1		ADSL		RIC8A	LANCL2			FBXL4		CASQ1
0.93	0.841	0.683	1.15	0.892	0.271	KRT1		ADSL		RIC8A	LANCL2				SLAMF1	CASQ1
0.929	0.848	0.712	1.08	0.921	0.305	KRT1		ADSL		RIC8A		GLO1	PGP	FBXL4		
0.934	0.829	0.677	0.9	0.923	0.366	KRT1		ADSL		RIC8A		GLO1	PGP		SLAMF1	
0.935	0.825	0.671	0.88	0.923	0.37	KRT1		ADSL		RIC8A		GLO1	PGP			CASQ1
0.928	0.861	0.692	0.82	0.931	0.378	KRT1		ADSL		RIC8A		GLO1		FBXL4	SLAMF1	
0.936	0.819	0.663	0.93	0.917	0.367	KRT1		ADSL		RIC8A		GLO1		FBXL4		CASQ1
0.788	1.42	1.133	1.53	0.844	0.367	KRT1		ADSL		RIC8A		GLO1			SLAMF1	CASQ1
0.932	0.837	0.687	0.94	0.917	0.366	KRT1		ADSL		RIC8A			PGP	FBXL4	SLAMF1	
0.929	0.853	0.701	0.96	0.924	0.329	KRT1		ADSL		RIC8A			PGP	FBXL4		CASQ1
0.935	0.818	0.68	0.97	0.91	0.325	KRT1		ADSL		RIC8A			PGP		SLAMF1	CASQ1
0.937	0.813	0.671	0.95	0.908	0.329	KRT1		ADSL		RIC8A				FBXL4	SLAMF1	CASQ1
0.936	0.819	0.668	0.91	0.916	0.33	KRT1		ADSL			LANCL2	GLO1	PGP	FBXL4		
0.937	0.814	0.659	1.01	0.897	0.32	KRT1		ADSL			LANCL2	GLO1	PGP		SLAMF1	

Train Rsquared	Train RMSE	Train MAE	Test RMSE	Test Rsquared	Sample Handling _CV	KRT1	KRT5	ADSL	TEX29	RIC8A	LANCL2	GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.936	0.819	0.674	0.96	0.913	0.325	KRT1		ADSL			LANCL2	GLO1	PGP			CASQ1
0.931	0.847	0.693	1.04	0.906	0.294	KRT1		ADSL			LANCL2	GLO1		FBXL4	SLAMF1	
0.915	0.955	0.77	0.95	0.906	0.352	KRT1		ADSL			LANCL2	GLO1		FBXL4		CASQ1
0.915	0.937	0.798	0.89	0.935	0.388	KRT1		ADSL			LANCL2	GLO1			SLAMF1	CASQ1
0.806	1.398	1.134	1.3	0.817	0.422	KRT1		ADSL			LANCL2		PGP	FBXL4	SLAMF1	
0.911	0.957	0.805	0.82	0.936	0.418	KRT1		ADSL			LANCL2		PGP	FBXL4		CASQ1
0.914	0.949	0.804	0.86	0.934	0.401	KRT1		ADSL			LANCL2		PGP		SLAMF1	CASQ1
0.915	0.945	0.801	0.95	0.921	0.412	KRT1		ADSL			LANCL2			FBXL4	SLAMF1	CASQ1
0.913	0.945	0.822	0.94	0.926	0.39	KRT1		ADSL				GLO1	PGP	FBXL4	SLAMF1	
0.916	0.935	0.796	0.92	0.936	0.37	KRT1		ADSL				GLO1	PGP	FBXL4		CASQ1
0.912	0.961	0.802	0.92	0.918	0.471	KRT1		ADSL				GLO1	PGP		SLAMF1	CASQ1
0.91	0.975	0.816	0.87	0.935	0.365	KRT1		ADSL				GLO1		FBXL4	SLAMF1	CASQ1
0.94	0.788	0.644	0.95	0.921	0.345	KRT1		ADSL					PGP	FBXL4	SLAMF1	CASQ1
0.94	0.786	0.643	0.92	0.919	0.349	KRT1			TEX29	RIC8A	LANCL2	GLO1	PGP			
0.938	0.804	0.655	0.87	0.927	0.351	KRT1			TEX29	RIC8A	LANCL2	GLO1		FBXL4		
0.89	1.087	0.907	1.09	0.885	0.391	KRT1			TEX29	RIC8A	LANCL2	GLO1			SLAMF1	
0.942	0.78	0.629	1	0.907	0.343	KRT1			TEX29	RIC8A	LANCL2	GLO1				CASQ1
0.939	0.791	0.649	0.97	0.919	0.344	KRT1			TEX29	RIC8A	LANCL2		PGP	FBXL4		
0.935	0.817	0.667	1.02	0.922	0.317	KRT1			TEX29	RIC8A	LANCL2		PGP		SLAMF1	
0.936	0.818	0.662	0.91	0.92	0.374	KRT1			TEX29	RIC8A	LANCL2		PGP			CASQ1
0.938	0.806	0.661	0.96	0.911	0.331	KRT1			TEX29	RIC8A	LANCL2			FBXL4	SLAMF1	
0.917	0.935	0.786	0.89	0.936	0.401	KRT1			TEX29	RIC8A	LANCL2			FBXL4		CASQ1
0.933	0.837	0.688	1.04	0.902	0.332	KRT1			TEX29	RIC8A	LANCL2				SLAMF1	CASQ1
0.933	0.838	0.686	1.04	0.902	0.332	KRT1			TEX29	RIC8A		GLO1	PGP	FBXL4		
0.931	0.849	0.688	1	0.903	0.338	KRT1			TEX29	RIC8A		GLO1	PGP		SLAMF1	

Train Rsquared	Train RMSE	Train MAE	Test RMSE	Test Rsquared	Sample Handling - CV	KRT1	KRT5	ADSL	TEX29	RIC8A	LANCL2	GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.934	0.839	0.678	1.1	0.885	0.325	KRT1			TEX29	RIC8A		GLO1	PGP			CASQ1
0.794	1.408	1.133	1.87	0.592	0.307	KRT1			TEX29	RIC8A		GLO1		FBXL4	SLAMF1	
0.93	0.858	0.709	1.06	0.909	0.332	KRT1			TEX29	RIC8A		GLO1		FBXL4		CASQ1
0.93	0.85	0.694	1.1	0.9	0.31	KRT1			TEX29	RIC8A		GLO1			SLAMF1	CASQ1
0.926	0.885	0.716	0.94	0.923	0.353	KRT1			TEX29	RIC8A			PGP	FBXL4	SLAMF1	
0.93	0.856	0.7	1.08	0.881	0.319	KRT1			TEX29	RIC8A			PGP	FBXL4		CASQ1
0.907	0.987	0.839	0.97	0.925	0.379	KRT1			TEX29	RIC8A			PGP		SLAMF1	CASQ1
0.919	0.918	0.737	1.19	0.881	0.344	KRT1			TEX29	RIC8A				FBXL4	SLAMF1	CASQ1
0.938	0.799	0.66	0.95	0.92	0.339	KRT1			TEX29		LANCL2	GLO1	PGP	FBXL4		
0.938	0.797	0.656	0.92	0.919	0.342	KRT1			TEX29		LANCL2	GLO1	PGP		SLAMF1	
0.936	0.815	0.667	0.88	0.925	0.343	KRT1			TEX29		LANCL2	GLO1	PGP			CASQ1
0.939	0.795	0.652	0.98	0.912	0.337	KRT1			TEX29		LANCL2	GLO1		FBXL4	SLAMF1	
0.811	1.342	1.072	1.77	0.67	0.302	KRT1			TEX29		LANCL2	GLO1		FBXL4		CASQ1
0.936	0.809	0.674	0.97	0.919	0.338	KRT1			TEX29		LANCL2	GLO1			SLAMF1	CASQ1
0.933	0.827	0.679	1.02	0.92	0.308	KRT1			TEX29		LANCL2		PGP	FBXL4	SLAMF1	
0.933	0.832	0.679	0.9	0.923	0.366	KRT1			TEX29		LANCL2		PGP	FBXL4		CASQ1
0.935	0.821	0.675	0.96	0.91	0.325	KRT1			TEX29		LANCL2		PGP		SLAMF1	CASQ1
0.915	0.942	0.804	0.89	0.935	0.386	KRT1			TEX29		LANCL2			FBXL4	SLAMF1	CASQ1
0.939	0.793	0.647	0.94	0.92	0.344	KRT1			TEX29			GLO1	PGP	FBXL4	SLAMF1	
0.933	0.841	0.69	1.04	0.902	0.332	KRT1			TEX29			GLO1	PGP	FBXL4		CASQ1
0.937	0.805	0.663	0.94	0.92	0.338	KRT1			TEX29			GLO1	PGP		SLAMF1	CASQ1
0.795	1.424	1.161	1.88	0.585	0.303	KRT1			TEX29			GLO1		FBXL4	SLAMF1	CASQ1
0.886	1.094	0.917	1.11	0.915	0.377	KRT1			TEX29				PGP	FBXL4	SLAMF1	CASQ1
0.887	1.084	0.886	1.22	0.912	0.372	KRT1				RIC8A	LANCL2	GLO1	PGP	FBXL4		
0.896	1.072	0.903	1.03	0.905	0.386	KRT1				RIC8A	LANCL2	GLO1	PGP		SLAMF1	

Train Rsquared	Train RMSE	Train MAE	Test RMSE	Test Rsquared	Sample Handling _CV	KRT1	KRT5	ADSL	TEX29	RIC8A	LANCL2	GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.741	1.572	1.283	2.43	0.746	0.26	KRT1				RIC8A	LANCL2	GLO1	PGP			CASQ1
0.731	1.604	1.305	1.87	0.647	0.247	KRT1				RIC8A	LANCL2	GLO1		FBXL4	SLAMF1	
0.764	1.511	1.212	1.91	0.738	0.247	KRT1				RIC8A	LANCL2	GLO1		FBXL4		CASQ1
0.801	1.449	1.175	1.28	0.861	0.512	KRT1				RIC8A	LANCL2	GLO1			SLAMF1	CASQ1
0.601	1.979	1.637	1.99	0.845	0.593	KRT1				RIC8A	LANCL2		PGP	FBXL4	SLAMF1	
0.596	1.972	1.646	1.85	0.867	0.475	KRT1				RIC8A	LANCL2		PGP	FBXL4		CASQ1
0.611	1.975	1.629	2.07	0.842	0.701	KRT1				RIC8A	LANCL2		PGP		SLAMF1	CASQ1
0.804	1.44	1.185	1.2	0.867	0.488	KRT1				RIC8A	LANCL2			FBXL4	SLAMF1	CASQ1
0.804	1.44	1.168	1.23	0.851	0.509	KRT1				RIC8A		GLO1	PGP	FBXL4	SLAMF1	
0.82	1.424	1.144	1.2	0.877	0.605	KRT1				RIC8A		GLO1	PGP	FBXL4		CASQ1
0.571	2.036	1.714	1.64	0.93	0.473	KRT1				RIC8A		GLO1	PGP		SLAMF1	CASQ1
0.617	1.986	1.676	1.7	0.916	0.487	KRT1				RIC8A		GLO1		FBXL4	SLAMF1	CASQ1
0.616	1.97	1.625	1.58	0.917	0.551	KRT1				RIC8A			PGP	FBXL4	SLAMF1	CASQ1
0.794	1.466	1.201	1.24	0.873	0.483	KRT1					LANCL2	GLO1	PGP	FBXL4	SLAMF1	
0.793	1.469	1.192	1.25	0.862	0.49	KRT1					LANCL2	GLO1	PGP	FBXL4		CASQ1
0.81	1.446	1.161	1.23	0.878	0.549	KRT1					LANCL2	GLO1	PGP		SLAMF1	CASQ1
0.591	1.977	1.62	1.99	0.779	0.292	KRT1					LANCL2	GLO1		FBXL4	SLAMF1	CASQ1
0.588	2.012	1.627	2.21	0.631	0.317	KRT1					LANCL2		PGP	FBXL4	SLAMF1	CASQ1
0.583	2.004	1.608	2.01	0.742	0.277	KRT1						GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.797	1.456	1.194	1.2	0.869	0.467		KRT5	ADSL	TEX29	RIC8A	LANCL2	GLO1				
0.812	1.442	1.168	1.18	0.883	0.514		KRT5	ADSL	TEX29	RIC8A	LANCL2		PGP			
0.813	1.44	1.155	1.19	0.872	0.539		KRT5	ADSL	TEX29	RIC8A	LANCL2			FBXL4		
0.573	2.068	1.697	1.89	0.872	0.247		KRT5	ADSL	TEX29	RIC8A	LANCL2				SLAMF1	
0.883	1.063	0.852	1.25	0.885	0.223		KRT5	ADSL	TEX29	RIC8A	LANCL2					CASQ1
0.874	1.117	0.908	1.4	0.85	0.19		KRT5	ADSL	TEX29	RIC8A		GLO1	PGP			

Train Rsquared	Train RMSE	Train MAE	Test RMSE	Test Rsquared	Sample Handling _CV	KRT1	KRT5	ADSL	TEX29	RIC8A	LANCL2	GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.912	0.954	0.782	0.96	0.903	0.388		KRT5	ADSL	TEX29	RIC8A		GLO1		FBXL4		
0.905	1.002	0.814	1.15	0.878	0.249		KRT5	ADSL	TEX29	RIC8A		GLO1			SLAMF1	
0.908	0.98	0.798	0.96	0.909	0.433		KRT5	ADSL	TEX29	RIC8A		GLO1				CASQ1
0.886	1.072	0.84	1.43	0.802	0.26		KRT5	ADSL	TEX29	RIC8A			PGP	FBXL4		
0.889	1.093	0.879	1.34	0.853	0.213		KRT5	ADSL	TEX29	RIC8A			PGP		SLAMF1	
0.893	1.065	0.85	1.14	0.867	0.244		KRT5	ADSL	TEX29	RIC8A			PGP			CASQ1
0.833	1.234	0.997	1.26	0.865	0.296		KRT5	ADSL	TEX29	RIC8A				FBXL4	SLAMF1	
0.887	1.044	0.886	1	0.887	1.256		KRT5	ADSL	TEX29	RIC8A				FBXL4		CASQ1
0.901	1.018	0.822	1.01	0.919	0.434		KRT5	ADSL	TEX29	RIC8A					SLAMF1	CASQ1
0.898	0.989	0.834	0.97	0.902	0.477		KRT5	ADSL	TEX29		LANCL2	GLO1	PGP			
0.871	1.097	0.925	1.31	0.856	0.425		KRT5	ADSL	TEX29		LANCL2	GLO1		FBXL4		
0.889	1.055	0.865	1.39	0.85	0.418		KRT5	ADSL	TEX29		LANCL2	GLO1			SLAMF1	
0.869	1.147	0.946	1.07	0.883	0.367		KRT5	ADSL	TEX29		LANCL2	GLO1				CASQ1
0.873	1.113	0.946	0.93	0.918	0.445		KRT5	ADSL	TEX29		LANCL2		PGP	FBXL4		
0.895	1.056	0.87	1.17	0.881	0.343		KRT5	ADSL	TEX29		LANCL2		PGP		SLAMF1	
0.895	1.015	0.863	0.88	0.935	0.366		KRT5	ADSL	TEX29		LANCL2		PGP			CASQ1
0.834	1.259	1.072	1.38	0.841	0.324		KRT5	ADSL	TEX29		LANCL2			FBXL4	SLAMF1	
0.881	1.099	0.924	1.45	0.873	0.399		KRT5	ADSL	TEX29		LANCL2			FBXL4		CASQ1
0.87	1.166	0.981	1.11	0.883	0.268		KRT5	ADSL	TEX29		LANCL2				SLAMF1	CASQ1
0.87	1.17	0.995	1.29	0.902	0.866		KRT5	ADSL	TEX29			GLO1	PGP	FBXL4		
0.87	1.147	0.979	1.06	0.889	0.498		KRT5	ADSL	TEX29			GLO1	PGP		SLAMF1	
0.86	1.199	1.032	1.23	0.848	0.852		KRT5	ADSL	TEX29			GLO1	PGP			CASQ1
0.873	1.135	0.933	1.21	0.838	1.212		KRT5	ADSL	TEX29			GLO1		FBXL4	SLAMF1	
0.878	1.149	0.971	1.22	0.889	1.01		KRT5	ADSL	TEX29			GLO1		FBXL4		CASQ1
0.88	1.125	0.947	1.1	0.907	0.449		KRT5	ADSL	TEX29			GLO1			SLAMF1	CASQ1

Train Rsquared	Train RMSE	Train MAE	Test RMSE	Test Rsquared	Sample Handling _CV	KRT1	KRT5	ADSL	TEX29	RIC8A	LANCL2	GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.873	1.173	0.966	1.32	0.875	0.555		KRT5	ADSL	TEX29				PGP	FBXL4	SLAMF1	
0.883	1.122	0.874	1.2	0.876	0.483		KRT5	ADSL	TEX29				PGP	FBXL4		CASQ1
0.873	1.171	0.967	1.34	0.888	0.512		KRT5	ADSL	TEX29				PGP	FBXL4	SLAMF1	CASQ1
0.877	1.134	0.948	1.06	0.884	0.412		KRT5	ADSL	TEX29					FBXL4	SLAMF1	CASQ1
0.883	1.101	0.89	1.11	0.872	0.417		KRT5	ADSL		RIC8A	LANCL2	GLO1	PGP			
0.887	1.103	0.919	1.04	0.9	0.464		KRT5	ADSL		RIC8A	LANCL2	GLO1		FBXL4		
0.878	1.16	0.904	1.46	0.792	0.701		KRT5	ADSL		RIC8A	LANCL2	GLO1			SLAMF1	
0.866	1.204	0.994	1.28	0.842	0.937		KRT5	ADSL		RIC8A	LANCL2	GLO1				CASQ1
0.883	1.139	0.887	1.23	0.844	1.619		KRT5	ADSL		RIC8A	LANCL2		PGP	FBXL4		
0.875	1.099	0.884	1.41	0.857	0.221		KRT5	ADSL		RIC8A	LANCL2		PGP		SLAMF1	
0.934	0.826	0.661	0.89	0.915	0.402		KRT5	ADSL		RIC8A	LANCL2		PGP			CASQ1
0.92	0.91	0.729	1.01	0.907	0.293		KRT5	ADSL		RIC8A	LANCL2			FBXL4	SLAMF1	
0.926	0.861	0.694	0.95	0.925	0.545		KRT5	ADSL		RIC8A	LANCL2			FBXL4		CASQ1
0.906	0.93	0.744	1.48	0.83	0.256		KRT5	ADSL		RIC8A	LANCL2				SLAMF1	CASQ1
0.906	0.985	0.809	1.43	0.869	0.258		KRT5	ADSL		RIC8A		GLO1	PGP	FBXL4		
0.898	1.024	0.822	1.13	0.876	0.246		KRT5	ADSL		RIC8A		GLO1	PGP		SLAMF1	
0.937	0.817	0.67	0.96	0.905	0.356		KRT5	ADSL		RIC8A		GLO1	PGP			CASQ1
0.921	0.911	0.767	1.25	0.832	0.256		KRT5	ADSL		RIC8A		GLO1		FBXL4	SLAMF1	
0.93	0.841	0.705	1.01	0.924	0.352		KRT5	ADSL		RIC8A		GLO1		FBXL4		CASQ1
0.886	1.02	0.831	1.66	0.771	0.217		KRT5	ADSL		RIC8A		GLO1			SLAMF1	CASQ1
0.904	1.007	0.844	1.56	0.858	0.217		KRT5	ADSL		RIC8A			PGP	FBXL4	SLAMF1	
0.901	1.018	0.845	1.26	0.838	0.217		KRT5	ADSL		RIC8A			PGP	FBXL4		CASQ1
0.919	0.932	0.752	1.03	0.901	0.399		KRT5	ADSL		RIC8A			PGP		SLAMF1	CASQ1
0.918	0.931	0.767	0.92	0.908	0.391		KRT5	ADSL		RIC8A				FBXL4	SLAMF1	CASQ1
0.923	0.903	0.723	1.1	0.864	0.378		KRT5	ADSL			LANCL2	GLO1	PGP	FBXL4		

Train Rsquared	Train RMSE	Train MAE	Test RMSE	Test Rsquared	Sample Handling _CV	KRT1	KRT5	ADSL	TEX29	RIC8A	LANCL2	GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.918	0.931	0.764	1.03	0.884	0.375		KRT5	ADSL			LANCL2	GLO1	PGP		SLAMF1	
0.925	0.907	0.722	1	0.898	0.407		KRT5	ADSL			LANCL2	GLO1	PGP			CASQ1
0.914	0.957	0.781	0.96	0.91	0.363		KRT5	ADSL			LANCL2	GLO1		FBXL4	SLAMF1	
0.906	0.994	0.791	1.31	0.819	0.262		KRT5	ADSL			LANCL2	GLO1		FBXL4		CASQ1
0.905	1.011	0.799	1.19	0.865	0.246		KRT5	ADSL			LANCL2	GLO1			SLAMF1	CASQ1
0.902	1.025	0.82	1.23	0.855	0.258		KRT5	ADSL			LANCL2		PGP	FBXL4	SLAMF1	
0.916	0.947	0.765	1.06	0.889	0.336		KRT5	ADSL			LANCL2		PGP	FBXL4		CASQ1
0.913	0.963	0.773	1.01	0.903	0.438		KRT5	ADSL			LANCL2		PGP		SLAMF1	CASQ1
0.918	0.946	0.754	0.94	0.907	0.365		KRT5	ADSL			LANCL2			FBXL4	SLAMF1	CASQ1
0.9	1.026	0.776	1.54	0.784	0.286		KRT5	ADSL				GLO1	PGP	FBXL4	SLAMF1	
0.899	1.014	0.783	1.36	0.797	0.273		KRT5	ADSL				GLO1	PGP	FBXL4		CASQ1
0.902	1.041	0.809	1.25	0.843	0.234		KRT5	ADSL				GLO1	PGP		SLAMF1	CASQ1
0.89	1.042	0.875	0.95	0.902	0.493		KRT5	ADSL				GLO1		FBXL4	SLAMF1	CASQ1
0.897	1.053	0.862	1.05	0.912	3.143		KRT5	ADSL					PGP	FBXL4	SLAMF1	CASQ1
0.907	0.955	0.794	0.91	0.927	0.403		KRT5		TEX29	RIC8A	LANCL2	GLO1	PGP			
0.86	1.12	0.922	1.44	0.828	0.368		KRT5		TEX29	RIC8A	LANCL2	GLO1		FBXL4		
0.892	1.043	0.886	1.53	0.853	0.362		KRT5		TEX29	RIC8A	LANCL2	GLO1			SLAMF1	
0.862	1.187	0.977	1.12	0.878	0.292		KRT5		TEX29	RIC8A	LANCL2	GLO1				CASQ1
0.907	1.014	0.835	0.97	0.923	0.782		KRT5		TEX29	RIC8A	LANCL2		PGP	FBXL4		
0.905	0.98	0.817	0.93	0.901	0.508		KRT5		TEX29	RIC8A	LANCL2		PGP		SLAMF1	
0.904	0.989	0.83	1.06	0.874	0.701		KRT5		TEX29	RIC8A	LANCL2		PGP			CASQ1
0.909	0.971	0.801	1.14	0.862	0.572		KRT5		TEX29	RIC8A	LANCL2			FBXL4	SLAMF1	
0.902	1.028	0.864	1	0.897	1.895		KRT5		TEX29	RIC8A	LANCL2			FBXL4		CASQ1
0.911	0.973	0.793	0.87	0.926	0.47		KRT5		TEX29	RIC8A	LANCL2				SLAMF1	CASQ1
0.904	1.001	0.807	1.05	0.908	0.459		KRT5		TEX29	RIC8A		GLO1	PGP	FBXL4		

Train Rsquared	Train RMSE	Train MAE	Test RMSE	Test Rsquared	Sample Handling CV	KRT1	KRT5	ADSL	TEX29	RIC8A	LANCL2	GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.911	0.994	0.802	1.06	0.905	0.417		KRT5		TEX29	RIC8A		GLO1	PGP		SLAMF1	
0.896	1.065	0.864	1.06	0.919	0.443		KRT5		TEX29	RIC8A		GLO1	PGP			CASQ1
0.91	0.952	0.792	0.99	0.908	0.436		KRT5		TEX29	RIC8A		GLO1		FBXL4	SLAMF1	
0.912	0.951	0.786	1.08	0.894	0.438		KRT5		TEX29	RIC8A		GLO1		FBXL4		CASQ1
0.908	0.979	0.81	0.9	0.911	0.54		KRT5		TEX29	RIC8A		GLO1			SLAMF1	CASQ1
0.907	0.982	0.817	1.51	0.828	0.73		KRT5		TEX29	RIC8A			PGP	FBXL4	SLAMF1	
0.881	1.08	0.888	1.22	0.851	0.578		KRT5		TEX29	RIC8A			PGP	FBXL4		CASQ1
0.9	1.052	0.855	1.27	0.852	0.405		KRT5		TEX29	RIC8A			PGP		SLAMF1	CASQ1
0.899	1.051	0.883	1.02	0.929	0.437		KRT5		TEX29	RIC8A				FBXL4	SLAMF1	CASQ1
0.9	1.003	0.852	0.79	0.94	0.405		KRT5		TEX29		LANCL2	GLO1	PGP	FBXL4		
0.882	1.088	0.909	1.01	0.899	0.452		KRT5		TEX29		LANCL2	GLO1	PGP		SLAMF1	
0.903	0.994	0.827	1.08	0.896	0.471		KRT5		TEX29		LANCL2	GLO1	PGP			CASQ1
0.904	1.034	0.868	0.94	0.925	0.477		KRT5		TEX29		LANCL2	GLO1		FBXL4	SLAMF1	
0.909	0.98	0.821	0.85	0.942	0.382		KRT5		TEX29		LANCL2	GLO1		FBXL4		CASQ1
0.884	1.088	0.894	1.23	0.869	0.332		KRT5		TEX29		LANCL2	GLO1			SLAMF1	CASQ1
0.906	1.003	0.829	1.14	0.903	0.328		KRT5		TEX29		LANCL2		PGP	FBXL4	SLAMF1	
0.888	1.105	0.915	1.22	0.878	0.317		KRT5		TEX29		LANCL2		PGP	FBXL4		CASQ1
0.901	0.999	0.848	0.89	0.941	0.362		KRT5		TEX29		LANCL2		PGP		SLAMF1	CASQ1
0.911	0.954	0.806	1.02	0.936	0.357		KRT5		TEX29		LANCL2			FBXL4	SLAMF1	CASQ1
0.913	0.966	0.812	0.81	0.939	0.371		KRT5		TEX29			GLO1	PGP	FBXL4	SLAMF1	
0.89	1.062	0.897	1.59	0.834	0.341		KRT5		TEX29			GLO1	PGP	FBXL4		CASQ1
0.868	1.15	0.946	1.25	0.845	0.295		KRT5		TEX29			GLO1	PGP		SLAMF1	CASQ1
0.9	1.048	0.889	1.25	0.876	0.307		KRT5		TEX29			GLO1		FBXL4	SLAMF1	CASQ1
0.881	1.129	0.96	1.11	0.908	0.513		KRT5		TEX29				PGP	FBXL4	SLAMF1	CASQ1
0.873	1.171	0.997	1.36	0.871	1.409		KRT5			RIC8A	LANCL2	GLO1	PGP	FBXL4		

Train Rsquared	Train RMSE	Train MAE	Test RMSE	Test Rsquared	Sample Handling _CV	KRT1	KRT5	ADSL	TEX29	RIC8A	LANCL2	GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.885	1.115	0.899	1.24	0.859	0.801		KRT5			RIC8A	LANCL2	GLO1	PGP		SLAMF1	
0.881	1.158	0.975	1.37	0.892	1.067		KRT5			RIC8A	LANCL2	GLO1	PGP			CASQ1
0.881	1.125	0.955	1.08	0.882	0.486		KRT5			RIC8A	LANCL2	GLO1		FBXL4	SLAMF1	
0.887	1.089	0.89	1.11	0.865	0.481		KRT5			RIC8A	LANCL2	GLO1		FBXL4		CASQ1
0.892	1.097	0.92	1.09	0.903	0.557		KRT5			RIC8A	LANCL2	GLO1			SLAMF1	CASQ1
0.888	1.098	0.883	1.32	0.803	0.699		KRT5			RIC8A	LANCL2		PGP	FBXL4	SLAMF1	
0.885	1.137	0.966	1.3	0.86	0.922		KRT5			RIC8A	LANCL2		PGP	FBXL4		CASQ1
0.895	1.089	0.884	1.22	0.849	0.803		KRT5			RIC8A	LANCL2		PGP		SLAMF1	CASQ1
0.885	1.117	0.931	1.1	0.901	0.445		KRT5			RIC8A	LANCL2			FBXL4	SLAMF1	CASQ1
0.89	1.087	0.878	1.08	0.888	0.441		KRT5			RIC8A		GLO1	PGP	FBXL4	SLAMF1	
0.891	1.101	0.911	1.09	0.908	0.483		KRT5			RIC8A		GLO1	PGP	FBXL4		CASQ1
0.888	1.118	0.876	1.33	0.829	0.491		KRT5			RIC8A		GLO1	PGP		SLAMF1	CASQ1
0.87	1.192	0.992	1.44	0.845	0.544		KRT5			RIC8A		GLO1		FBXL4	SLAMF1	CASQ1
0.888	1.127	0.88	1.28	0.851	0.526		KRT5			RIC8A			PGP	FBXL4	SLAMF1	CASQ1
0.893	1.076	0.86	1.15	0.863	0.413		KRT5				LANCL2	GLO1	PGP	FBXL4	SLAMF1	
0.894	1.09	0.902	1.06	0.895	0.456		KRT5				LANCL2	GLO1	PGP	FBXL4		CASQ1
0.898	1.067	0.856	1.06	0.884	0.456		KRT5				LANCL2	GLO1	PGP		SLAMF1	CASQ1
0.892	1.117	0.875	1.38	0.794	0.706		KRT5				LANCL2	GLO1		FBXL4	SLAMF1	CASQ1
0.879	1.092	0.863	1.44	0.878	0.211		KRT5				LANCL2		PGP	FBXL4	SLAMF1	CASQ1
0.918	0.925	0.754	0.94	0.919	0.363		KRT5					GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.919	0.922	0.754	1.04	0.899	0.283			ADSL	TEX29	RIC8A	LANCL2	GLO1	PGP			
0.916	0.922	0.748	1.02	0.924	0.376			ADSL	TEX29	RIC8A	LANCL2	GLO1		FBXL4		
0.903	0.978	0.782	1.44	0.876	0.242			ADSL	TEX29	RIC8A	LANCL2	GLO1			SLAMF1	
0.89	1.071	0.865	1.4	0.909	0.231			ADSL	TEX29	RIC8A	LANCL2	GLO1				CASQ1
0.893	1.059	0.859	1.14	0.893	0.225			ADSL	TEX29	RIC8A	LANCL2		PGP	FBXL4		

Train Rsquared	Train RMSE	Train MAE	Test RMSE	Test Rsquared	Sample Handling - CV	KRT1	KRT5	ADSL	TEX29	RIC8A	LANCL2	GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.924	0.889	0.736	1.1	0.886	0.327			ADSL	TEX29	RIC8A	LANCL2		PGP		SLAMF1	
0.926	0.886	0.717	1.33	0.805	0.251			ADSL	TEX29	RIC8A	LANCL2		PGP			CASQ1
0.923	0.88	0.735	1.14	0.908	0.325			ADSL	TEX29	RIC8A	LANCL2			FBXL4	SLAMF1	
0.887	1.036	0.813	1.66	0.806	0.201			ADSL	TEX29	RIC8A	LANCL2			FBXL4		CASQ1
0.89	1.071	0.878	1.62	0.869	0.199			ADSL	TEX29	RIC8A	LANCL2				SLAMF1	CASQ1
0.902	1.026	0.846	1.34	0.829	0.201			ADSL	TEX29	RIC8A		GLO1	PGP	FBXL4		
0.898	1.036	0.842	1.05	0.895	0.339			ADSL	TEX29	RIC8A		GLO1	PGP		SLAMF1	
0.895	1.038	0.846	0.93	0.915	0.354			ADSL	TEX29	RIC8A		GLO1	PGP			CASQ1
0.894	1.039	0.839	1.08	0.885	0.323			ADSL	TEX29	RIC8A		GLO1		FBXL4	SLAMF1	
0.888	1.075	0.892	0.99	0.906	0.333			ADSL	TEX29	RIC8A		GLO1		FBXL4		CASQ1
0.899	1.038	0.817	0.98	0.903	0.338			ADSL	TEX29	RIC8A		GLO1			SLAMF1	CASQ1
0.899	1.031	0.831	1	0.904	0.323			ADSL	TEX29	RIC8A			PGP	FBXL4	SLAMF1	
0.895	1.047	0.819	1.26	0.841	0.238			ADSL	TEX29	RIC8A			PGP	FBXL4		CASQ1
0.891	1.072	0.85	1.2	0.866	0.225			ADSL	TEX29	RIC8A			PGP		SLAMF1	CASQ1
0.893	1.063	0.833	1.22	0.855	0.231			ADSL	TEX29	RIC8A				FBXL4	SLAMF1	CASQ1
0.896	1.038	0.828	1.07	0.903	0.31			ADSL	TEX29		LANCL2	GLO1	PGP	FBXL4		
0.892	1.057	0.851	1.01	0.912	0.348			ADSL	TEX29		LANCL2	GLO1	PGP		SLAMF1	
0.899	1.034	0.809	0.97	0.908	0.325			ADSL	TEX29		LANCL2	GLO1	PGP			CASQ1
0.872	1.143	0.887	1.46	0.847	0.219			ADSL	TEX29		LANCL2	GLO1		FBXL4	SLAMF1	
0.883	1.097	0.842	1.29	0.838	0.236			ADSL	TEX29		LANCL2	GLO1		FBXL4		CASQ1
0.879	1.142	0.871	1.19	0.877	0.204			ADSL	TEX29		LANCL2	GLO1			SLAMF1	CASQ1
0.875	1.101	0.946	0.98	0.905	0.439			ADSL	TEX29		LANCL2		PGP	FBXL4	SLAMF1	
0.904	1.017	0.833	1.12	0.876	0.341			ADSL	TEX29		LANCL2		PGP	FBXL4		CASQ1
0.898	0.996	0.859	1.01	0.919	0.387			ADSL	TEX29		LANCL2		PGP		SLAMF1	CASQ1
0.861	1.161	0.988	1.39	0.894	0.315			ADSL	TEX29		LANCL2			FBXL4	SLAMF1	CASQ1

Train Rsquared	Train RMSE	Train MAE	Test RMSE	Test Rsquared	Sample Handling _CV	KRT1	KRT5	ADSL	TEX29	RIC8A	LANCL2	GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.873	1.135	0.958	1.54	0.895	0.301			ADSL	TEX29			GLO1	PGP	FBXL4	SLAMF1	
0.865	1.186	0.995	1.13	0.885	0.265			ADSL	TEX29			GLO1	PGP	FBXL4		CASQ1
0.897	1.05	0.866	0.97	0.916	2.086			ADSL	TEX29			GLO1	PGP		SLAMF1	CASQ1
0.89	1.042	0.877	0.97	0.903	0.469			ADSL	TEX29			GLO1		FBXL4	SLAMF1	CASQ1
0.887	1.073	0.918	1.01	0.908	0.465			ADSL	TEX29				PGP	FBXL4	SLAMF1	CASQ1
0.882	1.097	0.934	1.1	0.894	0.466			ADSL		RIC8A	LANCL2	GLO1	PGP	FBXL4		
0.882	1.11	0.947	0.95	0.906	0.512			ADSL		RIC8A	LANCL2	GLO1	PGP		SLAMF1	
0.901	1.013	0.832	0.91	0.917	0.451			ADSL		RIC8A	LANCL2	GLO1	PGP			CASQ1
0.903	1.016	0.832	1.01	0.92	0.981			ADSL		RIC8A	LANCL2	GLO1		FBXL4	SLAMF1	
0.899	1.044	0.856	1.03	0.916	0.381			ADSL		RIC8A	LANCL2	GLO1		FBXL4		CASQ1
0.896	1.052	0.864	1.05	0.907	0.396			ADSL		RIC8A	LANCL2	GLO1			SLAMF1	CASQ1
0.898	1.011	0.856	1.01	0.917	0.429			ADSL		RIC8A	LANCL2		PGP	FBXL4	SLAMF1	
0.894	1.031	0.859	1.08	0.902	0.428			ADSL		RIC8A	LANCL2		PGP	FBXL4		CASQ1
0.894	1.037	0.867	0.95	0.908	0.475			ADSL		RIC8A	LANCL2		PGP		SLAMF1	CASQ1
0.887	1.09	0.908	1.44	0.896	0.361			ADSL		RIC8A	LANCL2			FBXL4	SLAMF1	CASQ1
0.877	1.126	0.938	1.14	0.903	0.381			ADSL		RIC8A		GLO1	PGP	FBXL4	SLAMF1	
0.877	1.151	0.951	1.21	0.898	0.326			ADSL		RIC8A		GLO1	PGP	FBXL4		CASQ1
0.898	1.056	0.865	1.15	0.869	0.4			ADSL		RIC8A		GLO1	PGP		SLAMF1	CASQ1
0.89	1.05	0.895	0.91	0.927	0.388			ADSL		RIC8A		GLO1		FBXL4	SLAMF1	CASQ1
0.867	1.162	0.979	1.03	0.911	0.406			ADSL		RIC8A			PGP	FBXL4	SLAMF1	CASQ1
0.879	1.113	0.933	1.15	0.912	0.364			ADSL			LANCL2	GLO1	PGP	FBXL4	SLAMF1	
0.891	1.095	0.929	1	0.899	0.396			ADSL			LANCL2	GLO1	PGP	FBXL4		CASQ1
0.905	0.999	0.831	0.99	0.903	0.432			ADSL			LANCL2	GLO1	PGP		SLAMF1	CASQ1
0.895	1.06	0.845	1.27	0.837	0.318			ADSL			LANCL2	GLO1		FBXL4	SLAMF1	CASQ1
0.902	1.027	0.821	1.23	0.864	0.311			ADSL			LANCL2		PGP	FBXL4	SLAMF1	CASQ1

Train Rsquared	Train RMSE	Train MAE	Test RMSE	Test Rsquared	Sample Handling CV	KRT1	KRT5	ADSL	TEX29	RIC8A	LANCL2	GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.897	1.064	0.858	1.29	0.828	0.315			ADSL				GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.892	1.042	0.891	0.99	0.932	0.358				TEX29	RIC8A	LANCL2	GLO1	PGP	FBXL4		
0.897	1.023	0.859	1.11	0.93	0.357				TEX29	RIC8A	LANCL2	GLO1	PGP		SLAMF1	
0.905	1.007	0.852	0.93	0.918	0.368				TEX29	RIC8A	LANCL2	GLO1	PGP			CASQ1
0.869	1.172	0.958	1.6	0.894	0.282				TEX29	RIC8A	LANCL2	GLO1		FBXL4	SLAMF1	
0.871	1.178	0.983	1.23	0.863	0.266				TEX29	RIC8A	LANCL2	GLO1		FBXL4		CASQ1
0.884	1.129	0.951	1.29	0.886	0.255				TEX29	RIC8A	LANCL2	GLO1			SLAMF1	CASQ1
0.857	1.214	1.004	1.12	0.905	0.44				TEX29	RIC8A	LANCL2		PGP	FBXL4	SLAMF1	
0.848	1.265	1.05	1.29	0.911	0.668				TEX29	RIC8A	LANCL2		PGP	FBXL4		CASQ1
0.847	1.257	1.005	1.21	0.911	0.466				TEX29	RIC8A	LANCL2		PGP		SLAMF1	CASQ1
0.851	1.258	1.016	1.33	0.904	0.744				TEX29	RIC8A	LANCL2			FBXL4	SLAMF1	CASQ1
0.85	1.238	1.029	1.02	0.906	0.429				TEX29	RIC8A		GLO1	PGP	FBXL4	SLAMF1	
0.85	1.235	1.006	1.05	0.896	0.419				TEX29	RIC8A		GLO1	PGP	FBXL4		CASQ1
0.863	1.206	0.983	1.04	0.906	0.459				TEX29	RIC8A		GLO1	PGP		SLAMF1	CASQ1
0.835	1.307	1.064	1.16	0.9	0.53				TEX29	RIC8A		GLO1		FBXL4	SLAMF1	CASQ1
0.849	1.278	1.051	1.15	0.91	0.625				TEX29	RIC8A			PGP	FBXL4	SLAMF1	CASQ1
0.849	1.267	1.022	1.1	0.907	0.627				TEX29		LANCL2	GLO1	PGP	FBXL4	SLAMF1	
0.86	1.211	0.999	1.09	0.914	0.422				TEX29		LANCL2	GLO1	PGP	FBXL4		CASQ1
0.858	1.21	0.979	1.07	0.91	0.414				TEX29		LANCL2	GLO1	PGP		SLAMF1	CASQ1
0.864	1.199	0.974	1.1	0.907	0.437				TEX29		LANCL2	GLO1		FBXL4	SLAMF1	CASQ1
0.856	1.24	0.971	1.24	0.908	0.377				TEX29		LANCL2		PGP	FBXL4	SLAMF1	CASQ1
0.856	1.249	1.002	1.34	0.889	0.477				TEX29			GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.857	1.238	0.959	1.25	0.901	0.35					RIC8A	LANCL2	GLO1	PGP	FBXL4	SLAMF1	
0.856	1.223	0.988	1.06	0.905	0.39					RIC8A	LANCL2	GLO1	PGP	FBXL4		CASQ1
0.866	1.202	0.987	1.02	0.912	0.424					RIC8A	LANCL2	GLO1	PGP		SLAMF1	CASQ1

Train Rsquared	Train RMSE	Train MAE	Test RMSE	Test Rsquared	Sample Handling CV	KRT1	KRT5	ADSL	TEX29	RIC8A	LANCL2	GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.865	1.2	0.957	1.02	0.907	0.415											
0.853	1.281	1.026	1.21	0.898	0.381					RIC8A	LANCL2	GLO1		FBXL4	SLAMF1	CASQ1
0.896	1.028	0.804	1.33	0.848	0.346					RIC8A	LANCL2		PGP	FBXL4	SLAMF1	CASQ1
0.883	1.092	0.896	1.61	0.723	0.271							GLO1	PGP	FBXL4	SLAMF1	CASQ1

Table 14: Freeze-Thaw Plasma Model 7 Biomarkers

Train Rsquared	Train RMSE	Train MAE	Test RMSE	Test Rsquared	Sample Handling CV	KRT1	KRT5	ADSL	TEX29	RIC8A	LANCL2	GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.921	0.905	0.729	1.26	0.899	0.373	KRT1	KRT5	ADSL	TEX29	RIC8A	LANCL2	GLO1				
0.839	1.211	0.956	2.11	0.74	0.232	KRT1	KRT5	ADSL	TEX29	RIC8A	LANCL2		PGP			
0.821	1.337	1.089	2.16	0.8	0.227	KRT1	KRT5	ADSL	TEX29	RIC8A	LANCL2			FBXL4		
0.83	1.311	1.05	1.79	0.729	0.22	KRT1	KRT5	ADSL	TEX29	RIC8A	LANCL2				SLAMF1	
0.882	1.111	0.865	1.08	0.882	0.37	KRT1	KRT5	ADSL	TEX29	RIC8A	LANCL2					CASQ1
0.906	0.994	0.769	1.03	0.912	0.406	KRT1	KRT5	ADSL	TEX29	RIC8A		GLO1	PGP			
0.889	1.062	0.828	1.3	0.869	0.357	KRT1	KRT5	ADSL	TEX29	RIC8A		GLO1		FBXL4		
0.875	1.132	0.876	1.15	0.888	0.366	KRT1	KRT5	ADSL	TEX29	RIC8A		GLO1			SLAMF1	
0.876	1.135	0.865	1.09	0.884	0.367	KRT1	KRT5	ADSL	TEX29	RIC8A		GLO1				CASQ1
0.906	0.999	0.784	1.03	0.908	0.398	KRT1	KRT5	ADSL	TEX29	RIC8A			PGP	FBXL4		
0.872	1.117	0.902	1.45	0.814	0.283	KRT1	KRT5	ADSL	TEX29	RIC8A			PGP		SLAMF1	
0.857	1.217	0.991	1.36	0.833	0.282	KRT1	KRT5	ADSL	TEX29	RIC8A			PGP			CASQ1
0.861	1.2	0.974	1.36	0.814	0.284	KRT1	KRT5	ADSL	TEX29	RIC8A				FBXL4	SLAMF1	
0.909	0.97	0.775	1.2	0.909	0.368	KRT1	KRT5	ADSL	TEX29	RIC8A				FBXL4		CASQ1
0.907	0.99	0.775	1.12	0.909	0.712	KRT1	KRT5	ADSL	TEX29	RIC8A					SLAMF1	CASQ1
0.906	1	0.779	1.08	0.909	0.453	KRT1	KRT5	ADSL	TEX29		LANCL2	GLO1	PGP			
0.841	1.232	0.978	1.96	0.812	0.245	KRT1	KRT5	ADSL	TEX29		LANCL2	GLO1		FBXL4		

Train Rsquared	Train RMSE	Train MAE	Test RMSE	Test Rsquared	Sample Handling - CV	KRT1	KRT5	ADSL	TEX29	RIC8A	LANCL2	GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.843	1.218	0.959	1.75	0.79	0.245	KRT1	KRT5	ADSL	TEX29		LANCL2	GLO1			SLAMF1	
0.816	1.391	1.137	1.63	0.843	0.232	KRT1	KRT5	ADSL	TEX29		LANCL2	GLO1				CASQ1
0.904	0.997	0.789	1.46	0.761	0.329	KRT1	KRT5	ADSL	TEX29		LANCL2		PGP	FBXL4		
0.921	0.906	0.732	1.2	0.881	0.35	KRT1	KRT5	ADSL	TEX29		LANCL2		PGP		SLAMF1	
0.895	1.022	0.786	1.56	0.783	0.32	KRT1	KRT5	ADSL	TEX29		LANCL2		PGP			CASQ1
0.891	1.056	0.833	1.48	0.811	0.324	KRT1	KRT5	ADSL	TEX29		LANCL2			FBXL4	SLAMF1	
0.901	1.018	0.768	1.39	0.797	0.326	KRT1	KRT5	ADSL	TEX29		LANCL2			FBXL4		CASQ1
0.922	0.903	0.736	1.26	0.849	0.332	KRT1	KRT5	ADSL	TEX29		LANCL2				SLAMF1	CASQ1
0.875	1.088	0.887	1.87	0.63	0.249	KRT1	KRT5	ADSL	TEX29			GLO1	PGP	FBXL4		
0.875	1.117	0.924	1.81	0.66	0.251	KRT1	KRT5	ADSL	TEX29			GLO1	PGP		SLAMF1	
0.875	1.124	0.932	1.82	0.63	0.25	KRT1	KRT5	ADSL	TEX29			GLO1	PGP			CASQ1
0.918	0.911	0.749	1.36	0.874	0.328	KRT1	KRT5	ADSL	TEX29			GLO1		FBXL4	SLAMF1	
0.919	0.919	0.746	1.33	0.885	0.347	KRT1	KRT5	ADSL	TEX29			GLO1		FBXL4		CASQ1
0.923	0.907	0.722	1.24	0.87	0.335	KRT1	KRT5	ADSL	TEX29			GLO1			SLAMF1	CASQ1
0.823	1.269	0.969	2.37	0.672	0.205	KRT1	KRT5	ADSL	TEX29				PGP	FBXL4	SLAMF1	
0.839	1.217	0.957	2.03	0.64	0.21	KRT1	KRT5	ADSL	TEX29				PGP	FBXL4		CASQ1
0.836	1.29	1.021	1.96	0.702	0.208	KRT1	KRT5	ADSL	TEX29				PGP		SLAMF1	CASQ1
0.863	1.197	0.968	1.1	0.874	0.391	KRT1	KRT5	ADSL	TEX29					FBXL4	SLAMF1	CASQ1
0.809	1.357	1.078	1.48	0.755	0.327	KRT1	KRT5	ADSL		RIC8A	LANCL2	GLO1	PGP			
0.816	1.381	1.097	1.43	0.778	0.347	KRT1	KRT5	ADSL		RIC8A	LANCL2	GLO1		FBXL4		
0.819	1.379	1.086	1.4	0.788	0.344	KRT1	KRT5	ADSL		RIC8A	LANCL2	GLO1			SLAMF1	
0.861	1.182	0.958	1.14	0.873	0.367	KRT1	KRT5	ADSL		RIC8A	LANCL2	GLO1				CASQ1
0.868	1.174	0.954	1.08	0.881	0.413	KRT1	KRT5	ADSL		RIC8A	LANCL2		PGP	FBXL4		
0.869	1.184	0.939	1.07	0.879	0.385	KRT1	KRT5	ADSL		RIC8A	LANCL2		PGP		SLAMF1	
0.806	1.341	1.07	1.46	0.77	0.328	KRT1	KRT5	ADSL		RIC8A	LANCL2		PGP			CASQ1

Train Rsquared	Train RMSE	Train MAE	Test RMSE	Test Rsquared	Sample Handling _CV	KRT1	KRT5	ADSL	TEX29	RIC8A	LANCL2	GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.815	1.345	1.048	1.41	0.776	0.328	KRT1	KRT5	ADSL		RIC8A	LANCL2			FBXL4	SLAMF1	
0.824	1.359	1.06	1.32	0.807	0.346	KRT1	KRT5	ADSL		RIC8A	LANCL2			FBXL4		CASQ1
0.86	1.191	0.952	1.18	0.862	0.358	KRT1	KRT5	ADSL		RIC8A	LANCL2				SLAMF1	CASQ1
0.867	1.182	0.952	1.14	0.866	0.429	KRT1	KRT5	ADSL		RIC8A		GLO1	PGP	FBXL4		
0.868	1.186	0.941	1.12	0.869	0.397	KRT1	KRT5	ADSL		RIC8A		GLO1	PGP		SLAMF1	
0.768	1.464	1.18	1.84	0.612	0.228	KRT1	KRT5	ADSL		RIC8A		GLO1	PGP			CASQ1
0.773	1.456	1.165	1.83	0.611	0.232	KRT1	KRT5	ADSL		RIC8A		GLO1		FBXL4	SLAMF1	
0.767	1.527	1.243	1.77	0.642	0.22	KRT1	KRT5	ADSL		RIC8A		GLO1		FBXL4		CASQ1
0.865	1.164	0.937	1.2	0.868	0.373	KRT1	KRT5	ADSL		RIC8A		GLO1			SLAMF1	CASQ1
0.865	1.181	0.936	1.16	0.868	0.358	KRT1	KRT5	ADSL		RIC8A			PGP	FBXL4	SLAMF1	
0.873	1.167	0.922	1.11	0.873	0.43	KRT1	KRT5	ADSL		RIC8A			PGP	FBXL4		CASQ1
0.746	1.528	1.228	1.91	0.632	0.222	KRT1	KRT5	ADSL		RIC8A			PGP		SLAMF1	CASQ1
0.837	1.281	1.047	1.24	0.841	0.413	KRT1	KRT5	ADSL		RIC8A				FBXL4	SLAMF1	CASQ1
0.886	1.075	0.885	1.06	0.911	0.416	KRT1	KRT5	ADSL			LANCL2	GLO1	PGP	FBXL4		
0.811	1.351	1.131	1.28	0.876	0.468	KRT1	KRT5	ADSL			LANCL2	GLO1	PGP		SLAMF1	
0.808	1.34	1.087	1.44	0.865	0.389	KRT1	KRT5	ADSL			LANCL2	GLO1	PGP			CASQ1
0.811	1.353	1.124	1.14	0.869	0.578	KRT1	KRT5	ADSL			LANCL2	GLO1		FBXL4	SLAMF1	
0.893	1.06	0.866	1.03	0.907	0.408	KRT1	KRT5	ADSL			LANCL2	GLO1		FBXL4		CASQ1
0.828	1.295	1.075	1.48	0.784	0.328	KRT1	KRT5	ADSL			LANCL2	GLO1			SLAMF1	CASQ1
0.831	1.292	1.046	1.53	0.79	0.319	KRT1	KRT5	ADSL			LANCL2		PGP	FBXL4	SLAMF1	
0.82	1.343	1.105	1.53	0.742	0.324	KRT1	KRT5	ADSL			LANCL2		PGP	FBXL4		CASQ1
0.89	1.056	0.879	1.14	0.918	0.396	KRT1	KRT5	ADSL			LANCL2		PGP		SLAMF1	CASQ1
0.89	1.059	0.874	1.24	0.909	0.391	KRT1	KRT5	ADSL			LANCL2			FBXL4	SLAMF1	CASQ1
0.893	1.058	0.873	1.04	0.912	0.404	KRT1	KRT5	ADSL				GLO1	PGP	FBXL4	SLAMF1	
0.782	1.439	1.198	2.17	0.84	0.291	KRT1	KRT5	ADSL				GLO1	PGP	FBXL4		CASQ1

Train Rsquared	Train RMSE	Train MAE	Test RMSE	Test Rsquared	Sample Handling CV	KRT1	KRT5	ADSL	TEX29	RIC8A	LANCL2	GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.76	1.502	1.249	1.67	0.803	0.279	KRT1	KRT5	ADSL				GLO1	PGP		SLAMF1	CASQ1
0.773	1.485	1.198	1.83	0.818	0.268	KRT1	KRT5	ADSL				GLO1		FBXL4	SLAMF1	CASQ1
0.875	1.161	0.923	0.99	0.905	0.515	KRT1	KRT5	ADSL					PGP	FBXL4	SLAMF1	CASQ1
0.823	1.359	1.117	1.1	0.906	0.489	KRT1	KRT5		TEX29	RIC8A	LANCL2	GLO1	PGP			
0.812	1.403	1.105	1.14	0.893	0.563	KRT1	KRT5		TEX29	RIC8A	LANCL2	GLO1		FBXL4		
0.809	1.411	1.122	1.14	0.904	1.827	KRT1	KRT5		TEX29	RIC8A	LANCL2	GLO1			SLAMF1	
0.88	1.136	0.92	1.07	0.904	0.481	KRT1	KRT5		TEX29	RIC8A	LANCL2	GLO1				CASQ1
0.874	1.158	0.928	1.13	0.885	0.523	KRT1	KRT5		TEX29	RIC8A	LANCL2		PGP	FBXL4		
0.875	1.162	0.923	1.02	0.895	0.609	KRT1	KRT5		TEX29	RIC8A	LANCL2		PGP		SLAMF1	
0.811	1.393	1.166	1.37	0.886	0.44	KRT1	KRT5		TEX29	RIC8A	LANCL2		PGP			CASQ1
0.805	1.414	1.19	1.12	0.895	0.456	KRT1	KRT5		TEX29	RIC8A	LANCL2			FBXL4	SLAMF1	
0.792	1.463	1.164	1.19	0.875	0.758	KRT1	KRT5		TEX29	RIC8A	LANCL2			FBXL4		CASQ1
0.879	1.143	0.919	0.99	0.913	0.475	KRT1	KRT5		TEX29	RIC8A	LANCL2				SLAMF1	CASQ1
0.875	1.166	0.933	1.03	0.899	0.497	KRT1	KRT5		TEX29	RIC8A		GLO1	PGP	FBXL4		
0.877	1.154	0.917	1	0.904	0.521	KRT1	KRT5		TEX29	RIC8A		GLO1	PGP		SLAMF1	
0.817	1.374	1.108	1.34	0.902	0.384	KRT1	KRT5		TEX29	RIC8A		GLO1	PGP			CASQ1
0.815	1.373	1.131	1.3	0.883	1.317	KRT1	KRT5		TEX29	RIC8A		GLO1		FBXL4	SLAMF1	
0.806	1.43	1.123	1.33	0.875	0.36	KRT1	KRT5		TEX29	RIC8A		GLO1		FBXL4		CASQ1
0.88	1.134	0.923	1.15	0.904	0.458	KRT1	KRT5		TEX29	RIC8A		GLO1			SLAMF1	CASQ1
0.881	1.134	0.921	1.06	0.906	0.482	KRT1	KRT5		TEX29	RIC8A			PGP	FBXL4	SLAMF1	
0.876	1.158	0.924	1.11	0.889	0.675	KRT1	KRT5		TEX29	RIC8A			PGP	FBXL4		CASQ1
0.781	1.497	1.235	1.75	0.875	0.335	KRT1	KRT5		TEX29	RIC8A			PGP		SLAMF1	CASQ1
0.886	1.102	0.919	1.08	0.889	0.398	KRT1	KRT5		TEX29	RIC8A				FBXL4	SLAMF1	CASQ1
0.814	1.362	1.129	1.52	0.739	0.4	KRT1	KRT5		TEX29		LANCL2	GLO1	PGP	FBXL4		
0.821	1.319	1.073	1.48	0.765	0.414	KRT1	KRT5		TEX29		LANCL2	GLO1	PGP		SLAMF1	

Train Rsquared	Train RMSE	Train MAE	Test RMSE	Test Rsquared	Sample Handling - CV	KRT1	KRT5	ADSL	TEX29	RIC8A	LANCL2	GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.819	1.356	1.117	1.49	0.751	0.403	KRT1	KRT5		TEX29		LANCL2	GLO1	PGP			CASQ1
0.88	1.119	0.929	1.05	0.915	0.389	KRT1	KRT5		TEX29		LANCL2	GLO1		FBXL4	SLAMF1	
0.882	1.107	0.903	1.17	0.912	0.382	KRT1	KRT5		TEX29		LANCL2	GLO1		FBXL4		CASQ1
0.891	1.095	0.917	0.99	0.91	0.397	KRT1	KRT5		TEX29		LANCL2	GLO1			SLAMF1	CASQ1
0.79	1.422	1.144	1.58	0.846	0.353	KRT1	KRT5		TEX29		LANCL2		PGP	FBXL4	SLAMF1	
0.803	1.407	1.163	1.33	0.808	0.385	KRT1	KRT5		TEX29		LANCL2		PGP	FBXL4		CASQ1
0.811	1.367	1.097	1.37	0.822	0.351	KRT1	KRT5		TEX29		LANCL2		PGP		SLAMF1	CASQ1
0.886	1.098	0.923	1.1	0.886	0.391	KRT1	KRT5		TEX29		LANCL2			FBXL4	SLAMF1	CASQ1
0.886	1.092	0.906	1.14	0.887	0.389	KRT1	KRT5		TEX29			GLO1	PGP	FBXL4	SLAMF1	
0.89	1.09	0.917	1.07	0.89	0.392	KRT1	KRT5		TEX29			GLO1	PGP	FBXL4		CASQ1
0.807	1.345	1.082	1.78	0.686	0.298	KRT1	KRT5		TEX29			GLO1	PGP		SLAMF1	CASQ1
0.791	1.417	1.145	1.83	0.608	0.299	KRT1	KRT5		TEX29			GLO1		FBXL4	SLAMF1	CASQ1
0.807	1.357	1.085	1.74	0.676	0.294	KRT1	KRT5		TEX29				PGP	FBXL4	SLAMF1	CASQ1
0.883	1.098	0.909	1.23	0.918	0.369	KRT1	KRT5			RIC8A	LANCL2	GLO1	PGP	FBXL4		
0.891	1.086	0.921	1.05	0.904	0.381	KRT1	KRT5			RIC8A	LANCL2	GLO1	PGP		SLAMF1	
0.891	1.084	0.909	1.12	0.903	0.376	KRT1	KRT5			RIC8A	LANCL2	GLO1	PGP			CASQ1
0.768	1.491	1.222	1.95	0.743	0.249	KRT1	KRT5			RIC8A	LANCL2	GLO1		FBXL4	SLAMF1	
0.794	1.466	1.201	1.24	0.873	0.483	KRT1	KRT5			RIC8A	LANCL2	GLO1		FBXL4		CASQ1
0.793	1.47	1.192	1.25	0.862	0.49	KRT1	KRT5			RIC8A	LANCL2	GLO1			SLAMF1	CASQ1
0.81	1.447	1.162	1.23	0.878	0.549	KRT1	KRT5			RIC8A	LANCL2		PGP	FBXL4	SLAMF1	
0.602	1.964	1.64	1.76	0.907	0.443	KRT1	KRT5			RIC8A	LANCL2		PGP	FBXL4		CASQ1
0.614	1.972	1.633	1.92	0.861	0.793	KRT1	KRT5			RIC8A	LANCL2		PGP		SLAMF1	CASQ1
0.612	1.967	1.62	1.8	0.874	0.476	KRT1	KRT5			RIC8A	LANCL2			FBXL4	SLAMF1	CASQ1
0.796	1.458	1.196	1.2	0.869	0.467	KRT1	KRT5			RIC8A		GLO1	PGP	FBXL4	SLAMF1	
0.811	1.445	1.17	1.18	0.883	0.514	KRT1	KRT5			RIC8A		GLO1	PGP	FBXL4		CASQ1

Train Rsquared	Train RMSE	Train MAE	Test RMSE	Test Rsquared	Sample Handling CV	KRT1	KRT5	ADSL	TEX29	RIC8A	LANCL2	GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.813	1.442	1.157	1.19	0.872	0.539	KRT1	KRT5			RIC8A		GLO1	PGP		SLAMF1	CASQ1
0.619	1.972	1.663	1.54	0.937	0.44	KRT1	KRT5			RIC8A		GLO1		FBXL4	SLAMF1	CASQ1
0.786	1.485	1.216	1.22	0.876	0.469	KRT1	KRT5			RIC8A			PGP	FBXL4	SLAMF1	CASQ1
0.803	1.465	1.185	1.2	0.883	0.505	KRT1	KRT5				LANCL2	GLO1	PGP	FBXL4	SLAMF1	
0.804	1.465	1.174	1.21	0.874	0.519	KRT1	KRT5				LANCL2	GLO1	PGP	FBXL4		CASQ1
0.595	1.989	1.614	1.93	0.788	0.278	KRT1	KRT5				LANCL2	GLO1	PGP		SLAMF1	CASQ1
0.805	1.462	1.184	1.17	0.882	0.492	KRT1	KRT5				LANCL2	GLO1		FBXL4	SLAMF1	CASQ1
0.882	1.069	0.841	1.32	0.882	0.216	KRT1	KRT5				LANCL2		PGP	FBXL4	SLAMF1	CASQ1
0.929	0.848	0.699	0.88	0.92	0.39	KRT1	KRT5					GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.922	0.891	0.723	0.97	0.914	0.289	KRT1		ADSL	TEX29	RIC8A	LANCL2	GLO1	PGP			
0.921	0.883	0.727	0.95	0.925	0.397	KRT1		ADSL	TEX29	RIC8A	LANCL2	GLO1		FBXL4		
0.907	0.94	0.767	1.38	0.861	0.251	KRT1		ADSL	TEX29	RIC8A	LANCL2	GLO1			SLAMF1	
0.903	0.994	0.818	1.33	0.889	0.25	KRT1		ADSL	TEX29	RIC8A	LANCL2	GLO1				CASQ1
0.9	1.012	0.819	1.07	0.894	0.238	KRT1		ADSL	TEX29	RIC8A	LANCL2		PGP	FBXL4		
0.931	0.838	0.703	0.95	0.911	0.346	KRT1		ADSL	TEX29	RIC8A	LANCL2		PGP		SLAMF1	
0.926	0.88	0.728	1.19	0.851	0.253	KRT1		ADSL	TEX29	RIC8A	LANCL2		PGP			CASQ1
0.925	0.863	0.731	1.02	0.923	0.333	KRT1		ADSL	TEX29	RIC8A	LANCL2			FBXL4	SLAMF1	
0.891	1.015	0.829	1.52	0.817	0.211	KRT1		ADSL	TEX29	RIC8A	LANCL2			FBXL4		CASQ1
0.902	1.011	0.849	1.46	0.88	0.21	KRT1		ADSL	TEX29	RIC8A	LANCL2				SLAMF1	CASQ1
0.905	0.999	0.838	1.19	0.862	0.209	KRT1		ADSL	TEX29	RIC8A		GLO1	PGP	FBXL4		
0.915	0.947	0.773	0.98	0.911	0.381	KRT1		ADSL	TEX29	RIC8A		GLO1	PGP		SLAMF1	
0.913	0.951	0.784	0.9	0.912	0.378	KRT1		ADSL	TEX29	RIC8A		GLO1	PGP			CASQ1
0.917	0.931	0.752	1.05	0.882	0.364	KRT1		ADSL	TEX29	RIC8A		GLO1		FBXL4	SLAMF1	
0.911	0.96	0.787	0.98	0.898	0.362	KRT1		ADSL	TEX29	RIC8A		GLO1		FBXL4		CASQ1
0.919	0.932	0.745	0.95	0.908	0.387	KRT1		ADSL	TEX29	RIC8A		GLO1			SLAMF1	CASQ1

Train Rsquared	Train RMSE	Train MAE	Test RMSE	Test Rsquared	Sample Handling _CV	KRT1	KRT5	ADSL	TEX29	RIC8A	LANCL2	GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.911	0.97	0.797	0.95	0.912	0.334	KRT1		ADSL	TEX29	RIC8A			PGP	FBXL4	SLAMF1	
0.909	0.985	0.785	1.19	0.857	0.255	KRT1		ADSL	TEX29	RIC8A			PGP	FBXL4		CASQ1
0.906	1.002	0.79	1.11	0.886	0.24	KRT1		ADSL	TEX29	RIC8A			PGP		SLAMF1	CASQ1
0.905	1.005	0.81	1.13	0.88	0.249	KRT1		ADSL	TEX29	RIC8A				FBXL4	SLAMF1	CASQ1
0.911	0.969	0.78	1.04	0.895	0.316	KRT1		ADSL	TEX29		LANCL2	GLO1	PGP	FBXL4		
0.907	0.987	0.79	1	0.908	0.348	KRT1		ADSL	TEX29		LANCL2	GLO1	PGP		SLAMF1	
0.913	0.966	0.771	0.93	0.91	0.336	KRT1		ADSL	TEX29		LANCL2	GLO1	PGP			CASQ1
0.898	1.04	0.802	1.42	0.826	0.29	KRT1		ADSL	TEX29		LANCL2	GLO1		FBXL4	SLAMF1	
0.901	1.021	0.796	1.24	0.839	0.26	KRT1		ADSL	TEX29		LANCL2	GLO1		FBXL4		CASQ1
0.9	1.044	0.807	1.16	0.87	0.223	KRT1		ADSL	TEX29		LANCL2	GLO1			SLAMF1	CASQ1
0.887	1.042	0.884	0.93	0.907	0.479	KRT1		ADSL	TEX29		LANCL2		PGP	FBXL4	SLAMF1	
0.903	1.007	0.825	1.02	0.909	0.365	KRT1		ADSL	TEX29		LANCL2		PGP	FBXL4		CASQ1
0.901	0.973	0.825	0.92	0.925	0.391	KRT1		ADSL	TEX29		LANCL2		PGP		SLAMF1	CASQ1
0.866	1.112	0.943	1.32	0.864	0.358	KRT1		ADSL	TEX29		LANCL2			FBXL4	SLAMF1	CASQ1
0.889	1.051	0.889	1.43	0.874	0.347	KRT1		ADSL	TEX29			GLO1	PGP	FBXL4	SLAMF1	
0.869	1.148	0.949	1.06	0.891	0.291	KRT1		ADSL	TEX29			GLO1	PGP	FBXL4		CASQ1
0.904	1.002	0.825	0.93	0.925	0.791	KRT1		ADSL	TEX29			GLO1	PGP		SLAMF1	CASQ1
0.899	0.994	0.846	0.93	0.903	0.496	KRT1		ADSL	TEX29			GLO1		FBXL4	SLAMF1	CASQ1
0.9	0.998	0.851	1.02	0.886	0.643	KRT1		ADSL	TEX29				PGP	FBXL4	SLAMF1	CASQ1
0.902	0.989	0.826	1.1	0.875	0.576	KRT1		ADSL		RIC8A	LANCL2	GLO1	PGP	FBXL4		
0.897	1.031	0.876	0.96	0.904	0.749	KRT1		ADSL		RIC8A	LANCL2	GLO1	PGP		SLAMF1	
0.907	0.978	0.807	0.87	0.925	0.454	KRT1		ADSL		RIC8A	LANCL2	GLO1	PGP			CASQ1
0.906	0.982	0.804	0.99	0.917	0.484	KRT1		ADSL		RIC8A	LANCL2	GLO1		FBXL4	SLAMF1	
0.908	0.987	0.799	1	0.913	0.41	KRT1		ADSL		RIC8A	LANCL2	GLO1		FBXL4		CASQ1
0.899	1.028	0.831	1.01	0.919	0.427	KRT1		ADSL		RIC8A	LANCL2	GLO1			SLAMF1	CASQ1

Train Rsquared	Train RMSE	Train MAE	Test RMSE	Test Rsquared	Sample Handling - CV	KRT1	KRT5	ADSL	TEX29	RIC8A	LANCL2	GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.905	0.969	0.825	0.98	0.91	0.425	KRT1		ADSL		RIC8A	LANCL2		PGP	FBXL4	SLAMF1	
0.905	0.971	0.809	1.07	0.896	0.422	KRT1		ADSL		RIC8A	LANCL2		PGP	FBXL4		CASQ1
0.902	0.994	0.834	0.9	0.911	0.476	KRT1		ADSL		RIC8A	LANCL2		PGP		SLAMF1	CASQ1
0.902	0.998	0.84	1.41	0.855	0.451	KRT1		ADSL		RIC8A	LANCL2			FBXL4	SLAMF1	CASQ1
0.884	1.073	0.891	1.13	0.877	1.083	KRT1		ADSL		RIC8A		GLO1	PGP	FBXL4	SLAMF1	
0.894	1.056	0.866	1.19	0.873	0.385	KRT1		ADSL		RIC8A		GLO1	PGP	FBXL4		CASQ1
0.9	1.031	0.861	1	0.922	0.422	KRT1		ADSL		RIC8A		GLO1	PGP		SLAMF1	CASQ1
0.894	1.02	0.872	0.81	0.936	0.401	KRT1		ADSL		RIC8A		GLO1		FBXL4	SLAMF1	CASQ1
0.879	1.093	0.925	0.97	0.908	0.445	KRT1		ADSL		RIC8A			PGP	FBXL4	SLAMF1	CASQ1
0.897	1.014	0.855	1.05	0.904	0.418	KRT1		ADSL			LANCL2	GLO1	PGP	FBXL4	SLAMF1	
0.9	1.036	0.877	0.91	0.925	0.452	KRT1		ADSL			LANCL2	GLO1	PGP	FBXL4		CASQ1
0.907	0.986	0.827	0.88	0.932	0.391	KRT1		ADSL			LANCL2	GLO1	PGP		SLAMF1	CASQ1
0.894	1.049	0.864	1.15	0.883	0.33	KRT1		ADSL			LANCL2	GLO1		FBXL4	SLAMF1	CASQ1
0.907	0.991	0.807	1.09	0.906	0.325	KRT1		ADSL			LANCL2		PGP	FBXL4	SLAMF1	CASQ1
0.896	1.055	0.865	1.15	0.884	0.317	KRT1		ADSL				GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.895	1.018	0.871	0.91	0.938	0.355	KRT1			TEX29	RIC8A	LANCL2	GLO1	PGP	FBXL4		
0.905	0.975	0.828	1.03	0.934	0.353	KRT1			TEX29	RIC8A	LANCL2	GLO1	PGP		SLAMF1	
0.908	0.983	0.831	0.83	0.934	0.364	KRT1			TEX29	RIC8A	LANCL2	GLO1	PGP			CASQ1
0.887	1.075	0.901	1.47	0.865	0.321	KRT1			TEX29	RIC8A	LANCL2	GLO1		FBXL4	SLAMF1	
0.875	1.132	0.949	1.15	0.873	0.289	KRT1			TEX29	RIC8A	LANCL2	GLO1		FBXL4		CASQ1
0.898	1.052	0.903	1.18	0.89	0.292	KRT1			TEX29	RIC8A	LANCL2	GLO1			SLAMF1	CASQ1
0.876	1.139	0.97	1.1	0.908	0.499	KRT1			TEX29	RIC8A	LANCL2		PGP	FBXL4	SLAMF1	
0.872	1.164	0.992	1.24	0.894	4.475	KRT1			TEX29	RIC8A	LANCL2		PGP	FBXL4		CASQ1
0.879	1.125	0.911	1.16	0.883	1.107	KRT1			TEX29	RIC8A	LANCL2		PGP		SLAMF1	CASQ1
0.877	1.153	0.97	1.26	0.904	5.188	KRT1			TEX29	RIC8A	LANCL2			FBXL4	SLAMF1	CASQ1

Train Rsquared	Train RMSE	Train MAE	Test RMSE	Test Rsquared	Sample Handling - CV	KRT1	KRT5	ADSL	TEX29	RIC8A	LANCL2	GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.873	1.143	0.975	1.06	0.886	0.474	KRT1			TEX29	RIC8A		GLO1	PGP	FBXL4	SLAMF1	
0.879	1.112	0.915	1.08	0.873	0.473	KRT1			TEX29	RIC8A		GLO1	PGP	FBXL4		CASQ1
0.885	1.113	0.939	1.06	0.903	0.553	KRT1			TEX29	RIC8A		GLO1	PGP		SLAMF1	CASQ1
0.879	1.124	0.921	1.23	0.834	1.869	KRT1			TEX29	RIC8A		GLO1		FBXL4	SLAMF1	CASQ1
0.879	1.145	0.976	1.19	0.882	0.842	KRT1			TEX29	RIC8A			PGP	FBXL4	SLAMF1	CASQ1
0.886	1.108	0.901	1.14	0.87	0.687	KRT1			TEX29		LANCL2	GLO1	PGP	FBXL4	SLAMF1	
0.881	1.126	0.946	1.08	0.906	0.431	KRT1			TEX29		LANCL2	GLO1	PGP	FBXL4		CASQ1
0.884	1.103	0.89	1.05	0.897	0.428	KRT1			TEX29		LANCL2	GLO1	PGP		SLAMF1	CASQ1
0.885	1.114	0.926	1.08	0.908	0.459	KRT1			TEX29		LANCL2	GLO1		FBXL4	SLAMF1	CASQ1
0.885	1.118	0.87	1.22	0.868	0.513	KRT1			TEX29		LANCL2		PGP	FBXL4	SLAMF1	CASQ1
0.875	1.166	0.957	1.29	0.879	1.274	KRT1			TEX29			GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.885	1.123	0.875	1.19	0.878	0.603	KRT1				RIC8A	LANCL2	GLO1	PGP	FBXL4	SLAMF1	
0.886	1.099	0.882	1.12	0.872	0.396	KRT1				RIC8A	LANCL2	GLO1	PGP	FBXL4		CASQ1
0.887	1.108	0.925	1.04	0.899	0.437	KRT1				RIC8A	LANCL2	GLO1	PGP		SLAMF1	CASQ1
0.891	1.087	0.876	1.03	0.89	0.442	KRT1				RIC8A	LANCL2	GLO1		FBXL4	SLAMF1	CASQ1
0.887	1.128	0.895	1.26	0.836	1.44	KRT1				RIC8A	LANCL2		PGP	FBXL4	SLAMF1	CASQ1
0.937	0.803	0.661	0.92	0.917	0.37	KRT1				RIC8A		GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.924	0.891	0.729	1.11	0.877	0.275	KRT1					LANCL2	GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.93	0.832	0.684	1	0.931	0.371		KRT5	ADSL	TEX29	RIC8A	LANCL2	GLO1	PGP			
0.902	0.944	0.76	1.54	0.828	0.244		KRT5	ADSL	TEX29	RIC8A	LANCL2	GLO1		FBXL4		
0.906	0.979	0.813	1.51	0.878	0.244		KRT5	ADSL	TEX29	RIC8A	LANCL2	GLO1			SLAMF1	
0.899	1.019	0.841	1.2	0.865	0.229		KRT5	ADSL	TEX29	RIC8A	LANCL2	GLO1				CASQ1
0.936	0.826	0.66	0.84	0.928	0.4		KRT5	ADSL	TEX29	RIC8A	LANCL2		PGP	FBXL4		
0.933	0.829	0.667	0.85	0.925	0.399		KRT5	ADSL	TEX29	RIC8A	LANCL2		PGP		SLAMF1	
0.941	0.783	0.627	1.02	0.898	0.385		KRT5	ADSL	TEX29	RIC8A	LANCL2		PGP			CASQ1

Train Rsquared	Train RMSE	Train MAE	Test RMSE	Test Rsquared	Sample Handling - CV	KRT1	KRT5	ADSL	TEX29	RIC8A	LANCL2	GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.933	0.829	0.663	0.96	0.908	0.385		KRT5	ADSL	TEX29	RIC8A	LANCL2			FBXL4	SLAMF1	
0.935	0.832	0.654	0.86	0.918	0.4		KRT5	ADSL	TEX29	RIC8A	LANCL2			FBXL4		CASQ1
0.929	0.854	0.691	0.85	0.933	0.372		KRT5	ADSL	TEX29	RIC8A	LANCL2				SLAMF1	CASQ1
0.928	0.849	0.679	1.12	0.884	0.294		KRT5	ADSL	TEX29	RIC8A		GLO1	PGP	FBXL4		
0.922	0.905	0.722	1.03	0.912	0.293		KRT5	ADSL	TEX29	RIC8A		GLO1	PGP		SLAMF1	
0.918	0.921	0.737	1.01	0.906	0.291		KRT5	ADSL	TEX29	RIC8A		GLO1	PGP			CASQ1
0.931	0.835	0.681	1.05	0.915	0.346		KRT5	ADSL	TEX29	RIC8A		GLO1		FBXL4	SLAMF1	
0.926	0.868	0.701	1.01	0.923	0.394		KRT5	ADSL	TEX29	RIC8A		GLO1		FBXL4		CASQ1
0.927	0.871	0.69	0.89	0.926	0.387		KRT5	ADSL	TEX29	RIC8A		GLO1			SLAMF1	CASQ1
0.92	0.895	0.732	1.49	0.85	0.265		KRT5	ADSL	TEX29	RIC8A			PGP	FBXL4	SLAMF1	
0.912	0.916	0.729	1.31	0.847	0.262		KRT5	ADSL	TEX29	RIC8A			PGP	FBXL4		CASQ1
0.91	0.981	0.8	1.22	0.881	0.257		KRT5	ADSL	TEX29	RIC8A			PGP		SLAMF1	CASQ1
0.941	0.8	0.657	0.98	0.898	0.35		KRT5	ADSL	TEX29	RIC8A				FBXL4	SLAMF1	CASQ1
0.937	0.804	0.676	0.9	0.924	0.354		KRT5	ADSL	TEX29		LANCL2	GLO1	PGP	FBXL4		
0.938	0.797	0.651	1.08	0.884	0.341		KRT5	ADSL	TEX29		LANCL2	GLO1	PGP		SLAMF1	
0.936	0.814	0.663	1.03	0.906	0.337		KRT5	ADSL	TEX29		LANCL2	GLO1	PGP			CASQ1
0.942	0.792	0.639	0.94	0.904	0.349		KRT5	ADSL	TEX29		LANCL2	GLO1		FBXL4	SLAMF1	
0.935	0.822	0.681	0.97	0.91	0.323		KRT5	ADSL	TEX29		LANCL2	GLO1		FBXL4		CASQ1
0.922	0.886	0.741	1.32	0.818	0.253		KRT5	ADSL	TEX29		LANCL2	GLO1			SLAMF1	CASQ1
0.925	0.885	0.733	1.22	0.866	0.255		KRT5	ADSL	TEX29		LANCL2		PGP	FBXL4	SLAMF1	
0.92	0.917	0.763	1.23	0.836	0.252		KRT5	ADSL	TEX29		LANCL2		PGP	FBXL4		CASQ1
0.93	0.839	0.701	1.1	0.911	0.315		KRT5	ADSL	TEX29		LANCL2		PGP		SLAMF1	CASQ1
0.93	0.845	0.714	1.08	0.929	0.325		KRT5	ADSL	TEX29		LANCL2			FBXL4	SLAMF1	CASQ1
0.935	0.829	0.673	0.96	0.918	0.324		KRT5	ADSL	TEX29			GLO1	PGP	FBXL4	SLAMF1	
0.91	0.952	0.789	1.64	0.825	0.221		KRT5	ADSL	TEX29			GLO1	PGP	FBXL4		CASQ1

Train Rsquared	Train RMSE	Train MAE	Test RMSE	Test Rsquared	Sample Handling - CV	KRT1	KRT5	ADSL	TEX29	RIC8A	LANCL2	GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.907	0.95	0.78	1.4	0.81	0.223		KRT5	ADSL	TEX29			GLO1	PGP		SLAMF1	CASQ1
0.915	0.96	0.807	1.32	0.864	0.221		KRT5	ADSL	TEX29			GLO1		FBXL4	SLAMF1	CASQ1
0.917	0.939	0.769	0.92	0.913	0.386		KRT5	ADSL	TEX29				PGP	FBXL4	SLAMF1	CASQ1
0.922	0.915	0.73	1.08	0.876	0.377		KRT5	ADSL		RIC8A	LANCL2	GLO1	PGP	FBXL4		
0.917	0.938	0.76	1.01	0.898	0.376		KRT5	ADSL		RIC8A	LANCL2	GLO1	PGP		SLAMF1	
0.922	0.922	0.734	1.02	0.901	0.403		KRT5	ADSL		RIC8A	LANCL2	GLO1	PGP			CASQ1
0.921	0.92	0.751	0.99	0.893	0.369		KRT5	ADSL		RIC8A	LANCL2	GLO1		FBXL4	SLAMF1	
0.916	0.938	0.773	0.93	0.907	0.379		KRT5	ADSL		RIC8A	LANCL2	GLO1		FBXL4		CASQ1
0.922	0.92	0.742	0.91	0.912	0.387		KRT5	ADSL		RIC8A	LANCL2	GLO1			SLAMF1	CASQ1
0.922	0.911	0.733	1.12	0.863	0.359		KRT5	ADSL		RIC8A	LANCL2		PGP	FBXL4	SLAMF1	
0.926	0.897	0.709	1.06	0.876	0.386		KRT5	ADSL		RIC8A	LANCL2		PGP	FBXL4		CASQ1
0.923	0.915	0.724	1	0.895	0.382		KRT5	ADSL		RIC8A	LANCL2		PGP		SLAMF1	CASQ1
0.916	0.952	0.77	1.02	0.895	0.331		KRT5	ADSL		RIC8A	LANCL2			FBXL4	SLAMF1	CASQ1
0.913	0.965	0.776	0.96	0.911	0.348		KRT5	ADSL		RIC8A		GLO1	PGP	FBXL4	SLAMF1	
0.916	0.955	0.765	0.95	0.909	0.354		KRT5	ADSL		RIC8A		GLO1	PGP	FBXL4		CASQ1
0.909	0.988	0.771	1.28	0.833	0.25		KRT5	ADSL		RIC8A		GLO1	PGP		SLAMF1	CASQ1
0.906	0.994	0.787	1.28	0.825	0.265		KRT5	ADSL		RIC8A		GLO1		FBXL4	SLAMF1	CASQ1
0.905	1.014	0.798	1.17	0.867	0.245		KRT5	ADSL		RIC8A			PGP	FBXL4	SLAMF1	CASQ1
0.915	0.954	0.763	1.09	0.889	0.323		KRT5	ADSL			LANCL2	GLO1	PGP	FBXL4	SLAMF1	
0.918	0.944	0.752	1.01	0.893	0.33		KRT5	ADSL			LANCL2	GLO1	PGP	FBXL4		CASQ1
0.916	0.955	0.753	0.95	0.907	0.347		KRT5	ADSL			LANCL2	GLO1	PGP		SLAMF1	CASQ1
0.906	1.003	0.766	1.35	0.813	0.246		KRT5	ADSL			LANCL2	GLO1		FBXL4	SLAMF1	CASQ1
0.908	1.002	0.833	0.89	0.935	0.461		KRT5	ADSL			LANCL2		PGP	FBXL4	SLAMF1	CASQ1
0.906	0.964	0.81	0.84	0.927	0.431		KRT5	ADSL				GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.9	0.997	0.846	1.01	0.893	0.745		KRT5		TEX29	RIC8A	LANCL2	GLO1	PGP	FBXL4		

Train Rsquared	Train RMSE	Train MAE	Test RMSE	Test Rsquared	Sample Handling CV	KRT1	KRT5	ADSL	TEX29	RIC8A	LANCL2	GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.91	0.956	0.812	1.09	0.892	0.458		KRT5		TEX29	RIC8A	LANCL2	GLO1	PGP		SLAMF1	
0.904	1.014	0.855	0.89	0.921	0.487		KRT5		TEX29	RIC8A	LANCL2	GLO1	PGP			CASQ1
0.914	0.949	0.781	0.81	0.941	0.403		KRT5		TEX29	RIC8A	LANCL2	GLO1		FBXL4	SLAMF1	
0.901	1.006	0.816	1.05	0.908	0.364		KRT5		TEX29	RIC8A	LANCL2	GLO1		FBXL4		CASQ1
0.913	0.974	0.805	1.06	0.917	0.346		KRT5		TEX29	RIC8A	LANCL2	GLO1			SLAMF1	CASQ1
0.895	1.062	0.866	1.05	0.911	0.353		KRT5		TEX29	RIC8A	LANCL2		PGP	FBXL4	SLAMF1	
0.909	0.946	0.796	0.95	0.93	0.389		KRT5		TEX29	RIC8A	LANCL2		PGP	FBXL4		CASQ1
0.914	0.927	0.793	1.06	0.925	0.378		KRT5		TEX29	RIC8A	LANCL2		PGP		SLAMF1	CASQ1
0.912	0.953	0.802	0.83	0.934	0.393		KRT5		TEX29	RIC8A	LANCL2			FBXL4	SLAMF1	CASQ1
0.902	0.991	0.846	1.54	0.849	0.403		KRT5		TEX29	RIC8A		GLO1	PGP	FBXL4	SLAMF1	
0.876	1.093	0.897	1.2	0.863	0.344		KRT5		TEX29	RIC8A		GLO1	PGP	FBXL4		CASQ1
0.9	1.039	0.872	1.27	0.88	0.319		KRT5		TEX29	RIC8A		GLO1	PGP		SLAMF1	CASQ1
0.909	0.982	0.803	0.87	0.923	0.513		KRT5		TEX29	RIC8A		GLO1		FBXL4	SLAMF1	CASQ1
0.911	0.978	0.801	0.95	0.914	0.656		KRT5		TEX29	RIC8A			PGP	FBXL4	SLAMF1	CASQ1
0.914	0.974	0.788	0.98	0.903	0.554		KRT5		TEX29		LANCL2	GLO1	PGP	FBXL4	SLAMF1	
0.906	1.02	0.844	0.97	0.923	0.866		KRT5		TEX29		LANCL2	GLO1	PGP	FBXL4		CASQ1
0.91	0.957	0.802	0.94	0.906	0.513		KRT5		TEX29		LANCL2	GLO1	PGP		SLAMF1	CASQ1
0.911	0.956	0.79	1.01	0.893	0.474		KRT5		TEX29		LANCL2	GLO1		FBXL4	SLAMF1	CASQ1
0.908	0.983	0.82	0.9	0.909	0.524		KRT5		TEX29		LANCL2		PGP	FBXL4	SLAMF1	CASQ1
0.917	0.936	0.78	1.17	0.864	0.614		KRT5		TEX29			GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.908	0.988	0.825	1	0.89	0.701		KRT5			RIC8A	LANCL2	GLO1	PGP	FBXL4	SLAMF1	
0.912	0.981	0.812	1.05	0.878	0.849		KRT5			RIC8A	LANCL2	GLO1	PGP	FBXL4		CASQ1
0.913	0.954	0.782	0.87	0.928	0.459		KRT5			RIC8A	LANCL2	GLO1	PGP		SLAMF1	CASQ1
0.914	0.96	0.778	0.93	0.918	0.444		KRT5			RIC8A	LANCL2	GLO1		FBXL4	SLAMF1	CASQ1
0.91	0.98	0.802	0.86	0.926	0.472		KRT5			RIC8A	LANCL2		PGP	FBXL4	SLAMF1	CASQ1

Train Rsquared	Train RMSE	Train MAE	Test RMSE	Test Rsquared	Sample Handling _CV	KRT1	KRT5	ADSL	TEX29	RIC8A	LANCL2	GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.915	0.957	0.77	1.12	0.896	0.421		KRT5			RIC8A		GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.902	1.008	0.813	1.05	0.907	0.464		KRT5				LANCL2	GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.91	1.002	0.807	1.05	0.904	0.416			ADSL	TEX29	RIC8A	LANCL2	GLO1	PGP	FBXL4		
0.916	0.932	0.775	1.11	0.897	0.422			ADSL	TEX29	RIC8A	LANCL2	GLO1	PGP		SLAMF1	
0.911	0.96	0.799	0.93	0.913	0.446			ADSL	TEX29	RIC8A	LANCL2	GLO1	PGP			CASQ1
0.912	0.964	0.791	1	0.902	0.443			ADSL	TEX29	RIC8A	LANCL2	GLO1		FBXL4	SLAMF1	
0.907	0.994	0.812	1.35	0.847	0.431			ADSL	TEX29	RIC8A	LANCL2	GLO1		FBXL4		CASQ1
0.907	0.991	0.833	0.82	0.944	0.424			ADSL	TEX29	RIC8A	LANCL2	GLO1			SLAMF1	CASQ1
0.898	1.044	0.868	1.01	0.921	0.427			ADSL	TEX29	RIC8A	LANCL2		PGP	FBXL4	SLAMF1	
0.911	0.979	0.805	0.97	0.921	0.404			ADSL	TEX29	RIC8A	LANCL2		PGP	FBXL4		CASQ1
0.904	1.036	0.862	1	0.927	0.44			ADSL	TEX29	RIC8A	LANCL2		PGP		SLAMF1	CASQ1
0.9	1.005	0.853	0.82	0.941	0.403			ADSL	TEX29	RIC8A	LANCL2			FBXL4	SLAMF1	CASQ1
0.909	0.96	0.807	0.93	0.935	0.404			ADSL	TEX29	RIC8A		GLO1	PGP	FBXL4	SLAMF1	
0.912	0.973	0.819	0.79	0.939	0.423			ADSL	TEX29	RIC8A		GLO1	PGP	FBXL4		CASQ1
0.905	0.987	0.81	1.14	0.89	0.407			ADSL	TEX29	RIC8A		GLO1	PGP		SLAMF1	CASQ1
0.903	1.028	0.85	0.96	0.915	0.48			ADSL	TEX29	RIC8A		GLO1		FBXL4	SLAMF1	CASQ1
0.914	0.973	0.814	0.97	0.909	0.403			ADSL	TEX29	RIC8A			PGP	FBXL4	SLAMF1	CASQ1
0.907	0.985	0.826	0.85	0.943	0.387			ADSL	TEX29		LANCL2	GLO1	PGP	FBXL4	SLAMF1	
0.914	0.95	0.791	0.89	0.944	0.42			ADSL	TEX29		LANCL2	GLO1	PGP	FBXL4		CASQ1
0.912	0.974	0.814	0.84	0.939	0.382			ADSL	TEX29		LANCL2	GLO1	PGP		SLAMF1	CASQ1
0.905	0.998	0.821	1.18	0.894	0.327			ADSL	TEX29		LANCL2	GLO1		FBXL4	SLAMF1	CASQ1
0.886	1.087	0.888	1.21	0.872	0.316			ADSL	TEX29		LANCL2		PGP	FBXL4	SLAMF1	CASQ1
0.907	1.009	0.834	1.11	0.9	0.315			ADSL	TEX29			GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.91	0.957	0.805	1.05	0.935	0.36			ADSL		RIC8A	LANCL2	GLO1	PGP	FBXL4	SLAMF1	
0.91	0.973	0.812	0.83	0.939	0.368			ADSL		RIC8A	LANCL2	GLO1	PGP	FBXL4		CASQ1

Train Rsquared	Train RMSE	Train MAE	Test RMSE	Test Rsquared	Sample Handling CV	KRT1	KRT5	ADSL	TEX29	RIC8A	LANCL2	GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.917	0.945	0.8	0.91	0.938	0.368			ADSL		RIC8A	LANCL2	GLO1	PGP		SLAMF1	CASQ1
0.901	1.031	0.864	1.32	0.864	0.373			ADSL		RIC8A	LANCL2	GLO1		FBXL4	SLAMF1	CASQ1
0.881	1.13	0.955	1.1	0.901	0.49			ADSL		RIC8A	LANCL2		PGP	FBXL4	SLAMF1	CASQ1
0.886	1.1	0.897	1.08	0.886	0.479			ADSL		RIC8A		GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.888	1.113	0.93	1.1	0.908	0.547			ADSL			LANCL2	GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.887	1.108	0.894	1.25	0.846	1.069				TEX29	RIC8A	LANCL2	GLO1	PGP	FBXL4	SLAMF1	
0.881	1.152	0.976	1.33	0.877	0.81				TEX29	RIC8A	LANCL2	GLO1	PGP	FBXL4		CASQ1
0.891	1.107	0.896	1.22	0.865	2.102				TEX29	RIC8A	LANCL2	GLO1	PGP		SLAMF1	CASQ1
0.889	1.087	0.884	1.12	0.864	0.457				TEX29	RIC8A	LANCL2	GLO1		FBXL4	SLAMF1	CASQ1
0.891	1.102	0.925	1.08	0.898	0.533				TEX29	RIC8A	LANCL2		PGP	FBXL4	SLAMF1	CASQ1
0.895	1.078	0.874	1.06	0.885	0.525				TEX29	RIC8A		GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.895	1.087	0.895	1.23	0.839	0.798				TEX29		LANCL2	GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.891	1.087	0.873	1.09	0.885	0.424					RIC8A	LANCL2	GLO1	PGP	FBXL4	SLAMF1	CASQ1

Table 15: Freeze-Thaw Plasma Model 8 Biomarkers

Train Rsquared	Train RMSE	Train MAE	Test RMSE	Test Rsquared	Sample Handling CV	KRT1	KRT5	ADSL	TEX29	RIC8A	LANCL2	GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.89	1.105	0.914	1.08	0.903	0.458	KRT1	KRT5	ADSL	TEX29	RIC8A	LANCL2	GLO1	PGP			
0.894	1.083	0.869	1.06	0.892	0.453	KRT1	KRT5	ADSL	TEX29	RIC8A	LANCL2	GLO1		FBXL4		
0.889	1.12	0.88	1.3	0.835	0.577	KRT1	KRT5	ADSL	TEX29	RIC8A	LANCL2	GLO1			SLAMF1	
0.898	1.071	0.863	1.07	0.882	0.432	KRT1	KRT5	ADSL	TEX29	RIC8A	LANCL2	GLO1				CASQ1
0.925	0.88	0.729	1.06	0.904	0.34	KRT1	KRT5	ADSL	TEX29	RIC8A	LANCL2		PGP	FBXL4		
0.927	0.876	0.71	1.2	0.851	0.269	KRT1	KRT5	ADSL	TEX29	RIC8A	LANCL2		PGP		SLAMF1	
0.923	0.876	0.731	1.12	0.919	0.34	KRT1	KRT5	ADSL	TEX29	RIC8A	LANCL2		PGP			CASQ1
0.9	0.983	0.786	1.55	0.859	0.23	KRT1	KRT5	ADSL	TEX29	RIC8A	LANCL2			FBXL4	SLAMF1	

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Train Rsquared	Train RMSE	Train MAE	Test RMSE	Test Rsquared	Sample Handling_CV	KRT1	KRT5	ADSL	TEX29	RIC8A	LANCL2	GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.894	1.048	0.854	1.55	0.895	0.225	KRT1	KRT5	ADSL	TEX29	RIC8A	LANCL2			FBXL4		CASQ1
0.899	1.031	0.845	1.28	0.861	0.215	KRT1	KRT5	ADSL	TEX29	RIC8A	LANCL2				SLAMF1	CASQ1
0.925	0.898	0.719	0.9	0.918	0.361	KRT1	KRT5	ADSL	TEX29	RIC8A		GLO1	PGP	FBXL4		
0.919	0.91	0.74	0.92	0.926	0.374	KRT1	KRT5	ADSL	TEX29	RIC8A		GLO1	PGP		SLAMF1	
0.926	0.887	0.718	1.06	0.909	0.351	KRT1	KRT5	ADSL	TEX29	RIC8A		GLO1	PGP			CASQ1
0.916	0.94	0.771	0.97	0.92	0.355	KRT1	KRT5	ADSL	TEX29	RIC8A		GLO1		FBXL4	SLAMF1	
0.919	0.933	0.746	0.91	0.918	0.359	KRT1	KRT5	ADSL	TEX29	RIC8A		GLO1		FBXL4		CASQ1
0.922	0.902	0.73	0.92	0.924	0.348	KRT1	KRT5	ADSL	TEX29	RIC8A		GLO1			SLAMF1	CASQ1
0.924	0.887	0.723	1.11	0.894	0.284	KRT1	KRT5	ADSL	TEX29	RIC8A			PGP	FBXL4	SLAMF1	
0.916	0.939	0.764	1.04	0.907	0.281	KRT1	KRT5	ADSL	TEX29	RIC8A			PGP	FBXL4		CASQ1
0.918	0.927	0.758	1.04	0.899	0.283	KRT1	KRT5	ADSL	TEX29	RIC8A			PGP		SLAMF1	CASQ1
0.921	0.899	0.733	1.1	0.922	0.332	KRT1	KRT5	ADSL	TEX29	RIC8A				FBXL4	SLAMF1	CASQ1
0.914	0.936	0.757	1.04	0.925	0.364	KRT1	KRT5	ADSL	TEX29		LANCL2	GLO1	PGP	FBXL4		
0.916	0.933	0.756	0.97	0.923	0.356	KRT1	KRT5	ADSL	TEX29		LANCL2	GLO1	PGP		SLAMF1	
0.906	0.983	0.78	1.47	0.89	0.245	KRT1	KRT5	ADSL	TEX29		LANCL2	GLO1	PGP			CASQ1
0.906	0.975	0.78	1.3	0.88	0.244	KRT1	KRT5	ADSL	TEX29		LANCL2	GLO1		FBXL4	SLAMF1	
0.896	1.06	0.852	1.2	0.906	0.231	KRT1	KRT5	ADSL	TEX29		LANCL2	GLO1		FBXL4		CASQ1
0.934	0.84	0.676	1.13	0.859	0.322	KRT1	KRT5	ADSL	TEX29		LANCL2	GLO1			SLAMF1	CASQ1
0.928	0.86	0.716	1.04	0.908	0.336	KRT1	KRT5	ADSL	TEX29		LANCL2		PGP	FBXL4	SLAMF1	
0.926	0.876	0.717	1.21	0.872	0.315	KRT1	KRT5	ADSL	TEX29		LANCL2		PGP	FBXL4		CASQ1
0.922	0.901	0.747	1.15	0.889	0.316	KRT1	KRT5	ADSL	TEX29		LANCL2		PGP		SLAMF1	CASQ1
0.931	0.867	0.694	1.08	0.879	0.319	KRT1	KRT5	ADSL	TEX29		LANCL2			FBXL4	SLAMF1	CASQ1
0.931	0.846	0.688	1.11	0.879	0.309	KRT1	KRT5	ADSL	TEX29			GLO1	PGP	FBXL4	SLAMF1	
0.925	0.879	0.703	1.37	0.803	0.247	KRT1	KRT5	ADSL	TEX29			GLO1	PGP	FBXL4		CASQ1
0.924	0.894	0.711	1.32	0.826	0.249	KRT1	KRT5	ADSL	TEX29			GLO1	PGP		SLAMF1	CASQ1

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Train Rsquared	Train RMSE	Train MAE	Test RMSE	Test Rsquared	Sample Handling_CV	KRT1	KRT5	ADSL	TEX29	RIC8A	LANCL2	GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.924	0.897	0.726	1.32	0.808	0.247	KRT1	KRT5	ADSL	TEX29			GLO1		FBXL4	SLAMF1	CASQ1
0.923	0.881	0.733	1.21	0.901	0.305	KRT1	KRT5	ADSL	TEX29				PGP	FBXL4	SLAMF1	CASQ1
0.922	0.893	0.746	1.19	0.912	0.314	KRT1	KRT5	ADSL		RIC8A	LANCL2	GLO1	PGP	FBXL4		
0.928	0.871	0.702	1.09	0.898	0.309	KRT1	KRT5	ADSL		RIC8A	LANCL2	GLO1	PGP		SLAMF1	
0.896	1.02	0.824	1.68	0.842	0.203	KRT1	KRT5	ADSL		RIC8A	LANCL2	GLO1	PGP			CASQ1
0.905	0.983	0.79	1.45	0.814	0.206	KRT1	KRT5	ADSL		RIC8A	LANCL2	GLO1		FBXL4	SLAMF1	
0.906	1.016	0.824	1.39	0.854	0.204	KRT1	KRT5	ADSL		RIC8A	LANCL2	GLO1		FBXL4		CASQ1
0.897	1.036	0.842	0.96	0.91	0.344	KRT1	KRT5	ADSL		RIC8A	LANCL2	GLO1			SLAMF1	CASQ1
0.898	1.032	0.825	1.09	0.883	0.321	KRT1	KRT5	ADSL		RIC8A	LANCL2		PGP	FBXL4	SLAMF1	
0.896	1.045	0.852	1.05	0.896	0.337	KRT1	KRT5	ADSL		RIC8A	LANCL2		PGP	FBXL4		CASQ1
0.898	1.039	0.823	1.04	0.896	0.336	KRT1	KRT5	ADSL		RIC8A	LANCL2		PGP		SLAMF1	CASQ1
0.896	1.035	0.836	0.99	0.908	0.334	KRT1	KRT5	ADSL		RIC8A	LANCL2			FBXL4	SLAMF1	CASQ1
0.894	1.046	0.854	0.93	0.915	0.354	KRT1	KRT5	ADSL		RIC8A		GLO1	PGP	FBXL4	SLAMF1	
0.899	1.031	0.818	0.92	0.912	0.345	KRT1	KRT5	ADSL		RIC8A		GLO1	PGP	FBXL4		CASQ1
0.891	1.053	0.852	1.09	0.886	0.319	KRT1	KRT5	ADSL		RIC8A		GLO1	PGP		SLAMF1	CASQ1
0.898	1.036	0.815	1.04	0.889	0.323	KRT1	KRT5	ADSL		RIC8A		GLO1		FBXL4	SLAMF1	CASQ1
0.897	1.047	0.825	0.98	0.903	0.336	KRT1	KRT5	ADSL		RIC8A			PGP	FBXL4	SLAMF1	CASQ1
0.898	1.034	0.827	1.04	0.898	0.306	KRT1	KRT5	ADSL			LANCL2	GLO1	PGP	FBXL4	SLAMF1	
0.897	1.038	0.838	1	0.904	0.323	KRT1	KRT5	ADSL			LANCL2	GLO1	PGP	FBXL4		CASQ1
0.899	1.036	0.82	0.99	0.903	0.319	KRT1	KRT5	ADSL			LANCL2	GLO1	PGP		SLAMF1	CASQ1
0.892	1.063	0.829	1.24	0.851	0.232	KRT1	KRT5	ADSL			LANCL2	GLO1		FBXL4	SLAMF1	CASQ1
0.894	1.057	0.817	1.24	0.844	0.236	KRT1	KRT5	ADSL			LANCL2		PGP	FBXL4	SLAMF1	CASQ1
0.89	1.079	0.839	1.19	0.864	0.224	KRT1	KRT5	ADSL				GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.893	1.048	0.838	1.07	0.904	0.308	KRT1	KRT5		TEX29	RIC8A	LANCL2	GLO1	PGP	FBXL4		
0.898	1.039	0.813	1.02	0.902	0.305	KRT1	KRT5		TEX29	RIC8A	LANCL2	GLO1	PGP		SLAMF1	

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Train Rsquared	Train RMSE	Train MAE	Test RMSE	Test Rsquared	Sample Handling_CV	KRT1	KRT5	ADSL	TEX29	RIC8A	LANCL2	GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.898	1.041	0.815	0.97	0.908	0.324	KRT1	KRT5		TEX29	RIC8A	LANCL2	GLO1	PGP			CASQ1
0.881	1.116	0.852	1.28	0.853	0.222	KRT1	KRT5		TEX29	RIC8A	LANCL2	GLO1		FBXL4	SLAMF1	
0.905	1.013	0.846	1	0.9	0.418	KRT1	KRT5		TEX29	RIC8A	LANCL2	GLO1		FBXL4		CASQ1
0.896	1.01	0.873	0.94	0.92	0.41	KRT1	KRT5		TEX29	RIC8A	LANCL2	GLO1			SLAMF1	CASQ1
0.886	1.071	0.92	1.03	0.913	0.551	KRT1	KRT5		TEX29	RIC8A	LANCL2		PGP	FBXL4	SLAMF1	
0.887	1.065	0.92	1.14	0.907	0.385	KRT1	KRT5		TEX29	RIC8A	LANCL2		PGP	FBXL4		CASQ1
0.891	1.073	0.932	0.95	0.907	0.43	KRT1	KRT5		TEX29	RIC8A	LANCL2		PGP		SLAMF1	CASQ1
0.91	0.969	0.811	0.94	0.916	0.486	KRT1	KRT5		TEX29	RIC8A	LANCL2			FBXL4	SLAMF1	CASQ1
0.905	1	0.819	1.09	0.892	0.342	KRT1	KRT5		TEX29	RIC8A		GLO1	PGP	FBXL4	SLAMF1	
0.907	1.001	0.826	1.12	0.894	0.329	KRT1	KRT5		TEX29	RIC8A		GLO1	PGP	FBXL4		CASQ1
0.902	1.027	0.841	1.12	0.874	0.335	KRT1	KRT5		TEX29	RIC8A		GLO1	PGP		SLAMF1	CASQ1
0.9	0.992	0.863	1.03	0.928	0.382	KRT1	KRT5		TEX29	RIC8A		GLO1		FBXL4	SLAMF1	CASQ1
0.901	0.992	0.853	1.13	0.922	0.375	KRT1	KRT5		TEX29	RIC8A			PGP	FBXL4	SLAMF1	CASQ1
0.904	0.993	0.857	0.94	0.92	0.383	KRT1	KRT5		TEX29		LANCL2	GLO1	PGP	FBXL4	SLAMF1	
0.884	1.093	0.923	1.54	0.901	0.308	KRT1	KRT5		TEX29		LANCL2	GLO1	PGP	FBXL4		CASQ1
0.876	1.129	0.945	1.19	0.894	0.303	KRT1	KRT5		TEX29		LANCL2	GLO1	PGP		SLAMF1	CASQ1
0.884	1.119	0.948	1.29	0.898	0.279	KRT1	KRT5		TEX29		LANCL2	GLO1		FBXL4	SLAMF1	CASQ1
0.899	1.027	0.846	0.9	0.918	0.473	KRT1	KRT5		TEX29		LANCL2		PGP	FBXL4	SLAMF1	CASQ1
0.902	1.026	0.853	0.94	0.925	0.485	KRT1	KRT5		TEX29			GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.897	1.052	0.874	0.96	0.917	0.479	KRT1	KRT5			RIC8A	LANCL2	GLO1	PGP	FBXL4	SLAMF1	
0.896	1.058	0.876	0.97	0.916	0.987	KRT1	KRT5			RIC8A	LANCL2	GLO1	PGP	FBXL4		CASQ1
0.896	1.023	0.867	0.96	0.917	0.489	KRT1	KRT5			RIC8A	LANCL2	GLO1	PGP		SLAMF1	CASQ1
0.891	1.045	0.877	1.03	0.903	0.442	KRT1	KRT5			RIC8A	LANCL2	GLO1		FBXL4	SLAMF1	CASQ1
0.892	1.049	0.883	0.92	0.909	0.476	KRT1	KRT5			RIC8A	LANCL2		PGP	FBXL4	SLAMF1	CASQ1
0.892	1.06	0.897	1.13	0.906	0.458	KRT1	KRT5			RIC8A		GLO1	PGP	FBXL4	SLAMF1	CASQ1

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Train Rsquared	Train RMSE	Train MAE	Test RMSE	Test Rsquared	Sample Handling_CV	KRT1	KRT5	ADSL	TEX29	RIC8A	LANCL2	GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.89	1.075	0.923	0.95	0.913	0.466	KRT1	KRT5				LANCL2	GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.885	1.102	0.936	1	0.903	0.736	KRT1		ADSL	TEX29	RIC8A	LANCL2	GLO1	PGP	FBXL4		CASQ1
0.904	0.999	0.828	0.9	0.928	0.554	KRT1		ADSL	TEX29	RIC8A	LANCL2	GLO1	PGP		SLAMF1	
0.9	1.022	0.842	0.93	0.919	0.443	KRT1		ADSL	TEX29	RIC8A	LANCL2	GLO1	PGP			CASQ1
0.9	1.019	0.837	0.91	0.917	0.451	KRT1		ADSL	TEX29	RIC8A	LANCL2	GLO1		FBXL4	SLAMF1	
0.904	1.018	0.839	1.04	0.924	0.412	KRT1		ADSL	TEX29	RIC8A	LANCL2	GLO1		FBXL4		CASQ1
0.902	1.017	0.833	1.01	0.92	0.981	KRT1		ADSL	TEX29	RIC8A	LANCL2	GLO1			SLAMF1	CASQ1
0.899	1.047	0.858	1.03	0.916	0.381	KRT1		ADSL	TEX29	RIC8A	LANCL2		PGP	FBXL4	SLAMF1	
0.899	1.014	0.851	1.09	0.916	0.417	KRT1		ADSL	TEX29	RIC8A	LANCL2		PGP	FBXL4		CASQ1
0.898	1.02	0.866	0.96	0.92	0.44	KRT1		ADSL	TEX29	RIC8A	LANCL2		PGP		SLAMF1	CASQ1
0.894	1.043	0.87	1.01	0.908	0.431	KRT1		ADSL	TEX29	RIC8A	LANCL2			FBXL4	SLAMF1	CASQ1
0.888	1.098	0.92	1.27	0.904	0.373	KRT1		ADSL	TEX29	RIC8A		GLO1	PGP	FBXL4	SLAMF1	
0.903	1.014	0.845	0.97	0.906	4.015	KRT1		ADSL	TEX29	RIC8A		GLO1	PGP	FBXL4		CASQ1
0.897	1.059	0.863	1.13	0.873	0.482	KRT1		ADSL	TEX29	RIC8A		GLO1	PGP		SLAMF1	CASQ1
0.9	1.035	0.84	1.11	0.885	0.369	KRT1		ADSL	TEX29	RIC8A		GLO1		FBXL4	SLAMF1	CASQ1
0.9	1.056	0.865	1.12	0.874	0.52	KRT1		ADSL	TEX29	RIC8A			PGP	FBXL4	SLAMF1	CASQ1
0.89	1.055	0.896	0.92	0.932	0.39	KRT1		ADSL	TEX29		LANCL2	GLO1	PGP	FBXL4	SLAMF1	
0.894	1.038	0.87	1.03	0.93	0.392	KRT1		ADSL	TEX29		LANCL2	GLO1	PGP	FBXL4		CASQ1
0.903	1.02	0.861	0.89	0.92	0.45	KRT1		ADSL	TEX29		LANCL2	GLO1	PGP		SLAMF1	CASQ1
0.881	1.112	0.925	1.19	0.914	0.353	KRT1		ADSL	TEX29		LANCL2	GLO1		FBXL4	SLAMF1	CASQ1
0.891	1.098	0.919	1.01	0.898	0.385	KRT1		ADSL	TEX29		LANCL2		PGP	FBXL4	SLAMF1	CASQ1
0.895	1.076	0.91	1.04	0.902	0.347	KRT1		ADSL	TEX29			GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.904	1.007	0.838	0.99	0.907	0.871	KRT1		ADSL		RIC8A	LANCL2	GLO1	PGP	FBXL4	SLAMF1	
0.906	0.995	0.815	1.01	0.912	0.421	KRT1		ADSL		RIC8A	LANCL2	GLO1	PGP	FBXL4		CASQ1
0.907	1	0.832	0.98	0.903	0.975	KRT1		ADSL		RIC8A	LANCL2	GLO1	PGP		SLAMF1	CASQ1

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Train Rsquared	Train RMSE	Train MAE	Test RMSE	Test Rsquared	Sample Handling_CV	KRT1	KRT5	ADSL	TEX29	RIC8A	LANCL2	GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.9	1.032	0.815	1.24	0.869	0.307	KRT1		ADSL		RIC8A	LANCL2	GLO1		FBXL4	SLAMF1	CASQ1
0.895	1.065	0.85	1.26	0.837	0.309	KRT1		ADSL		RIC8A	LANCL2		PGP	FBXL4	SLAMF1	CASQ1
0.901	1.036	0.837	1.21	0.862	0.301	KRT1		ADSL		RIC8A		GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.896	1.03	0.87	1.12	0.934	0.365	KRT1		ADSL			LANCL2	GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.903	1.016	0.861	0.94	0.922	0.378	KRT1			TEX29	RIC8A	LANCL2	GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.905	1.008	0.853	1	0.923	0.401	KRT1			TEX29	RIC8A	LANCL2	GLO1	PGP	FBXL4		CASQ1
0.885	1.124	0.94	1.33	0.887	0.258	KRT1			TEX29	RIC8A	LANCL2	GLO1	PGP		SLAMF1	CASQ1
0.857	1.221	1.009	1.09	0.914	0.426	KRT1			TEX29	RIC8A	LANCL2	GLO1		FBXL4	SLAMF1	CASQ1
0.856	1.218	0.987	1.07	0.91	0.415	KRT1			TEX29	RIC8A	LANCL2		PGP	FBXL4	SLAMF1	CASQ1
0.861	1.212	0.984	1.1	0.908	0.447	KRT1			TEX29	RIC8A		GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.848	1.261	1.012	1.18	0.917	0.466	KRT1			TEX29		LANCL2	GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.851	1.265	1.032	1.27	0.909	0.541	KRT1				RIC8A	LANCL2	GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.85	1.258	0.999	1.19	0.911	0.483		KRT5	ADSL	TEX29	RIC8A	LANCL2	GLO1	PGP	FBXL4		
0.851	1.238	1.003	1.04	0.906	0.402		KRT5	ADSL	TEX29	RIC8A	LANCL2	GLO1	PGP		SLAMF1	
0.862	1.217	0.998	1.02	0.913	0.447		KRT5	ADSL	TEX29	RIC8A	LANCL2	GLO1	PGP			CASQ1
0.861	1.214	0.972	1.01	0.908	0.429		KRT5	ADSL	TEX29	RIC8A	LANCL2	GLO1		FBXL4	SLAMF1	
0.85	1.274	1.03	1.09	0.912	0.516		KRT5	ADSL	TEX29	RIC8A	LANCL2	GLO1		FBXL4		CASQ1
0.858	1.218	0.985	1.05	0.917	0.406		KRT5	ADSL	TEX29	RIC8A	LANCL2	GLO1			SLAMF1	CASQ1
0.863	1.21	0.988	1.07	0.914	0.428		KRT5	ADSL	TEX29	RIC8A	LANCL2		PGP	FBXL4	SLAMF1	
0.862	1.209	0.966	1.06	0.911	0.417		KRT5	ADSL	TEX29	RIC8A	LANCL2		PGP	FBXL4		CASQ1
0.856	1.246	0.977	1.22	0.906	0.362		KRT5	ADSL	TEX29	RIC8A	LANCL2		PGP		SLAMF1	CASQ1
0.863	1.211	0.97	1	0.914	0.402		KRT5	ADSL	TEX29	RIC8A	LANCL2			FBXL4	SLAMF1	CASQ1
0.905	0.992	0.78	1.31	0.819	0.342		KRT5	ADSL	TEX29	RIC8A		GLO1	PGP	FBXL4	SLAMF1	
0.92	0.908	0.728	1.16	0.898	0.362		KRT5	ADSL	TEX29	RIC8A		GLO1	PGP	FBXL4		CASQ1
0.901	1.001	0.776	1.45	0.837	0.334		KRT5	ADSL	TEX29	RIC8A		GLO1	PGP		SLAMF1	CASQ1

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Train Rsquared	Train RMSE	Train MAE	Test RMSE	Test Rsquared	Sample Handling_CV	KRT1	KRT5	ADSL	TEX29	RIC8A	LANCL2	GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.893	1.044	0.824	1.38	0.852	0.337		KRT5	ADSL	TEX29	RIC8A		GLO1		FBXL4	SLAMF1	CASQ1
0.899	1.024	0.777	1.3	0.836	0.338		KRT5	ADSL	TEX29	RIC8A			PGP	FBXL4	SLAMF1	CASQ1
0.922	0.904	0.727	1.19	0.877	0.344		KRT5	ADSL	TEX29		LANCL2	GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.886	1.05	0.855	1.65	0.741	0.269		KRT5	ADSL	TEX29		LANCL2	GLO1	PGP	FBXL4		CASQ1
0.879	1.104	0.908	1.61	0.749	0.268		KRT5	ADSL	TEX29		LANCL2	GLO1	PGP		SLAMF1	CASQ1
0.88	1.104	0.905	1.61	0.722	0.269		KRT5	ADSL	TEX29		LANCL2	GLO1		FBXL4	SLAMF1	CASQ1
0.919	0.907	0.735	1.33	0.896	0.338		KRT5	ADSL	TEX29		LANCL2		PGP	FBXL4	SLAMF1	CASQ1
0.918	0.92	0.741	1.29	0.901	0.363		KRT5	ADSL	TEX29			GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.921	0.914	0.728	1.21	0.891	0.35		KRT5	ADSL		RIC8A	LANCL2	GLO1	PGP	FBXL4	SLAMF1	
0.845	1.208	0.952	2.15	0.777	0.234		KRT5	ADSL		RIC8A	LANCL2	GLO1	PGP	FBXL4		CASQ1
0.849	1.188	0.932	1.9	0.737	0.231		KRT5	ADSL		RIC8A	LANCL2	GLO1	PGP		SLAMF1	CASQ1
0.837	1.293	1.036	1.87	0.774	0.224		KRT5	ADSL		RIC8A	LANCL2	GLO1		FBXL4	SLAMF1	CASQ1
0.904	1.01	0.782	0.98	0.913	0.396		KRT5	ADSL		RIC8A	LANCL2		PGP	FBXL4	SLAMF1	CASQ1
0.889	1.065	0.845	1.2	0.868	0.357		KRT5	ADSL		RIC8A		GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.881	1.116	0.87	1.08	0.882	0.37		KRT5	ADSL			LANCL2	GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.881	1.116	0.868	1.08	0.882	0.37		KRT5		TEX29	RIC8A	LANCL2	GLO1	PGP	FBXL4	SLAMF1	
0.908	0.981	0.774	1.12	0.911	0.376		KRT5		TEX29	RIC8A	LANCL2	GLO1	PGP	FBXL4		CASQ1
0.906	0.995	0.77	1.03	0.912	0.406		KRT5		TEX29	RIC8A	LANCL2	GLO1	PGP		SLAMF1	CASQ1
0.904	1.008	0.774	1.01	0.912	0.401		KRT5		TEX29	RIC8A	LANCL2	GLO1		FBXL4	SLAMF1	CASQ1
0.888	1.066	0.833	1.3	0.869	0.357		KRT5		TEX29	RIC8A	LANCL2		PGP	FBXL4	SLAMF1	CASQ1
0.886	1.076	0.839	1.26	0.868	0.356		KRT5		TEX29	RIC8A		GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.874	1.144	0.875	1.1	0.884	0.366		KRT5		TEX29		LANCL2	GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.907	0.985	0.793	1.11	0.908	0.364		KRT5			RIC8A	LANCL2	GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.906	1	0.785	1.03	0.908	0.398			ADSL	TEX29	RIC8A	LANCL2	GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.906	1.001	0.785	1.03	0.908	0.398			ADSL	TEX29	RIC8A	LANCL2	GLO1	PGP	FBXL4		CASQ1

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Train Rsquared	Train RMSE	Train MAE	Test RMSE	Test Rsquared	Sample Handling_CV	KRT1	KRT5	ADSL	TEX29	RIC8A	LANCL2	GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.869	1.133	0.918	1.45	0.822	0.282			ADSL	TEX29	RIC8A	LANCL2	GLO1	PGP		SLAMF1	CASQ1
0.872	1.117	0.902	1.45	0.814	0.283			ADSL	TEX29	RIC8A	LANCL2	GLO1		FBXL4	SLAMF1	CASQ1
0.857	1.22	0.993	1.36	0.833	0.282			ADSL	TEX29	RIC8A	LANCL2		PGP	FBXL4	SLAMF1	CASQ1
0.908	0.972	0.777	1.2	0.909	0.368			ADSL	TEX29	RIC8A		GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.907	0.981	0.783	1.19	0.909	0.367			ADSL	TEX29		LANCL2	GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.905	1.003	0.782	1.08	0.909	0.453			ADSL		RIC8A	LANCL2	GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.84	1.241	0.993	1.79	0.813	0.245				TEX29	RIC8A	LANCL2	GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.921	0.908	0.74	1.2	0.859	0.342	KRT1	KRT5	ADSL	TEX29	RIC8A	LANCL2	GLO1	PGP	FBXL4		
0.901	0.994	0.792	1.52	0.752	0.32	KRT1	KRT5	ADSL	TEX29	RIC8A	LANCL2	GLO1	PGP		SLAMF1	

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Table 16: Freeze-Thaw Plasma Model 9 Biomarkers

Train Rsquared	Train RMSE	Train MAE	Test RMSE	Test Rsquared	Sample Handling_CV	KRT1	KRT5	ADSL	TEX29	RIC8A	LANCL2	GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.901	1.009	0.804	1.47	0.764	0.325	KRT1	KRT5	ADSL	TEX29	RIC8A	LANCL2	GLO1	PGP			CASQ1
0.903	1.005	0.787	1.44	0.768	0.326	KRT1	KRT5	ADSL	TEX29	RIC8A	LANCL2	GLO1		FBXL4	SLAMF1	
0.919	0.914	0.747	1.26	0.874	0.339	KRT1	KRT5	ADSL	TEX29	RIC8A	LANCL2	GLO1		FBXL4		CASQ1
0.92	0.915	0.74	1.21	0.882	0.349	KRT1	KRT5	ADSL	TEX29	RIC8A	LANCL2	GLO1			SLAMF1	CASQ1
0.923	0.907	0.722	1.17	0.874	0.343	KRT1	KRT5	ADSL	TEX29	RIC8A	LANCL2		PGP	FBXL4	SLAMF1	
0.891	1.037	0.807	1.58	0.79	0.315	KRT1	KRT5	ADSL	TEX29	RIC8A	LANCL2		PGP	FBXL4		CASQ1
0.899	1.013	0.776	1.48	0.781	0.317	KRT1	KRT5	ADSL	TEX29	RIC8A	LANCL2		PGP		SLAMF1	CASQ1
0.898	1.03	0.786	1.41	0.797	0.321	KRT1	KRT5	ADSL	TEX29	RIC8A	LANCL2			FBXL4	SLAMF1	CASQ1
0.919	0.912	0.751	1.31	0.846	0.322	KRT1	KRT5	ADSL	TEX29	RIC8A		GLO1	PGP	FBXL4	SLAMF1	
0.92	0.912	0.745	1.27	0.85	0.331	KRT1	KRT5	ADSL	TEX29	RIC8A		GLO1	PGP	FBXL4		CASQ1
0.921	0.911	0.737	1.25	0.851	0.329	KRT1	KRT5	ADSL	TEX29	RIC8A		GLO1	PGP		SLAMF1	CASQ1
0.872	1.099	0.9	1.86	0.658	0.247	KRT1	KRT5	ADSL	TEX29	RIC8A		GLO1		FBXL4	SLAMF1	CASQ1

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Train Rsquared	Train RMSE	Train MAE	Test RMSE	Test Rsquared	Sample Handling - CV	KRT1	KRT5	ADSL	TEX29	RIC8A	LANCL2	GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.872	1.099	0.902	1.85	0.635	0.246	KRT1	KRT5	ADSL	TEX29	RIC8A					SLAMF1	CASQ1
0.871	1.132	0.941	1.79	0.663	0.248	KRT1	KRT5	ADSL	TEX29		LANCL2	GLO1	PGP	FBXL4	SLAMF1	
0.915	0.925	0.761	1.38	0.877	0.326	KRT1	KRT5	ADSL	TEX29		LANCL2	GLO1	PGP	FBXL4		CASQ1
0.919	0.917	0.744	1.3	0.866	0.322	KRT1	KRT5	ADSL	TEX29		LANCL2	GLO1	PGP		SLAMF1	CASQ1
0.921	0.918	0.731	1.25	0.872	0.333	KRT1	KRT5	ADSL	TEX29		LANCL2	GLO1		FBXL4	SLAMF1	CASQ1
0.839	1.226	0.969	2.05	0.682	0.209	KRT1	KRT5	ADSL	TEX29		LANCL2		PGP	FBXL4	SLAMF1	CASQ1
0.856	1.206	0.971	1.14	0.868	0.363	KRT1	KRT5	ADSL	TEX29			GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.863	1.2	0.97	1.1	0.874	0.391	KRT1	KRT5	ADSL		RIC8A	LANCL2	GLO1	PGP	FBXL4	SLAMF1	
0.865	1.2	0.952	1.08	0.877	0.383	KRT1	KRT5	ADSL		RIC8A	LANCL2	GLO1	PGP	FBXL4		CASQ1
0.808	1.358	1.079	1.48	0.755	0.327	KRT1	KRT5	ADSL		RIC8A	LANCL2	GLO1	PGP		SLAMF1	CASQ1
0.81	1.366	1.074	1.45	0.763	0.327	KRT1	KRT5	ADSL		RIC8A	LANCL2	GLO1		FBXL4	SLAMF1	CASQ1
0.819	1.38	1.088	1.4	0.788	0.344	KRT1	KRT5	ADSL		RIC8A	LANCL2		PGP	FBXL4	SLAMF1	CASQ1
0.86	1.184	0.96	1.14	0.873	0.367	KRT1	KRT5	ADSL		RIC8A		GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.861	1.198	0.953	1.12	0.872	0.362	KRT1	KRT5	ADSL			LANCL2	GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.869	1.186	0.941	1.07	0.879	0.386	KRT1	KRT5		TEX29	RIC8A	LANCL2	GLO1	PGP	FBXL4	SLAMF1	
0.815	1.346	1.049	1.41	0.776	0.328	KRT1	KRT5		TEX29	RIC8A	LANCL2	GLO1	PGP	FBXL4		CASQ1
0.859	1.194	0.955	1.18	0.862	0.358	KRT1	KRT5		TEX29	RIC8A	LANCL2	GLO1	PGP		SLAMF1	CASQ1
0.86	1.199	0.952	1.16	0.864	0.356	KRT1	KRT5		TEX29	RIC8A	LANCL2	GLO1		FBXL4	SLAMF1	CASQ1
0.868	1.189	0.943	1.12	0.869	0.397	KRT1	KRT5		TEX29	RIC8A	LANCL2		PGP	FBXL4	SLAMF1	CASQ1
0.767	1.476	1.188	1.81	0.621	0.229	KRT1	KRT5		TEX29	RIC8A		GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.864	1.184	0.938	1.16	0.868	0.358	KRT1	KRT5		TEX29		LANCL2	GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.89	1.077	0.881	1.01	0.91	0.418	KRT1	KRT5			RIC8A	LANCL2	GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.84	1.267	1.051	1.23	0.847	0.489	KRT1		ADSL	TEX29	RIC8A	LANCL2	GLO1	PGP	FBXL4	SLAMF1	
0.839	1.264	1.028	1.29	0.841	0.607	KRT1		ADSL	TEX29	RIC8A	LANCL2	GLO1	PGP	FBXL4		CASQ1
0.835	1.291	1.062	1.24	0.842	0.411	KRT1		ADSL	TEX29	RIC8A	LANCL2	GLO1	PGP		SLAMF1	CASQ1

Train Rsquared	Train RMSE	Train MAE	Test RMSE	Test Rsquared	Sample Handling CV	KRT1	KRT5	ADSL	TEX29	RIC8A	LANCL2	GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.886	1.079	0.893	1.08	0.917	0.41	KRT1		ADSL	TEX29	RIC8A	LANCL2	GLO1		FBXL4	SLAMF1	CASQ1
0.885	1.08	0.886	1.17	0.91	0.401	KRT1		ADSL	TEX29	RIC8A	LANCL2		PGP	FBXL4	SLAMF1	CASQ1
0.889	1.08	0.894	0.99	0.917	0.414	KRT1		ADSL	TEX29	RIC8A		GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.82	1.321	1.092	1.49	0.878	0.376	KRT1		ADSL	TEX29		LANCL2	GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.819	1.335	1.126	1.2	0.866	0.437	KRT1		ADSL		RIC8A	LANCL2	GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.818	1.33	1.092	1.3	0.861	0.372	KRT1			TEX29	RIC8A	LANCL2	GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.891	1.066	0.881	1.04	0.909	0.417		KRT5	ADSL	TEX29	RIC8A	LANCL2	GLO1	PGP	FBXL4	SLAMF1	
0.89	1.069	0.877	1.1	0.903	0.406		KRT5	ADSL	TEX29	RIC8A	LANCL2	GLO1	PGP	FBXL4		CASQ1
0.892	1.068	0.874	1.02	0.908	0.408		KRT5	ADSL	TEX29	RIC8A	LANCL2	GLO1	PGP		SLAMF1	CASQ1
0.833	1.274	1.036	1.53	0.818	0.318		KRT5	ADSL	TEX29	RIC8A	LANCL2	GLO1		FBXL4	SLAMF1	CASQ1
0.826	1.302	1.081	1.47	0.783	0.327		KRT5	ADSL	TEX29	RIC8A	LANCL2		PGP	FBXL4	SLAMF1	CASQ1
0.829	1.299	1.053	1.52	0.789	0.318		KRT5	ADSL	TEX29	RIC8A		GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.888	1.067	0.895	1.25	0.919	0.388		KRT5	ADSL	TEX29		LANCL2	GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.891	1.065	0.892	1.07	0.915	0.397		KRT5	ADSL		RIC8A	LANCL2	GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.89	1.07	0.889	1.15	0.909	0.391		KRT5		TEX29	RIC8A	LANCL2	GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.789	1.426	1.183	1.88	0.836	0.279			ADSL	TEX29	RIC8A	LANCL2	GLO1	PGP	FBXL4	SLAMF1	CASQ1

Table 17: Freeze-Thaw Plasma Model 10 and 11 Biomarkers

Train Rsquared	Train RMSE	Train MAE	Test RMSE	Test Rsquared	Sample Handling CV	KRT1	KRT5	ADSL	TEX29	RIC8A	LANCL2	GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.877	1.151	0.926	0.99	0.913	0.477	KRT1	KRT5	ADSL	TEX29	RIC8A	LANCL2	GLO1		FBXL4	SLAMF1	
0.873	1.174	0.939	1.03	0.9	0.496	KRT1	KRT5	ADSL	TEX29	RIC8A	LANCL2	GLO1	PGP	FBXL4		CASQ1
0.875	1.166	0.927	0.99	0.905	0.516	KRT1	KRT5	ADSL	TEX29	RIC8A	LANCL2	GLO1	PGP		SLAMF1	CASQ1
0.822	1.364	1.108	1.15	0.91	0.474	KRT1	KRT5	ADSL	TEX29	RIC8A	LANCL2	GLO1		FBXL4	SLAMF1	CASQ1
0.822	1.36	1.118	1.1	0.906	0.489	KRT1	KRT5	ADSL	TEX29	RIC8A	LANCL2		PGP	FBXL4	SLAMF1	CASQ1

Train Rsquared	Train RMSE	Train MAE	Test RMSE	Test Rsquared	Sample Handling _CV	KRT1	KRT5	ADSL	TEX29	RIC8A	LANCL2	GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.811	1.407	1.109	1.14	0.893	0.563	KRT1	KRT5	ADSL	TEX29	RIC8A		GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.877	1.149	0.932	1.13	0.904	0.463	KRT1	KRT5	ADSL	TEX29		LANCL2	GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.877	1.151	0.932	1.04	0.906	0.485	KRT1	KRT5	ADSL		RIC8A	LANCL2	GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.872	1.174	0.937	1.08	0.891	0.539	KRT1	KRT5		TEX29	RIC8A	LANCL2	GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.808	1.41	1.18	1.27	0.893	0.433	KRT1		ADSL	TEX29	RIC8A	LANCL2	GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.876	1.157	0.933	1.02	0.914	0.465		KRT5	ADSL	TEX29	RIC8A	LANCL2	GLO1	PGP	FBXL4	SLAMF1	CASQ1
0.879	1.144	0.92	0.99	0.913	0.475	KRT1	KRT5	ADSL	TEX29	RIC8A	LANCL2	GLO1	PGP	FBXL4	SLAMF1	CASQ1

What is claimed is:

1. A method of assessing quality of a sample collected from a subject comprising detecting the level of each of N biomarker proteins in the sample, wherein N is at least 1, and wherein at least 1 of the N biomarker proteins are selected from Keratin-1, KRT5, PUR8, TEX29, RIC8A, LANC2, Glyoxalase I, PGP, FBXL4, SLAF1, CASQ1, wherein the sample is a plasma sample.

2. A method comprising:

- a) measuring the level of each of N biomarker proteins in a plasma sample from a subject, wherein N is at least 1, and wherein at least 1 of the N biomarker proteins are selected from Keratin-1, KRT5, PUR8, TEX29, RIC8A, LANC2, Glyoxalase I, PGP, FBXL4, SLAF1, CASQ1; and
- b) identifying the sample as an analysis sample or negative sample based on the level of the N biomarker proteins;

wherein the analysis sample is a sample that is suitable for use in one or more of the following: protein biomarker discovery analysis, protein expression level analysis, a diagnostic method or a prognostic method, and the negative sample is a sample that is not suitable for use as an analysis sample.

3. A method comprising:

- a) contacting a serum sample from a subject with a set of capture reagents, wherein each capture reagent has affinity for a different biomarker protein of N biomarker proteins wherein N is at least 1, and wherein at least 1 of the N biomarker proteins is selected from Keratin-1, KRT5, PUR8, TEX29, RIC8A, LANC2, Glyoxalase I, PGP, FBXL4, SLAF1, CASQ1; and
- b) measuring the level of each N biomarker protein with the set of capture reagents.

4. The method of any one of claims 1-3, wherein 2 of the N biomarker proteins are Keratin-1 and KRT5.

5. The method of any one of claims 1-3, wherein 2 of the N biomarker proteins are Keratin -1 and PUR8.

6. The method of any one of claims 1-3, wherein 2 of the N biomarker proteins are Keratin-1 and TEX29.

7. The method of any one of claims 1-3, wherein 2 of the N biomarker proteins are Keratin-1 and RIC8A.

8. The method of any one of claims 1-3, wherein 2 of the N biomarker proteins are Keratin-1 and LANC2.
9. The method of any one of claims 1-3, wherein 2 of the N biomarker proteins are Keratin-1 and Glyoxalase I.
10. The method of any one of claims 1-3, wherein 2 of the N biomarker proteins are Keratin-1 and PGP.
11. The method of any one of claims 1-3, wherein 2 of the N biomarker proteins are Keratin -1 and FBXL4.
12. The method of any one of claims 1-3, wherein 2 of the N biomarker proteins are Keratin-1 and SLAF1.
13. The method of any one of claims 1-3, wherein 2 of the N biomarker proteins are Keratin-1 and CASQ1.
14. The method of any one of claims 1-3, wherein 2 of the N biomarker proteins are K2C5 and PUR8.
15. The method of any one of claims 1-3, wherein 2 of the N biomarker proteins are K2C5 and TEX29.
16. The method of any one of claims 1-3, wherein 2 of the N biomarker proteins are K2C5 and RIC8A.
17. The method of any one of claims 1-3, wherein 2 of the N biomarker proteins are K2C5 and LANC2.
18. The method of any one of claims 1-3, wherein 2 of the N biomarker proteins are K2C5 and Glyoxalase I.
19. The method of any one of claims 1-3, wherein 2 of the N biomarker proteins are K2C5 and PGP.
20. The method of any one of claims 1-3, wherein 2 of the N biomarker proteins are K2C5 and FBXL4.
21. The method of any one of claims 1-3, wherein 2 of the N biomarker proteins are K2C5 and SLAF1.
22. The method of any one of claims 1-3, wherein 2 of the N biomarker proteins are K2C5 and CASQ1.
23. The method of any one of claims 1-3, wherein 2 of the N biomarker proteins are PUR8 and TEX29.
24. The method of any one of claims 1-3, wherein 2 of the N biomarker proteins are PUR8 and RIC8A.

25. The method of any one of claims 1-3, wherein 2 of the N biomarker proteins are PUR8 and LANC2.

26. The method of any one of claims 1-3, wherein 2 of the N biomarker proteins are PUR8 and Glyoxalase I.

27. The method of any one of claims 1-3, wherein 2 of the N biomarker proteins are PUR8 and PGP.

28. The method of any one of claims 1-3, wherein 2 of the N biomarker proteins are PUR8 and FBXL4.

29. The method of any one of claims 1-3, wherein 2 of the N biomarker proteins are PUR8 and SLAF1.

30. The method of any one of claims 1-3, wherein 2 of the N biomarker proteins are PUR8 and CASQ1.

31. The method of any one of claims 1-3, wherein 2 of the N biomarker proteins are TEX29 and RIC8A.

32. The method of any one of claims 1-3, wherein 2 of the N biomarker proteins are TEX29 and LANC2.

33. The method of any one of claims 1-3, wherein 2 of the N biomarker proteins are TEX29 and Glyoxalase I.

34. The method of any one of claims 1-3, wherein 2 of the N biomarker proteins are TEX29 and PGP.

35. The method of any one of claims 1-3, wherein 2 of the N biomarker proteins are TEX29 and FBXL4.

36. The method of any one of claims 1-3, wherein 2 of the N biomarker proteins are TEX29 and SLAF1.

37. The method of any one of claims 1-3, wherein 2 of the N biomarker proteins are TEX29 and CASQ1.

38. The method of any one of claims 1-3, wherein 2 of the N biomarker proteins are RIC8A and LANC2.

39. The method of any one of claims 1-3, wherein 2 of the N biomarker proteins are RIC8A and Glyoxalase I.

40. The method of any one of claims 1-3, wherein 2 of the N biomarker proteins are RIC8A and PGP.

41. The method of any one of claims 1-3, wherein 2 of the N biomarker proteins are RIC8A and FBXL4.

42. The method of any one of claims 1-3, wherein 2 of the N biomarker proteins are RIC8A and SLAF1.

43. The method of any one of claims 1-3, wherein 2 of the N biomarker proteins are RIC8A and CASQ1.

44. The method of any one of claims 1-3, wherein 2 of the N biomarker proteins are LANC2 and Glyoxalase I.

45. The method of any one of claims 1-3, wherein 2 of the N biomarker proteins are LANC2 and PGP.

46. The method of any one of claims 1-3, wherein 2 of the N biomarker proteins are LANC2 and FBXL4.

47. The method of any one of claims 1-3, wherein 2 of the N biomarker proteins are LANC2 and SLAF1.

48. The method of any one of claims 1-3, wherein 2 of the N biomarker proteins are LANC2 and CASQ1.

49. The method of any one of claims 1-3, wherein 2 of the N biomarker proteins are Glyoxalase I and PGP.

50. The method of any one of claims 1-3, wherein 2 of the N biomarker proteins are Glyoxalase I and FBXL4.

51. The method of any one of claims 1-3, wherein 2 of the N biomarker proteins are Glyoxalase I and SLAF1.

52. The method of any one of claims 1-3, wherein 2 of the N biomarker proteins are Glyoxalase I and CASQ1.

53. The method of any one of claims 1-3, wherein 2 of the N biomarker proteins are PGP and FBXL4.

54. The method of any one of claims 1-3, wherein 2 of the N biomarker proteins are PGP and SLAF1.

55. The method of any one of claims 1-3, wherein 2 of the N biomarker proteins are PGP and CASQ1.

56. The method of any one of claims 1-3, wherein 2 of the N biomarker proteins are FBXL4 and SLAF1.

57. The method of any one of claims 1-3, wherein 2 of the N biomarker proteins are FBXL4 and CASQ1.

58. The method of any one of claims 1-3, wherein 2 of the N biomarker proteins are SLAF1 and CASQ1.

59. The method of any one of claims 1-58, wherein N is 3, N is 4, N is 5, N is 6, N is 7, N is 8, N is 9, N is 10 or N is 11.

60. The method of claim 31, wherein all of the N biomarker proteins are selected from Keratin-1, K2C5, PUR8, TEX29, RIC8A, LANC2, Glyoxalase I, PGP, FBXL4, SLAF1 and CASQ1.

61. The method of any one of claims 1-60, wherein the subject is a human subject.

62. The method of any one of claims 1-61, wherein the sample was processed, frozen, and thawed after the sample collection and prior to the detecting.

63. The method of claim 62, wherein the sample processing steps comprised at least one freeze-thaw cycle.

64. The method of claim 62, wherein the sample processing steps comprised greater than one freeze-thaw cycle.

65. The method of any one of claims 62-64, comprising determining a number of freeze-thaw cycles for the sample.

66. The method of claim 65, wherein the determining is based on comparing the detected levels of the N biomarker proteins to reference levels, wherein the reference levels are average levels of the N biomarker proteins present in samples having 1 freeze-thaw cycle or 2 freeze-thaw cycles.

67. The method of claims 1-66, wherein the detected levels of the N biomarker proteins compared to the reference levels indicates that the number of freeze-thaw cycles was greater than 1, greater than 2, greater than 3, greater than 4, greater than 5, greater than 7 or greater than 10 freeze-thaw cycles.

68. The method of any one of claims 65-67, wherein the determining is based on a panel of N biomarker proteins having an R^2 value of at least 0.600, at least 0.650, at least 0.700, at least 0.750, at least 0.800, at least 0.850, at least 0.900, or at least 0.950.

69. The method of any one of claims 65-68, comprising performing protein biomarker discovery analysis, protein expression level analysis, a diagnostic method or a prognostic method on the sample.

70. The method of any one of claims 1-69, comprising identifying the sample as passing a quality assessment or failing a quality assessment.

71. The method of claim 70, wherein the identifying is based, at least in part, on the detected levels of the N biomarker proteins.

72. The method of claim 70 or 71, wherein the sample is identified as passing if the number of freeze-thaw cycles is determined to be 1, less than 2, less than 3, less than 4, less than 5, or 5.

73. The method of claim 70 or 71, wherein the sample is identified as failing if the number of freeze-thaw cycles is determined to be greater than 5, greater than 6, greater than 7, greater than 8, greater than 9 or greater than 10.

74. The method of any one of claims 70-73, comprising either a) performing further analysis of the sample if it is identified as passing the quality assessment; or b) discarding the sample if it is identified as failing the quality assessment.

75. The method of any one of claims 1-74, comprising detecting the level of each of N biomarkers in a plurality of samples from a plurality of subjects.

76. A method for comparing a plurality of samples collected from a plurality of subjects comprising detecting a level of each of N biomarker proteins in each of the plurality of samples, wherein N is at least 1, and wherein at least 1 of the N biomarker proteins are selected Keratin-1, KRT5, PUR8, TEX29, RIC8A, LANC2, Glyoxalase I, PGP, FBXL4, SLAF1, CASQ1, wherein the sample is a plasma sample.

77. The method of claim 76, comprising a) determining a number of freeze-thaw cycles and b) comparing the determined number freeze-thaw cycles for each of the plurality of samples.

78. The method of claim 77, comprising identifying the plurality of samples as handled consistently or inconsistently, wherein samples handled consistently all have a determined number of freeze-thaw cycles within 1, 2, 3, 4 or 5 freeze-thaw cycles of each other.

79. The method of claim 76 or 77, wherein the determining is based on comparing the detected levels of each of the N biomarker proteins to reference levels, wherein the reference levels are average levels of each of the N biomarker proteins present in samples having 1 freeze-thaw cycle or 2 freeze-thaw cycles.

80. The method of any one of claims 76-79, wherein the detected levels of each of the N biomarker proteins compared to the reference levels indicates that the number of freeze-thaw cycles was greater than 1, greater than 2, greater than 3, greater than 4, greater than 5, greater than 7 or greater than 10 freeze-thaw cycles; or wherein the levels of each of the N biomarker proteins used in a linear regression model predicts the number of freeze-thaw cycles was greater than 1, greater than 2, greater than 3, greater than 4, greater than 5, greater than 7 or greater than 10 freeze-thaw cycles.

81. The method of any one of claims 76-80, wherein the determining is based on a panel of N biomarker proteins having an R^2 value of at least 0.600, at least 0.650, at least 0.700, at least 0.750, at least 0.800, at least 0.850, at least 0.900, or at least 0.950.

82. The method of any one of claims 76-81, comprising performing protein biomarker discovery analysis, protein expression level analysis, a diagnostic method or a prognostic method on the plurality of samples.

83. The method of claim 82, comprising modifying a panel of proteins in the protein biomarker discovery analysis, the protein expression level analysis, the diagnostic method or the prognostic method based on the determined number of freeze-thaw cycles for each of the plurality of samples; or identifying one or more proteins in the sample as being affected by the number of freeze-thaw cycles; or identifying the level of one or more proteins in the sample as being affected by the number of freeze-thaw cycles; or changing the proteins used in a diagnostic, a prognostic or a health assessment related test based on the predicted number of freeze-thaw cycles; removing the proteins used in a diagnostic, a prognostic or a health assessment related test based on the predicted number of freeze-thaw cycles.

84. The method of claim 83, wherein the panel of biomarker proteins is reduced in number of biomarker proteins measured.

85. The method of any one of claims 76-84, wherein the determining measures compliance with a clinical trial sample collection and processing protocol.

86. The method of any one of claims 76-85, wherein the plurality of samples are collected at more than one sample collection site.

87. The method of claim 86, wherein the plurality of samples from a first sample collection site are compared to a second plurality of samples from a second sample collection site.

88. The method of any one of claims 76-87, wherein one or more of the plurality of samples may be removed based on the number of freeze-thaw cycles.

89. The method of any one of claims 76-88, wherein 2 of the N biomarker proteins are Keratin-1 and KRT5; or

wherein 2 of the N biomarker proteins are Keratin -1 and PUR8; or

wherein 2 of the N biomarker proteins are Keratin-1 and TEX29; or

wherein 2 of the N biomarker proteins are Keratin-1 and RIC8A; or

wherein 2 of the N biomarker proteins are Keratin-1 and LANC2; or

wherein 2 of the N biomarker proteins are Keratin-1 and Glyoxalase I; or

wherein 2 of the N biomarker proteins are Keratin-1 and PGP; or

wherein 2 of the N biomarker proteins are Keratin -1 and FBXL4; or
wherein 2 of the N biomarker proteins are Keratin-1 and SLAF1; or
wherein 2 of the N biomarker proteins are Keratin-1 and CASQ1; or
wherein 2 of the N biomarker proteins are K2C5 and PUR8; or
wherein 2 of the N biomarker proteins are K2C5 and TEX29; or
wherein 2 of the N biomarker proteins are K2C5 and RIC8A; or
wherein 2 of the N biomarker proteins are K2C5 and LANC2; or
wherein 2 of the N biomarker proteins are K2C5 and Glyoxalase I; or
wherein 2 of the N biomarker proteins are K2C5 and PGP; or
wherein 2 of the N biomarker proteins are K2C5 and FBXL4; or
wherein 2 of the N biomarker proteins are K2C5 and SLAF1; or
wherein 2 of the N biomarker proteins are K2C5 and CASQ1; or
wherein 2 of the N biomarker proteins are PUR8 and TEX29; or
wherein 2 of the N biomarker proteins are PUR8 and RIC8A; or
wherein 2 of the N biomarker proteins are PUR8 and LANC2; or
wherein 2 of the N biomarker proteins are PUR8 and Glyoxalase I; or
wherein 2 of the N biomarker proteins are PUR8 and PGP; or
wherein 2 of the N biomarker proteins are PUR8 and FBXL4; or
wherein 2 of the N biomarker proteins are PUR8 and SLAF1; or
wherein 2 of the N biomarker proteins are PUR8 and CASQ1; or
wherein 2 of the N biomarker proteins are TEX29 and RIC8A; or
wherein 2 of the N biomarker proteins are TEX29 and LANC2; or
wherein 2 of the N biomarker proteins are TEX29 and Glyoxalase I; or
wherein 2 of the N biomarker proteins are TEX29 and PGP; or
wherein 2 of the N biomarker proteins are TEX29 and FBXL4; or
wherein 2 of the N biomarker proteins are TEX29 and SLAF1; or
wherein 2 of the N biomarker proteins are TEX29 and CASQ1; or
wherein 2 of the N biomarker proteins are RIC8A and LANC2; or
wherein 2 of the N biomarker proteins are RIC8A and Glyoxalase I; or
wherein 2 of the N biomarker proteins are RIC8A and PGP; or
wherein 2 of the N biomarker proteins are RIC8A and FBXL4; or
wherein 2 of the N biomarker proteins are RIC8A and SLAF1; or
wherein 2 of the N biomarker proteins are RIC8A and CASQ1; or
wherein 2 of the N biomarker proteins are LANC2 and Glyoxalase I; or

wherein 2 of the N biomarker proteins are LANC2 and PGP; or
wherein 2 of the N biomarker proteins are LANC2 and FBXL4; or
wherein 2 of the N biomarker proteins are LANC2 and SLAF1; or
wherein 2 of the N biomarker proteins are LANC2 and CASQ1; or
wherein 2 of the N biomarker proteins are Glyoxalase I and PGP; or
wherein 2 of the N biomarker proteins are Glyoxalase I and FBXL4; or
wherein 2 of the N biomarker proteins are Glyoxalase I and SLAF1; or
wherein 2 of the N biomarker proteins are Glyoxalase I and CASQ1; or
wherein 2 of the N biomarker proteins are PGP and FBXL4; or
wherein 2 of the N biomarker proteins are PGP and SLAF1; or
wherein 2 of the N biomarker proteins are PGP and CASQ1; or
wherein 2 of the N biomarker proteins are FBXL4 and SLAF1; or
wherein 2 of the N biomarker proteins are FBXL4 and CASQ1; or
wherein 2 of the N biomarker proteins are SLAF1 and CASQ1.

90. The method of any one of claims 76-89, wherein N is 3, N is 4, N is 5, N is 6, N is 7, N is 8, N is 9, N is 10 or N is 11.

91. The method of claim 90, wherein all of the N biomarker proteins are selected from Keratin-1, K2C5, PUR8, TEX29, RIC8A, LANC2, Glyoxalase I, PGP, FBXL4, SLAF1 and CASQ1.

92. The method of any one of claims 76-91, wherein the subject is a human subject.

93. The method of any one of claims 76-92, wherein the sample was processed, frozen, and thawed after the sample collection and prior to the detecting.

94. The method of claim 93, wherein the sample processing steps comprised at least one freeze-thaw cycle.

95. The method of claim 94, wherein the sample processing steps comprised greater than one freeze-thaw cycle.

96. The method of any one of claims 1-95, wherein the detecting comprises performing mass spectrometry, an aptamer based assay, and/or an antibody based assay.

97. The method of any one of claims 1-97, wherein the method comprises contacting biomarker proteins of the sample from the subject with a set of capture reagents, wherein each capture reagent of the set of capture reagents specifically binds to one biomarker protein being detected.

98. The method of claim 97, wherein each the capture reagents specifically binds to a different biomarker protein being detected.
99. The method of claim 97 or 98, wherein each capture reagent is an antibody or an aptamer.
100. The method of claim 99, wherein each capture reagent is an aptamer.
101. The method of claim 100, wherein at least one aptamer is a slow off-rate aptamer.
102. The method of claim 101, wherein at least one slow off-rate aptamer comprises at least 1, at least 2, at least 3, at least 4, at least 5, at least 6, at least 7, at least 8, at least 9, or at least 10 nucleotides with modifications.
103. The method of claim 101 or 102, wherein each slow off-rate aptamer binds to its target protein with an off rate ($t_{1/2}$) of ≥ 30 minutes, ≥ 60 minutes, ≥ 90 minutes, ≥ 120 minutes, ≥ 150 minutes, ≥ 180 minutes, ≥ 210 minutes, or ≥ 240 minutes.
104. A kit comprising N biomarker protein capture reagents, wherein N is at least 1, and wherein at least 1 of the capture reagents bind to proteins selected from Keratin-1, KRT5, PUR8, TEX29, RIC8A, LANC2, Glyoxalase I, PGP, FBXL4, SLAF1, CASQ1.
105. The kit of claim 104, wherein N is at least 2, and wherein at least 2 of the capture reagents binds to a protein selected from Keratin-1, KRT5, PUR8, TEX29, RIC8A, LANC2, Glyoxalase I, PGP, FBXL4, SLAF1, CASQ1.
106. The kit of claim 104 or 105, wherein each of the capture reagents binds to a different protein.
107. The kit of any one of claims 104-106, wherein N is 2, N is 3, N is 4, N is 5, N is 6, N is 7, N is 8, N is 9, N is 10 or N is 11.
108. The kit of claim 107, wherein each of the capture reagents binds to a protein selected from Keratin-1, KRT5, PUR8, TEX29, RIC8A, LANC2, Glyoxalase I, PGP, FBXL4, SLAF1, CASQ1.
109. The kit of any one of claims 104-108, wherein each of the capture reagents is an antibody or an aptamer.
110. The kit of claim 109, wherein each capture reagent is an aptamer.
111. The kit of claim 110, wherein at least one aptamer is a slow off-rate aptamer.
112. The kit of claim 111, wherein at least one slow off-rate aptamer comprises at least 1, at least 2, at least 3, at least 4, at least 5, at least 6, at least 7, at least 8, at least 9, or at least 10 nucleotides with modifications.

113. The kit of claim 111 or claim 112, wherein each slow off-rate aptamer binds to its target protein with an off rate ($t_{1/2}$) of ≥ 30 minutes, ≥ 60 minutes, ≥ 90 minutes, ≥ 120 minutes, ≥ 150 minutes, ≥ 180 minutes, ≥ 210 minutes, or ≥ 240 minutes.

114. The kit of any one of claims 104-113, for use in detecting the N biomarker proteins in a sample from a subject.

115. The kit of claim 114, for use in assessing the quality of the sample based at least in part on the levels of the detected N biomarker proteins in the sample.

116. The kit of any one of claims 104-115, for use in determining the number of freeze-thaw cycles for the sample.

117. A method comprising detecting a level of each of N biomarker proteins in a sample, wherein N is at least 1, and wherein at least 1 of the N biomarker proteins is selected from Keratin-1, KRT5, PUR8, TEX29, RIC8A, LANC2, Glyoxalase I, PGP, FBXL4, SLAF1, CASQ1.

118. The method of claim 117, wherein the sample is a serum sample.

119. The method of claim 118, wherein the serum sample is a human serum sample.

120. The method of any one of claims 117-119, wherein a number of freeze-thaw cycles is determined with the level of each of the N biomarker proteins.

121. The method of claim 120, wherein the number of freeze-thaw cycles is determined to be greater than 1, greater than 2, greater than 3, greater than 4, greater than 5, greater than 7 or greater than 10 freeze-thaw cycles.

122. The method of claim 120 or 121, wherein the determined number of freeze-thaw cycles is derived from the input of the level of each of the N biomarker proteins in a statistical model.

123. The method of claim 122, wherein the statistical model is a linear regression model.

124. A method comprising detecting a level of each of at least 1, 2, 3, 4, 5, 6, 7, 8, 9, 10 or 11 biomarker proteins in a sample, wherein biomarker proteins are selected from Keratin-1, KRT5, PUR8, TEX29, RIC8A, LANC2, Glyoxalase I, PGP, FBXL4, SLAF1, CASQ1.

125. The method of claim 124, wherein the sample is a serum sample.

126. The method of claim 125, wherein the serum sample is a human serum sample.

127. The method of any one of claims 124-126, wherein a number of freeze-thaw cycles is determined with the level of each of the at least 1, 2, 3, 4, 5, 6, 7, 8, 9, 10 or 11 biomarker proteins.

128. The method of claim 127, wherein the number of freeze-thaw cycles is determined to be greater than 1, greater than 2, greater than 3, greater than 4, greater than 5, greater than 7 or greater than 10 freeze-thaw cycles.

129. The method of claim 127 or 128, wherein the determined number of freeze-thaw cycles is greater than 1, greater than 2, greater than 3, greater than 4, greater than 5, greater than 7 or greater than 10 freeze-thaw cycles is derived from the input of the level of at least 1, 2, 3, 4, 5, 6, 7, 8, 9, 10 or 11 biomarker proteins in a statistical model.

130. The method of claim 129, wherein the statistical model is a linear regression model.

131. The method of claim 129 or 130, further comprising modifying a panel of proteins in a protein biomarker discovery analysis, a protein expression level analysis, a diagnostic method or a prognostic method; identifying one or more proteins in the sample as being affected; identifying the level of one or more proteins in the sample as being affected; changing the proteins used in a diagnostic, a prognostic or a health assessment related test; or removing one or more proteins used in a diagnostic, a prognostic or a health assessment related test, each based on the outcome of the statistical model.