CLAIMS

1. A method of comparing the level of expression of at least two markers present in a biological sample obtained from a subject afflicted with a sarcoma, the method comprising:

comparing the level of expression of the at least two markers present in a first sample obtained from the subject prior to administering at least a portion of a therapy for treating a sarcoma in the subject, wherein the markers are selected from the group consisting of:

ANGPTL3, CCL2, CDH5, CXCL1, CXCL3, PRMT3, HDAC2, Nitric Oxide Synthase bNOS, Acetyl phospho Histone H3 AL9 S10, MTA 2, Glutamic Acid Decarboxylase GAD65 67, KSR, HDAC4, BOB1 OBF1, a1Syntrophin, BAP1, Importin-α5, Importin-α7, αE-Catenin, Grb2, Bax, Proteasome 26S subunit 13, Endophilin B1, Actin-like 6A, Eukaryotic Initiation Factor 4A11, Nuclear Chloride Channel protein, Proteasome 26S subunit, Dismutase Cu/Zn Superoxide, Translin-associated factor X, Arsenite translocating ATPase, Spermine synthetase, ribosomal protein SA, dCTP pyrophosphatase 1, proteasome beta 3, proteasome beta 4, acid phosphatase 1, diazepam binding inhibitor, alpha 2-HS glycoprotein, ribosomal protein P2 (RPLP2); histone H2A, microtubule associated protein, proteasome alpha 3, *eukaryotic translation elongation factor 1 delta*, *lamin B1*, *SMT 3, suppressor of mif two 3* homolog 2, heat shock protein 27kD, hnRNP C1/C2, eukaryotic translation elongation factor 1 beta 2, Similar to HSPC-300, DNA directed DNA polymerase epsilon 3, canopy 2 homolog, LAMA5, PXLDC1, p300 CBP, P53R2, Phosphatidylserine Receptor, Cytokeratin Peptide 17, Cytokeratin peptide 13, Neurofilament 160, Neurofilament 200, Rab5, Filensin, P53R2, MDM2, MSH6, Heat Shock Factor 2, AFX, FLIPg d, JAB 1, Myosine, MEKK4, cRaf pSer621, FKHR FOXO1a, MDM2, Fas Ligand, P53R2, Myosin Regulatory Light Chain, Ubiquilin 1, Phosphatase 2A, alpha 2-HS glycoprotein, beta actin, hnRNP C1/C2, heat shock protein 70kD, beta tubulin, ATP dependent helicase II, ER lipid raft associated 2 isoform 1, signal sequence receptor 1 delta, Eukaryotic translation initiation factor 3, subunit 3 gamma, Bilverdin reductase A, Transaldolase 1, Keratin 1, Keratin 10, Parathymosin, GST omega 1, chain B Dopamine Quinone Conjugation to Dj-1, Proteasome Activator Reg (alpha), T-complex protein 1 isoform A, Chain A Tapasin ERP57, Chaperonin containing TCP1, Ubiquitin activating enzyme E1, Alanyl-tRNA synthetase, Dynactin 1, Heat shock protein 60kd, Spermidine synthase, retinoblastoma binding protein 4 isoform A, TAR DNA binding protein, chaperonin containing TCP1, subunit 3, cytoplasmic dynein IC-2, Angiotensin-converting enzyme (ACE), Caspase 3, GARS, Matrix Metalloproteinase 6 (MMP-6), Neurolysin (NLN)-Catalytic Domain, and Neurolysin (NLN), ADRB, CEACAM1, DUSP4, FOXC2, FOXP3, GCGR, GPD1, HMOX1, IL4R, INPPL1, IRS2, VEGFA, putative c-myc-responsive isoform 1, PDK 1, Caspase 12, Phospholipase D1, P34 cdc2, P53 BP1, BTK, ASC2, BUBR1, ARTS, PCAF, Raf1, MSK1, SNAP25,

APRIL, DAPK, RAIDD, HAT1, PSF, HDAC1, Rad17, Survivin, SLIPR, MAG13, Caspase 10, Crk2, Cdc 6, P21 WAF 1 Cip 1, ASPP 1, HDAC 4, Cyclin B1, CD 40, GAD 65, TAP, Par4 (prostate apoptosis response 4), MRP1, MDC1, Laminin2 a2, bCatenin, FXR2, Annexin V, SMAC Diablo, MBNL1, Dimethyl Histone h3, Growth factor independence 1, U2AF65, mTOR, E2F2, Kaiso, Glycogen Synthase Kinase 3, ATF2, HDRP MITR, Neurabin I, AP1, and Apaf1; and the level of expression of the markers present in a second sample obtained from the subject following administration of at least a portion of the therapy, wherein a modulation in the level of expression of the markers in the second sample as compared to the first sample is an indication that the therapy is efficacious for treating the sarcoma in the subject.

2. A method of comparing the level of expression of at least two markers present in a biological sample obtained from a subject suspected of being afflicted with a sarcoma, the method comprising:

determining the level of expression of the at least two markers present in the biological sample obtained from the subject, wherein the markers are selected from the group consisting of the markers according to claim 1; and

comparing the level of expression of the markers present in the biological sample obtained from the subject with the level of expression of the markers present in a control sample,

wherein a modulation in the level of expression of the markers in the biological sample obtained from the subject relative to the level of expression of the markers in the control sample is an indication that the subject is afflicted with a sarcoma.

3. A method of comparing the level of expression of at least two markers present in a biological sample obtained from a subject, the method comprising:

determining the level of expression of the at least two markers present in the biological sample obtained from the subject, wherein the markers are selected from the group consisting of the markers according to claim 1; and

comparing the level of expression of the markers present in the biological sample obtained from the subject with the level of expression of the markers present in a control sample,

wherein a modulation in the level of expression of the markers in the biological sample obtained from the subject relative to the level of expression of the markers in the control sample is an indication that the subject is predisposed to developing a sarcoma.

4. A method of comparing the level of expression of at least two markers present in a biological sample obtained from a subject in remission after treatment of a sarcoma, the method comprising:

determining the level of expression of the at least two markers present in the biological sample obtained from the subject, wherein the markers are selected from the group consisting of the markers according to claim 1; and

comparing the level of expression of the markers present in the biological sample obtained from the subject with the level of expression of the markers present in a control sample,

wherein a modulation in the level of expression of the markers in the biological sample obtained from the subject relative to the level of expression of the markers in the control sample is an indication of the recurrence of the sarcoma.

5. A method of comparing the level of expression of at least two markers present in a biological sample obtained from a subject that has been treated for a sarcoma, the method comprising:

determining the level of expression of the at least two markers present in the biological sample obtained from the subject, wherein the markers are selected from the group consisting of the markers according to claim 1; and

comparing the level of expression of the markers present in the biological sample obtained from the subject with the level of expression of the markers present in a control sample,

wherein a modulation in the level of expression of the markers in the biological sample obtained from the subject relative to the level of expression of the markers in the control sample is an indication of survival of the subject.

6. A method of comparing the level of expression of at least two markers present in a biological sample obtained from a subject afflicted with a sarcoma, the method comprising:

comparing the level of expression of the at least two markers present in a first sample obtained from the subject prior to administering at least a portion of a therapy for treating a sarcoma to the subject and the level of expression of the markers present in a second sample obtained from the subject following administration of at least a portion of the therapy, wherein the markers are selected from the group consisting of the markers according to claim 1 .

7. A method of identifying a compound for treating a sarcoma in a subject, the method comprising:

contacting a biological sample obtained from a subject with a test compound;

determining the level of expression of at least two markers present in the biological sample obtained from the subject, wherein the at least two markers are selected from the group consisting of the markers according to claim 1 with a positive fold change or with a negative fold change;

comparing the level of expression of the at least two markers in the biological sample with a control; and

selecting a test compound that decreases the level of expression of the markers with a negative fold change present in the biological sample or increases the level of expression of the markers with a positive fold change present in the biological sample, thereby identifying a compound for treating the sarcoma in a subject.

8. The method of any one of claims 1-7, wherein the sarcoma is a type of sarcoma in Ewing's family of tumors.

9. The method of claim 8 wherein the type of sarcoma in Ewing's family of tumors is Ewing's sarcoma.

10. The method of any one of claims 1-7, wherein the sample comprises a fluid obtained from the subject.

11. The method of claim 10, wherein the fluid is selected from the group consisting of blood fluids, vomit, saliva, lymph, cystic fluid, urine, fluids collected by bronchial lavage, fluids collected by peritoneal rinsing, and gynecological fluids.

12. The method of claim 11, wherein the sample is a blood sample or a component thereof.

13. The method of any one of claims 1-7, wherein the sample comprises a tissue or component thereof obtained from the subject.

14. The method of claim 13, wherein the tissue is selected from the group consisting of bone, connective tissue, cartilage, lung, liver, kidney, muscle tissue, heart, pancreas, and skin.

15. The method of any one of claims 1-7, wherein the subject is a human.

16. The method of any one of claims 1-7, wherein the level of expression of the markers in the biological sample is determined by assaying a transcribed polynucleotide or a portion thereof in the sample.

17. The method of claim 16 wherein assaying the transcribed polynucleotide comprises amplifying the transcribed polynucleotide.

18. The method of any one of claims 1-7, wherein the level of expression of the markers in the subject sample is determined by assaying a protein or a portion thereof in the sample.

19. The method of claim 18 wherein the protein is assayed using an antibody and an antigen-binding antibody fragment which specifically binds with the protein.

20. The method of any one of claims 1-7, wherein the level of expression of the markers in the sample is determined using a technique selected from the group consisting of polymerase chain reaction (PCR) amplification reaction, reverse-transcriptase PCR analysis, single-strand conformation polymorphism analysis (SSCP), mismatch cleavage detection, heteroduplex analysis, Southern blot analysis, Northern blot analysis, Western blot analysis, in situ hybridization, array analysis, deoxyribonucleic acid sequencing, restriction fragment length polymorphism analysis, and combinations or subcombinations thereof, of said sample.

21. The method of any one of claims 1-7, wherein the level of expression of the markers in the sample is determined using a technique selected from the group consisting of immunohistochemistry, immunocytochemistry, flow cytometry, ELISA, and mass spectrometry.

22. The method of any one of claims 1-7, wherein the level of expression of at least four markers is determined.

23. The method of any one of claims 1, 5 or 6, wherein the subject is being treated with a therapy selected from the group consisting of an environmental influencer compound, surgery, radiation, hormone therapy, antibody therapy, therapy with growth factors, cytokines, chemotherapy, and allogenic stem cell therapy, wherein the environmental influencer compound is selected from the group consisting of a multidimensional intracellular molecule (MIM), an epimetabolic shifter (epi- shifter), a CoQ10 molecule, vitamin D3, acetyl Co-A, palmityl Co-A, L-carnitine, tyrosine, phenylalanine, cysteine, a small molecule, fibronectin, TNF-alpha, IL-5, IL-12, IL-23, an angiogenic factor, an apoptotic factor, and the combination thereof.

24. The method of claim 23 wherein the environmental influencer compound is a Coenzyme Q10 molecule.

25. A kit for assessing the efficacy of a therapy for treating a sarcoma, the kit comprising probes for determining the level of expression of at least two markers selected from the group consisting of the markers according to claim 1, wherein the probes are selected from the group consisting of RNA, DNA, proteins, and antibodies, and instructions for use of the kit to assess the efficacy of the therapy for treating the sarcoma.

26. A kit for assessing whether a subject is afflicted with a sarcoma, the kit comprising probes for determining the level of expression of at least two markers selected from the group consisting of the

markers according to claim 1, wherein the probes are selected from the group consisting of RNA, DNA, proteins, and antibodies, and instructions for use of the kit to assess whether the subject is afflicted with the sarcoma.

27. A kit for prognosing whether a subject is predisposed to developing a sarcoma, the kit comprising probes for determining the level of expression of at least two markers selected from the group consisting of the markers according to claim 1, wherein the probes are selected from the group consisting of RNA, DNA, proteins, and antibodies, and instructions for use of the kit to prognose whether the subject is predisposed to developing the sarcoma.

28. A kit for prognosing the recurrence of a sarcoma in a subject, the kit comprising probes for assessing the level of expression of at least two markers selected from the group consisting of the markers according to claim 1, wherein the probes are selected from the group consisting of RNA, DNA, proteins, and antibodies, and instructions for use of the kit to prognose the recurrence of the sarcoma.

29. A kit for prognosing the recurrence of a sarcoma, the kit comprising probes for determining the level of expression of at least two markers selected from the group consisting of the markers according to claim 1, wherein the probes are selected from the group consisting of RNA, DNA, proteins, and antibodies, and instructions for use of the kit to prognose the recurrence of the sarcoma.

30. A kit for prognosing the survival of a subject with a sarcoma, the kit comprising probes for determining the level of expression of at least two markers selected from the group consisting of the markers according to claim 1, wherein the probes are selected from the group consisting of RNA, DNA, proteins, and antibodies, and instructions for use of the kit to prognose the survival of the subject with the sarcoma.

31. A kit for monitoring the progression of a sarcoma in a subject, the kit comprising probes for determining the level of expression of at least two markers selected from the group consisting of the markers according to claim 1, wherein the probes are selected from the group consisting of RNA, DNA, proteins, and antibodies, and instructions for use of the kit to prognose the progression of the sarcoma in a subject.

32. The kit of any one of claims 25-31, further comprising tools for obtaining a biological sample from a subject.

33. The kit of any one of claims 25-31,further comprising a control sample.

34. The kit of any one of claims 25-31, wherein the probes for determining the level of expression of at least two markers comprise probes for assaying a transcribed polynucleotide or a portion thereof.

35. The kit of any one of claims 25-31, wherein the probes for determining the level of expression of at least two markers comprise probes for assaying a protein or a portion thereof.

36. The kit of any one of claims 25-31, further comprising an environmental influencer compound selected from the group consisting of a multidimensional intracellular molecule (MIM), an epimetabolic shifter (epi- shifter), a CoQ10 molecule, vitamin D3, acetyl Co-A, palmityl Co-A, L-carnitine, tyrosine, phenylalanine, cysteine, a small molecule, fibronectin, TNF-alpha, IL-5, IL-12, IL-23, an angiogenic factor, an apoptotic factor, and the combination thereof.

37. The kit of any one of claims 25-31, wherein the kit comprises probes for determining the level of expression of at least four markers, wherein the probes are selected from the group consisting of RNA, DNA, proteins, and antibodies.

CLAIMS

1. A method of comparing the level of expression of at least two markers present in a sarcoma cell sample obtained from a subject afflicted with a sarcoma, the method comprising:

comparing the level of expression of the at least two markers present in a first sarcoma cell sample obtained from the subject prior to administering at least a portion of a Coenzyme Q10 therapy for treating a sarcoma in the subject, wherein the markers are selected from the group consisting of:

ANGPTL3, CCL2, CDH5, CXCL1, CXCL3, PRMT3, HDAC2, Nitric Oxide Synthase bNOS, Acetyl phospho Histone H3 AL9 S10, MTA 2, Glutamic Acid Decarboxylase GAD65 67, KSR, HDAC4, BOB1 OBF1, a1Syntrophin, BAP1, αE-Catenin, Grb2, Bax, Proteasome 26S subunit 13, Endophilin B1, Actin-like 6A, Eukaryotic Initiation Factor 4A11, Nuclear Chloride Channel protein, Proteasome 26S subunit, Dismutase Cu/Zn Superoxide, Translin-associated factor X, Arsenite translocating ATPase Spermine synthetase, ribosomal protein SA, dCTP pyrophosphatase 1, proteasome beta 3, proteasome beta 4, acid phosphatase 1, diazepam binding inhibitor, alpha 2-HS glycoprotein, ribosomal protein P2 (RPLP2); histone H2A, microtubule associated protein, proteasome alpha 3, eukaryotic translation elongation factor 1 delta, lamin Bl, SMT 3, suppressor of mif two 3 homolog 2, heat shock protein 27kD, hnRNP C1/C2, eukaryotic translation elongation factor 1 beta 2, Similar to HSPC-300, DNA directed DNA polymerase epsilon 3 (canopy 2 homolog), LAMA5, PXLDC1, p300 CBP, P53R2, Phosphatidylserine Receptor, Cytokeratin Peptide 17, Cytokeratin peptide 13, Neurofilament 160, Neurofilament 200, Rab5, Filensin, P53R2, MDM2, MSH6, Heat Shock Factor 2, AFX, FLIPg d, JAB 1, Myosine, MEKK4, cRaf pSer621, FKHR FOXO1a, MDM2, Fas Ligand, P53R2, Myosin Regulatory Light Chain, hnRNP C1/C2, Ubiquilin 1 (Phosphatase 2A), alpha 2-HS glycoprotein, beta actin, heat shock protein 70kD, beta tubulin, ATP dependent helicase II, ER lipid raft associated 2 isoform 1, signal sequence receptor 1 delta, Eukaryotic translation initiation factor 3, subunit 3 gamma, Bilverdin reductase A, Transaldolase 1, Keratin 1, Keratin 10 Parathymosin, GST omega 1, chain B Dopamine Quinone Conjugation to Dj-1, Proteasome Activator Reg (alpha), T-complex protein 1 isoform A, Chain A Tapasin ERP57, Chaperonin containing TCPl, Ubiquitin activating enzyme E1; Alanyl-tRNA synthetase, Dynactin 1, Heat shock protein 60kd, Beta Actin, Spermidine synthase, retinoblastoma binding protein 4 isoform A, TAR DNA binding protein, eukaryotic translation elongation factor 1 beta 2, chaperonin containing TCP1, subunit 3, cytoplasmic dynein IC-2, Angiotensin-converting enzyme (ACE),

Caspase 3, GARS, Matrix Metalloproteinase 6 (MMP-6), Neurolysin (NLN)-Catalytic Domain, and Neurolysin (NLN), ADRB, CEACAM1, DUSP4, FOXC2, FOXP3, GCGR, GPD1, HMOX1, IL4R, INPPL1, IRS2, VEGFA, putative c-myc-responsive isoform 1, PDK 1, Caspase 12, Phospholipase D1, P34 cdc2, P53 BP1, BTK, ASC2, BUBR1, ARTS, PCAF, Raf1, MSK1, SNAP25, APRIL, DAPK, RAIDD, HAT1, PSF, HDAC1, Rad17, Surviving, SLIPR, MAG13, Caspase 10, Crk2, Cdc 6, P21 WAF 1 Cip 1, ASPP 1, HDAC 4, Cyclin B1, CD 40, GAD 65, TAP, Par4 (prostate apoptosis response 4), MRP1, MDC1, Laminin2 a2, bCatenin, FXR2, Annexin V, SMAC Diablo, MBNL1, Dimethyl Histone h3, Growth factor independence 1, U2AF65, mTOR, E2F2, Kaiso, Glycogen Synthase Kinase 3, ATF2, HDRP MITR, Neurabin I, AP1, and Apaf1; and the level of expression of the markers present in a second sarcoma cell sample obtained from the subject following administration of at least a portion of the therapy, wherein a modulation in the level of expression of the markers in the second sample as compared to the first sample is an indication that the therapy is efficacious for treating the sarcoma in the subject.

2. A method of comparing the level of expression of at least two markers present in a sarcoma cell sample obtained from a subject that has been treated for a sarcoma, the method comprising:

determining the level of expression of the at least two markers present in the sarcoma cell sample obtained from the subject, wherein the markers are selected from the group consisting of the markers according to claim 1; and

comparing the level of expression of the markers present in the sarcoma cell sample obtained from the subject with the level of expression of the markers present in a control sample,

wherein a modulation in the level of expression of the markers in the sarcoma cell sample obtained from the subject relative to the level of expression of the markers in the control sample is an indication of survival of the subject.

3. A method of comparing the level of expression of at least two markers present in a sarcoma cell sample obtained from a subject afflicted with a sarcoma, the method comprising:

comparing the level of expression of the at least two markers present in a first sarcoma cell sample obtained from the subject prior to administering at least a portion of a Coenzyme Q10

therapy for treating a sarcoma to the subject and the level of expression of the markers present in a second sarcoma cell sample obtained from the subject following administration of at least a portion of the therapy, wherein the markers are selected from the group consisting of the markers according to claim 1.

4. A method of identifying a compound for treating a sarcoma in a subject, the method comprising:

contacting a sarcoma cell sample obtained from a subject with a test compound;

determining the level of expression of at least two markers present in the sarcoma cell sample obtained from the subject, wherein the at least two markers are selected from the group consisting of the markers according to claim 1 with a positive fold change or with a negative fold change;

comparing the level of expression of the at least two markers in the ~~biological~~ sarcoma cell sample with a control; and

selecting a test compound that decreases the level of expression of the markers with a negative fold change present in the sarcoma cell sample or increases the level of expression of the markers with a positive fold change present in the sarcoma cell sample, thereby identifying a compound for treating the sarcoma in a subject.

5. The method of any one of claims 1-4, wherein the sarcoma is a type of sarcoma in Ewing's family of tumors.

6. The method of claim 5, wherein the type of sarcoma in Ewing's family of tumors is Ewing's sarcoma.

7. The method of any one of claims 1-4, wherein the subject is a human.

8. The method of any one of claims 1-4, wherein the level of expression of the markers in the biological sample is determined by assaying a transcribed polynucleotide or a portion thereof in the sample.

9. The method of claim 8, wherein assaying the transcribed polynucleotide comprises amplifying the transcribed polynucleotide.

10. The method of any one of claims 1-4, wherein the level of expression of the markers in the subject sample is determined by assaying a protein or a portion thereof in the sample.

11. The method of claim 10, wherein the protein is assayed using an antibody and an antigen-binding antibody fragment which specifically binds with the protein.

12. The method of any one of claims 1-4, wherein the level of expression of the markers in the sample is determined using a technique selected from the group consisting of polymerase chain reaction (PCR) amplification reaction, reverse-transcriptase PCR analysis, single-strand conformation polymorphism analysis (SSCP), mismatch cleavage detection, heteroduplex analysis, Southern blot analysis, Northern blot analysis, Western blot analysis, in situ hybridization, array analysis, deoxyribonucleic acid sequencing, restriction fragment length polymorphism analysis, and combinations or subcombinations thereof, of said sample.

13. The method of any one of claims 1-4, wherein the level of expression of the markers in the sample is determined using a technique selected from the group consisting of immunohistochemistry, immunocytochemistry, flow cytometry, ELISA, and mass spectrometry.

14. The method of any one of claims 1-4, wherein the level of expression of at least four markers is determined.

15. A kit for assessing the efficacy of a therapy for treating a sarcoma, the kit comprising probes for determining the level of expression of at least two markers selected from the group consisting of the markers according to claim 1, wherein the probes are selected from the group consisting of RNA, DNA, proteins, and antibodies, and instructions for use of the kit to assess the efficacy of the therapy for treating the sarcoma.

16. A kit for prognosing the survival of a subject with a sarcoma, the kit comprising probes for determining the level of expression of at least two markers selected from the group consisting of the markers according to claim 1, wherein the probes are selected from the group consisting of RNA, DNA, proteins, and antibodies, and instructions for use of the kit to prognose the survival of the subject with the sarcoma.

17. A kit for monitoring the progression of a sarcoma in a subject, the kit comprising probes for determining the level of expression of at least two markers selected from the group consisting of the markers according to claim 1, wherein the probes are selected from the group consisting of

RNA, DNA, proteins, and antibodies, and instructions for use of the kit to prognose the progression of the sarcoma in a subject.

18. The kit of any one of claims 15-17, further comprising tools for obtaining a sarcoma cell sample from a subject.

19. The kit of any one of claims 15-17, further comprising a control sample.

20. The kit of any one of claims 15-17, wherein the probes for determining the level of expression of at least two markers comprise probes for assaying a transcribed polynucleotide or a portion thereof.

21. The kit of any one of claims 15-17, wherein the probes for determining the level of expression of at least two markers comprise probes for assaying a protein or a portion thereof.

22. The kit of any one of claims 15-17, further comprising a CoQ10 molecule.

23. The kit of any one of claims 15-17, wherein the kit comprises probes for determining the level of expression of at least four markers, wherein the probes are selected from the group consisting of RNA, DNA, proteins, and antibodies.