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| GeneLab SOP for sample aliquoting, labeling and storage | Document No.: | GL-SOP-1.1 |
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| | Last revised by: | Valery Boyko |

Purpose/Scope:

This SOP describes in detail how GeneLab SPL handles sample storage, aliquoting, labeling and the consensus acronyms we use.

There's 3 sections for the SOP:

Section 1: Aliquoting and storage

Section 2: Labeling

Section 3: GeneLab abbreviation list

1. Section 1: Aliquoting and storage standardization

1.1. Tissue samples

Non GeneLab generated:

- Tissue aliquots received from a PI/collaborator/biorepository shall be stored in an original tube provided if it is intact and appropriate for the designated storage temperature.

GeneLab generated:

- Genelab generated tissues shall be aliquoted and stored in Brooks Life Science 2mL, 5mL or 7.8mL tubes or an acceptable alternative. Storage temperature of all tissue samples is -80°C.
- If RNAlater used as a preservative, the tube shall be at least 12X bigger than the tissue mass to allow for 10X volume of preservative and headroom. After the submersion of the tissue into RNAlater, sample should be stored at 4°C for 24 hours before transfer to -80°C freezer.

1.2. RNA/DNA samples

Once RNA/DNA is extracted and quantified, it should be aliquoted as following:

- Aliquot “0” – The remaining RNA/DNA sample after all aliquots were created. Stored in 0.5mL barcoded tube without a jacket from Brooks.
- Aliquot “1” – Designated for subsequent library preparation, shall contain 1.5uG of RNA/DNA sample in 17-18uL of RNase/DNase free water. Stored in 1.5ml snap cap tube.
- Aliquot “2” – Shall have 1.5uG of RNA/DNA. Stored in 0.5mL barcoded tube without a jacket from Brooks.
- Aliquot “3” – Shall have 1.5uG of RNA/DNA. Stored in 0.5mL barcoded tube without a jacket from Brooks.
- Aliquot “4” – Shall have 1.5uG of RNA/DNA. Stored in 0.5mL barcoded tube without a jacket from Brooks.

If total amount of RNA/DNA extracted is below 7.5uG, number of generated aliquots can be reduced.

If DNA is not to be processed and used for library preparation in the near future, it is acceptable to generate Aliquot “0” only.

All RNA/DNA vials should be stored at -80°C.

Samples received from a PI/collaborator/biorepository shall be stored in an original tube provided if it is intact and appropriate for the designated storage temperature.

1.3. Sequencing libraries and library pools

- Libraries should be stored in a non-stick/low DNA binding tubes or plates.
- Sequencing libraries shall be stored at -20°C for up to 6 months after generation.
For longer storage, it is advised to transfer libraries to -80°C storage right after the sequencing is completed. If a library needs to be re-sequenced, a re-quantification and an iSeq run are required to assess the library quality.
- Multiplexed libraries can be stored for 6-12 weeks.

2. Section 2: Label standardization

2.1. For all labels, only use freezer tested labels to avoid peeling. If using untested material, label the tube both in writing and with a label.

2.2. If incorporation of color coding is possible:

2.2.1. Use **BLUE** label/tape for DNA

2.2.2. Use **YELLOW** label/tape for RNA

2.3. Human readable side labeling format with example following

“Study _ Treatment/Group _ Source-id _ Sample-id _ Extract-id _ Aliquot-number”

Example: second aliquot of DNA sample extracted from the left eye tissue sample dissected from mouse number G5 as was part of Rodent Research 1 mission in Ground Control group will have the following printed on it’s side label:

RR1_GC_G5_LEYE_DNA_ALQ-2

2.4. Human readable top labeling format with example following

“Aliquot number”

“Source-id”

“Sample-id”

“Extract-id”

Example:

2

G5

L EYE

DNA

- If a microcentrifuge tube is used, write the aliquot number on the connecting part of the tube (see example image below):



2.5. Barcode side label

- 2.5.1. Affix the label in a way that will facilitate scanning, 1D barcode should be oriented lengthwise on the sample tube.

2.6. Barcode top/bottom label

- 2.6.1. Use Datamatrix (2D) format for top or bottom of the tube labeling.

2.7. Cryobox/SBS Rack Labeling Procedure

- 2.7.1. All boxes must be labeled with the following information:

“Study-id”

“Sample-id”

“Extract-id”

“Box Number”

“Storage Temp”

Example:

RR-5

Skin

DNA

Box 5

-80°C

- 2.7.2. Make sure to erase all previous writing on the box.

- 2.7.3. It is preferred to label the box on 2 opposite sides.

2.8. Preferred labeling type

- 2.8.1. Tissue samples – Barcode and human readable

- 2.8.2. RNA/DNA samples:

Aliquot “0” – Barcode and human readable

Aliquot “1” – Barcode and human readable

Aliquot “2” – Barcode and human readable

Aliquot “3” – Barcode and human readable

Aliquot “4” – Barcode and human readable

2.8.3. Sequencing libraries and library pools - Barcode and human readable.

2.9. Use of Brady BMP55 for label printing

2.10. Use of Brooks Life Science Solutions FluidX IntelliXmark for label printing

2.11. Use of Brady CR2600 hand held scanner for tube scanning

2.12. Use of Brooks Life Science Solutions Preception HD LF for tube scanning

2.13. Integration with Genohm SLIMS

3. Section 3: GeneLab Sample Abbreviations

Abbreviation list is frequently updates. For the most current version refer to: *URL*

| Abbreviation | Definition |
|---------------------|--|
| 1D11 | Antibody that binds to TGFB and thus inhibits function |
| 1G | 1x gravity |
| 2D | cells grown in 2D condition |
| 2G | 2x gravity |
| 2T3cells | osteoblast cell line 2T3 |
| 3D | cells grown in 3D condition |
| 3DCoC | 3D co-culture model |
| 4T1-Tumor | Flank tumor derived from the 4T1 murine mammary carcinoma cell line that was generated from a BALB/cfC3H mouse |
| 28Si | Si 28 isotope |
| 56Fe | Iron isotope |

| Abbreviation | Definition |
|------------------|---|
| 168 | Strain of <i>Bacillus subtilis</i> |
| AB | Strain of <i>Danio rerio</i> |
| ACF | Animal Care Facility |
| act | activated |
| act2-3 | <i>Arabidopsis thaliana</i> vegetative actin mutant |
| ADR | Adrenal Glands |
| ADR | Adrenal Gland |
| AG01522 | human fibroblasts AG01522 cells |
| AG1522 | a normal human foreskin fibroblast cell line |
| AHSFS | air handling system filter screen of ISS |
| AJ-Jms-Slc | A/J Jms mice from Japan Slc, Inc |
| Alight | specimen grown in Ambient light |
| ALLCL | acute lymphoblastic leukemia cell line |
| ALQ | Aliquot |
| ALSDA | Ames Life Science Data Archive |
| aposym | aposymbiotic |
| ARG1-KO | <i>A. thaliana</i> Col-0 knock-out line deficient in the gene encoding Altered response to gravity-1 |
| Asyn | Asynchronous cells, cells in various phases of cell cycle |
| AT | Adipose Tissue |
| Atha | <i>Arabidopsis thaliana</i> |
| ATM1 | mutant defective in the DSB-sensing protein kinase ATM |
| B6.129S2KrasL A1 | B6.129S2- <i>Kras</i> ^{tm2Tyj} /Nci Mouse strain - This strain carries a targeted latent 'hit-and-run' K-ras allele that can be activated by an in vivo spontaneous recombination event ('run'). One half of the in vivo recombination events result in a normal K-ras allele and one half in an activated allele (K-rasG12D). |
| B# | mouse number from a basal group |

| Abbreviation | Definition |
|--------------|--|
| BA1 | BRIC A PDFU-1 |
| BA2 | BRIC A PDFU-2 |
| BA3 | BRIC A PDFU-3 |
| BA4 | BRIC A PDFU-4 |
| BA5 | BRIC A PDFU-5 |
| BAL-JL | BALB/c mouse from Jackson Laboratory |
| BAL-SL | BALB/c mouse from Simonsen Labs |
| BAL-TAL | BALB/c mouse from Taconic Animal Laboratory |
| Batr | <i>Bacillus atrophaeus</i> |
| BB2 | BRIC B PDFU-2 |
| BB3 | BRIC B PDFU-3 |
| BB4 | BRIC B PDFU-4 |
| BB5 | BRIC B PDFU-5 |
| Bbas | Beauveria bassiana |
| BG1 | BRIC G PDFU-1 |
| BG2 | BRIC G PDFU-2 |
| BG3 | BRIC G PDFU-3 |
| bildisMCL | bilateral disruption of the medial collateral ligament |
| blank | no DNA or RNA added to extraction kit |
| BLD | Blood - we may want to revisit this - Whole Blood (WB), White Blood Cells (WBCs), Red Blood Cells (RBCs) |
| ble | bleomycin |
| BM | bone marrow |
| BMCs | bone marrow cells |
| BMSC | Bone Marrow Stromal Cells |
| Brap | <i>Brassica rapa</i> |

| Abbreviation | Definition |
|----------------|--|
| BRN | Brain |
| BSL | baseline (or basal) control for a spaceflight experiment - subjects from the same cohort as a spaceflight experiment that are processed at the start of a spaceflight experiment to establish the initial condition of the experimental subjects |
| BSP | Biospecimen Sharing Program |
| Bsub | Bacillus subtilis |
| BY4742 | Strain of Saccharomyces cerevisiae |
| BY4742_FLO1 | S. cerevisiae strain BY4742 over-expressing the FLO1 member of the Flo adhesin protein family |
| BY4742_FLO8 | S. cerevisiae strain BY4742 over-expressing the FLO8 member of the Flo adhesin protein family |
| C | dissected from frozen carcass |
| C | Celsius |
| C3H-He-Slc | C3H/He mice from Japan Slc, Inc. |
| C3H-HeJ | C3H Heston mouse from Jackson Labs (aka C3H/HeJ) |
| C57-6 | C57BL/6 mouse from an unknown origin |
| C57-6CR | C57BL/6 mouse from Charles River |
| C57-6IBCh | C57BL/6 mouse from Shemyakin & Ovchinnikov Institute of Bioorganic Chemistry, Russia |
| C57-6J | C57BL/6 mouse from Jackson Labs |
| C57-6J-Jms-Slc | C57BL/6J Jms mice from Japan Slc, Inc. |
| C57-6T | C57BL/6 mouse from Taconic Biosciences |
| C57-10J | C57BL/10J mouse from Jackson Labs |
| C# | Cohort Number |
| Cab | wild type Cab strain of Oryzias latipes (Japanese medaka fish) |
| Can-S | Canton-Special (strain of Drosophila melanogaster) |
| cax1-1 | describes cax1-1 transgenic line of Arabidopsis thaliana |
| Cb | cerebellum |

| Abbreviation | Definition |
|---------------|--|
| CC | Cohort Control |
| Cele | Caenorhabditis elegans |
| cells | material type - cell line |
| cGy | centigray |
| Clinorotation | Clinorotation |
| CLN | Colon |
| cls | plant callus |
| CO2 | Carbon Dioxide |
| Col-0 | Arabidopsis thaliana Columbia-0 ecotype |
| Col-0-PhyD | Columbia ecotype with a mutation in phytochrome D (PhyD) |
| CPCs | Cardiac progenitor cells |
| CRCCCL | colorectal cancer cell line |
| Cs137 | Caesium-137 isotope |
| CTRL | control group for a space-relevant (but NOT spaceflight) experiment |
| CTRLSet | control set of animals (or samples) processed/preserved in a given day of operations |
| Cvi-0 | Cape Verde Islands - 0 (Arabidopsis thaliana) ecotype, species variant 98 |
| CyroC | Cyrochiller |
| D | Dorsal |
| d | day (time) |
| dark | specimen grown in darkness |
| dhfq | isogenic hfq deletion mutant |
| DI | Dry Ice |
| DIN | DNA integrity number |
| DLD-1 | DLD-1 cells epithelial, adherent cell line derived from a colorectal adenocarcinoma (Dukes type C) |

| Abbreviation | Definition |
|--------------|--|
| Dmel | Drosophila melanogaster |
| DNA | Deoxyribonucleic acid |
| do | days old |
| Drer | Danio rerio |
| DSKN | Dorsal Skin |
| dT | delta (change in) Temperature |
| Ecol | Escherichia coli |
| EDL | Extensor Digitorum Longus |
| EMF | treated with electromagnetic fields |
| Epi200MT | 3-dimensional tissue model of human epidermis, MatTek Corporation, Ashland, MA |
| Esco | Euprymna scolopes |
| Etsl | Etiolated seedlings - after further review I think "etiolation" should be made into standalone factor |
| Euth | Euthasol |
| ext1 | RNA was extracted the same day organs were dissected from frozen carcasses |
| ext2 | Organs were dissected from frozen carcasses, flash frozen in (l)N2 and stored at -80C then RNA was extracted on a later date |
| EYE | Eye |
| F | Femoral |
| F# | mouse number from a spaceflight group |
| FBC | fibroblasts cells |
| FCS | Feces |
| FirstSet | first set of animals (or samples) processed/preserved in a given day of operations |
| FLT | spaceflight |
| FNR | Fast Neutron Radiation |

| Abbreviation | Definition |
|--------------|--|
| FourthSet | fourth set of animals (or samples) processed/preserved in a given day of operations |
| FS | Freezing Study |
| FSKN | Femoral Skin |
| G1 | G1 phase of cell cycle |
| G2 | G2 phase of cell cycle |
| G# | mouse number from a ground control group |
| GC | ground control for a spaceflight experiment - mimics the environmental conditions, timeline, and equipment used for the spaceflight samples |
| GF | Glovebox Freezer |
| GM15036 | Lymphoblastoid Cell Line GM15036 |
| GM15510 | Lymphoblastoid Cell Line GM15510 |
| Gspe | Genus species |
| GST | Gastrocnemius |
| Gy | Gray |
| h | hour (Time) |
| HARV | high-aspect-ratio rotating wall vessel bioreactors |
| HBECs | human bronchial epithelial cells |
| HBF | hyper-buoyancy flotation (used for bed-rest study) |
| HEBC3KT | a human bronchial epithelial cell line |
| HF | Hair Follicles |
| HG | hypergravity http://bioportal.bioontology.org/ontologies/MESH?p=classes&conceptid=D018471 |
| Hi-LET | High Linear Energy Transfer |
| HIR | Heavy Ion Radiation |
| HLLC | hind limb loaded control |
| HLU | hind limb unloading (aka hindlimb suspension) |

| Abbreviation | Definition |
|------------------|--|
| Hml-Gal4-UAS-GFP | Hemolentin-GAL4 crossed with UAS-GFP to make a transgenic line in Dmel |
| HMVEC-dBL | Human dermal microvascular endothelial cells |
| Hsap | Homo sapiens |
| HSFA2-KO | a knockout Arabidopsis thaliana line deficient in the gene encoding HSFA2 |
| HT1080 | a human fibrosarcoma cell line |
| HT-29 | human colorectal adenocarcinoma cell line with epithelial morphology |
| HUVEC | Cells derived from the endothelium of veins from the umbilical cord |
| Hypocotyl | hypocotyl |
| HypocotylCC | Hypocotyl cell culture (a cell culture derived from the hypocotyl part of the plant) |
| HZE | High (H) Charge (Z) and Energy (E) HZE ionizing radiation |
| I | dissected immediately after euthanasia |
| IMR90iPSCs | induced pluripotent stem cells derived from the IMR90 human cell line |
| In-FLT-CTRL | In-flight Control |
| infdw | infected with |
| inFLT | in spaceflight (describes condition in which sample was collected) |
| InsP-5-ptase | transgenic Arabidopsis thaliana (Columbia-0) plants constitutively express the mammalian type I inositol polyphosphate 5-phosphatase (InsP 5-ptase) |
| INT | Intestines |
| IR | Irradiation |
| IRC | Irradiation Control - No mock IR was performed, i.e. subjects were not exposed to IR nor an IR set-up |
| IsoCTRL | Isotype control - primary antibodies that lack specificity to the target, but match the class and type of the primary antibody used in the application |
| ISS | International Space Station |
| ISS-T | ISS Terminal Animal |
| ITS | Fungal amplicon sequence |

| Abbreviation | Definition |
|--------------|--|
| JAXA | Japan Aerospace Exploration Agency |
| JC | JAXA Chow |
| JCwFOS | JAXA Chow fortified with fructooligosaccharides (FOS) |
| JkTcells | Jurkat T cells |
| K-12MG1655 | strain (of E. coli) K-12 MG1655 |
| KDN | Kidney |
| KDN | Kidney |
| Ket-Xyl | Ketamine/Xylazine |
| kPa | kilopascals |
| KSC | Kennedy Space Center |
| L | Left |
| Lac | Lactating |
| LAR | Live Animal Return |
| LC | Laboratory control - may refer to a control group or groups grown under standard laboratory conditions and processed to test an aspect(s) of spaceflight experimental parameters |
| LCL | Lymphoblastoid Cell Line |
| LD | longissimus dorsi muscle |
| LDC | Large Diameter Centrifuge |
| Ler-0 | Landsberg ecotype |
| leu | Leukocytes |
| LHM4 | Strain of Mycobacterium marinum |
| LLC | Lewis lung carcinoma |
| LLU | Loma Linda University |
| Lminus | Launch minus (usually followed by a time frame, for example Lminus30d means 30 days before launch) |
| LN2 | Liquid nitrogen |

| Abbreviation | Definition |
|--------------|---|
| LNG | Lung |
| LO | Light Organ |
| LoopG | Loop Genomics |
| Low-LET | Low Linear Energy Transfer |
| Lplus | Launch plus (usually followed by a time frame, for example Lplus30d means 30 days after launch) |
| LPS | lipopolysaccharide |
| lpup | late pupae - may want to revisit. combining time/development and organism part |
| LS292 | C.elegans strain representing a dys1(cx18) mutant |
| LSDA | Life Science Data Archive |
| ltdO2 | limited Oxygen |
| lvCMC | left ventricular cardiomyocytes |
| LVR | liver |
| MCC | MidiCAR centrifuge |
| MCF10Acells | MCF10A cells - human mammary epithelial cells |
| MCL | medial collateral ligament |
| MG | Mammary Gland |
| MgSO4 | magnesium sulfate |
| MHU | Mouse Habitat Unit (JAXA mouse habitat unit) |
| min | minute |
| MIX1 | ERCC Spike In mix 1 |
| MIX2 | ERCC Spike In mix 2 |
| ML | Magnetic Levitator |
| MM2d | Arabidopsis thaliana MM2d cell line |
| Mmar | Mycobacterium marinum |
| Mmus | Mus musculus |

| Abbreviation | Definition |
|--------------|--|
| MOLT-4 | MOLT-4 cell line T lymphoblast, suspension cell line derived from an acute lymphoblastic leukemia |
| mon | month |
| MSCs | Mesenchymal Stem Cells |
| MUT | mutant |
| N2 | Bristol N2 (C.elegans strain) |
| NCTC-86 | strain (of E. coli) NCTC 86; ATCC 4157 |
| nipp | <i>nipposinica</i> (variant of <i>Brassica rapa</i>) |
| Node3 | node 3 of ISS |
| NODT | no change in Temperature |
| nonact | non-activated |
| noODNCpG | adjuvant treatment control (animals were not treated with ODNCpG, just the solution used to dilute the ODNCpG) |
| normO2 | normal Oxygen levels |
| noSx | no surgery |
| not-ind | not induced |
| noTT | tetanus toxoid control (animals were not treated with tetanus toxoid, just the solution used to dilute the tetanus toxoid) |
| nSMK | non-Smoker |
| NuRFB | Nutrient Upgraded Rodent Food Bar |
| OD | Optical Density |
| ODNCpG | adjuvant treatment of a synthetic oligodeoxynucleotide (ODN) containing unmethylated CpG motifs (CpG) |
| Olat | <i>Oryzias latipes</i> |
| oLDC | outside the Large Diameter Centrifuge |
| oML | outside the Magnetic Levitator |
| OR | Oregon R (Fruit Fly strain) |

| Abbreviation | Definition |
|--------------|---|
| oRPoM | outside the Random Positioning Machine |
| os-ind | osteo-induced |
| OVY | Ovary or Ovaries |
| PA01 | PAO1 strain - <i>Pseudomonas aeruginosa</i> |
| Paer | <i>Pseudomonas aeruginosa</i> |
| PAS | passive aerosol sample |
| PBLD | Peripheral Blood |
| PBLs | peripheral blood lymphocytes |
| PBMCs | peripheral blood mononuclear cells |
| PC | pipette centrifuge |
| PCar | Partial Carcass (i.e. the samples was extracted from a carcass that had one or more part(s) removed) |
| pFLT | parabolic flight |
| pGC | ground control for parabolic flight (i.e. samples were grown/processed in the same equipment as those in the pFLT groups) |
| PhaB | Pharyngeal Bones |
| pip2Dclino | 2D pipette clinostat |
| pipcent | pipette centrifuge |
| post-IR | describes sample post irradiation |
| post-Sham | describes sample post sham |
| postFLT | post spaceflight (describes condition in which sample was collected) |
| preFLT | pre spaceflight (describes condition in which sample was collected) |
| Preg | Pregnant |
| PRT | Protein |
| PTN-OSF1 | transgenic mice overexpressing the osteogenic factor PTN/OSF1 |
| Quad | Quadricep |

| Abbreviation | Definition |
|--------------|---|
| R | Right |
| R1 | Forward Read |
| R2 | Reverse Read |
| RAD51 | RAD51 gene |
| RAW2647cells | RAW 264.7 cell line |
| RBCs | Red Blood Cells |
| RCCS | Rotary Cell Culture System |
| Rep | replicate |
| RIN | RNA integrity number |
| RL | re-loaded - subjects re-exposed to limb/body loading |
| RLT | RNeasy Lysis Buffer |
| Rminus | Return minus (usually followed by a time frame, for example Rminus30d means 30 days before return to earth) |
| RNA | Ribonucleic acid |
| RNAlat | RNA later |
| Rnor | Rattus norvegicus |
| Rotation | rotation |
| Rplus | Return plus (usually followed by a time frame, for example Rplus30d means 30 days after return to earth) |
| RPoM | Random Positioning Machine |
| RR | Rodent Research |
| RTN | Retina |
| RWV | Rotating Wall Vessel |
| RWV-H | Rotating Wall Vessel in horizontal direction |
| RWV-V | Rotating Wall Vessel in vertical direction |
| S288C | strain of <i>Saccharomyces cerevisiae</i> |

| Abbreviation | Definition |
|--------------|--|
| S-UHRR | Stratagene Universal Human Reference RNA |
| Saur | Staphylococcus aureus |
| Scer | Saccharomyces cerevisiae |
| SDR | Sprague Dawley Rats |
| SDR-TF | Sprague Dawley Rats from Taconic Farms |
| SecondSet | second set of animals (or samples) processed/preserved in a given day of operations |
| Sham | type of control sample |
| shamIR | mock irradiation (i.e. subject to irradiation equipment but not exposed to irradiation) |
| shamSx | sham surgery |
| Si | Silicon isotope |
| SIEVd | sieved dust |
| SKN | Skin |
| sl | seedling |
| SL1344 | Salmonella enterica subsp. enterica serovar Typhimurium strain SL1344 |
| sl-pool | pool of 2 or more whole seedlings |
| SLS | Soleus |
| SM | Skeletal Muscle |
| SMK | Smoker - not to be confused with Super Mario Kart |
| Smut | Streptococcus mutans |
| soFLT | suborbital ballistic rocket flight |
| soGC | ground control for suborbital ballistic rocket flight (i.e. samples were grown/processed in the same equipment as those in the soFLT groups) |
| SP | spleen pool - spleens from 2 or more animals pooled together to make one sample |
| SPL | spleen |
| ss-tissues | tissues that underwent size selection during library prep (after extraction) |

| Abbreviation | Definition |
|--------------|--|
| sShoots | seedling shoots - will probably change. |
| Styp | Salmonella typhimurium |
| suG | simulated microgravity |
| suppO2 | supplemented with Oxygen |
| Sx | surgery |
| sym | symbiotic |
| T | tesla (magnetic field unit) |
| TA | Tibialis Anterior |
| Tcells | T cells |
| TES | Testis or Testes |
| TGFB | Tumor Growth Factor Beta |
| TGFB-Het | TGFBeta-Heterozygote |
| TGFP-ODsRed | Oryzias latipes (Japanese medaka) F1 fish of two closed colonies; Japanese medaka wild type Cab and Cab strain transgenic fish (TRAP:GFP, Osterix:DsRed) |
| ThirdSet | third set of animals (or samples) processed/preserved in a given day of operations |
| tissues | more than 1 tissue from 1 animal was pooled |
| TK6cells | TK6 Lymphoblast Cell Line |
| TKSC | Tsukuba Space Center (JAXA) |
| TLCs | T lymphocyte cells |
| TMS | Thymus |
| TNG | tongue |
| TNR | Thermal Neutron Radiation |
| TRHLLC | tail restrained hind limb loaded control |
| Trp53N-MG | Trp53 null mammary gland |
| Trp53N-MGT | Trp53 null mammary gland tumor |

| Abbreviation | Definition |
|--------------|--|
| TT | tetanus toxoid (treatment with tetanus toxoid) |
| tumor | tumor |
| U937 | human macrophage cell line established from a diffuse histiocytic lymphoma |
| UAMS-1 | Strain of Staphylococcus aureus |
| UdCC | undifferentiated cell culture |
| uG | microgravity |
| ug-mL | concentration in micrograms per milliliter |
| UHRR | Universal Human Reference RNA |
| um | micrometer |
| UMRR | Universal Mouse Reference RNA |
| uninf | uninfected |
| URR | Universal Reference RNA |
| V | Ventral |
| V# | mouse number from a vivarium group |
| VIV | vivarium control for a spaceflight experiment - same timeline and subjects as the spaceflight experiment but housed under standard laboratory conditions |
| VL | vastus lateralis |
| WB | whole blood |
| WBCs | White Blood Cells |
| WCar | Whole Carcass (i.e. the sample was extracted from an intact carcass) |
| wk | week (Time) |
| WN624 | Strain of Bacillus subtilis |
| WN1106 | Strain of Bacillus subtilis |
| wo | whole organism |
| Ws | Wassilewskija (Arabidopsis thaliana) ecotype, species variant 382 |
| Ws-0 | Wassilewskija-0 (Arabidopsis thaliana) ecotype, species variant 391 |

| Abbreviation | Definition |
|--------------|---|
| Ws-2 | Wassilewskija-2 (<i>Arabidopsis thaliana</i>) ecotype, species variant 393 |
| WT | wild-type |
| X-ray | X-ray irradiation |
| y | year(s) |
| yo | years old |
| YR | Gamma Radiation |
| Zone-I | region of root apex: 0.5 mm, root cap and meristematic zone |
| Zone-II | region of root apex: 1.5 mm, transition, elongation and growth terminating zone |