Miltenyi Biotec

Reference list

gentleMACS™ Dissociators, Tubes, and Reagent Kits

The gentleMACS™ Dissociators are a family of benchtop instruments designed for automated and standardized dissociation, homogenization, and *ex vivo* perfusion of various tissues. Viable single-cell suspensions or intact organelles are efficiently obtained using our unique C Tubes in combination with our extraction buffers or tissue-specific enzyme kits, respectively. Thorough homogenates are easily achieved with our specialized M Tubes and optimized programs. Additionally, *ex vivo* perfusion can be performed using gentleMACS Perfusers to extract viable fragile cells. After processing, samples can be used for any cellular and molecular downstream analysis.

With several thousand publications citing gentleMACS Technology, our devices have proven to be the most trusted tissue dissociators among scientists and researchers, assisting in multiple ways, such as:

- Efficiently generate suspensions of viable single cells and intact cell organelles in a fast, standardized, and automated way.
- Eliminate the variability introduced by manual techniques and ensure reproducible results across researchers and settings.
- Ensure high-quality results in every experiment with ready-to-use tissue-specific kits that contain highly active, lot-to-lot consistent enzymes, and optimized buffer solutions.
- Preserve cellular composition and surface epitopes with gentle and optimized protocols designed for the perfect balance between mechanical shearing and enzymatic digestion.
- Minimize cross-contamination, and reduce handling risks with single-use, sterile consumables.

We have compiled a reference list of selected recent publications using our products. This list highlights how our products contribute to cutting-edge research and reflects their reliability, effectiveness, and recognition by scientists worldwide.

Tissue dissociation

Human tumor

Tumor Dissociation kit, human (130-095-929)

Dissociation of the human endometrial metastasis biopsies into single cells for single-cell (sc) sequencing
Cassier, P. A. *et al.* (2023) Netrin-1 blockade inhibits tumour growth and EMT features in endometrial cancer. Nature 620: 409–416.
https://doi.org/10.1038/s41586-023-06367-z

Dissociation of human gastric tissue biopsies into single cells for scRNA sequencing
Huang, K. K. *et al.* (2023) Spatiotemporal genomic profiling of intestinal metaplasia reveals clonal dynamics of gastric cancer progression. Cancer Cell 41: 2019–2037.e8.
https://doi.org/10.1016/j.ccell.2023.10.004

Dissociation of high-grade serous ovarian carcinoma tissue into single cells for scRNA sequencing
Denisenko, E. *et al.* (2024) Spatial transcriptomics reveals discrete tumour microenvironments and autocrine loops within ovarian cancer subclones. Nat. Commun. 15: 2860.
https://doi.org/10.1038/s41467-024-47271-y

Dissociation of human glioblastoma tumor into single cells for *in vitro* sc-radiotracing and flow cytometry
Bartos, L. M. *et al.* (2023) Deciphering sources of PET signals in the tumor microenvironment of glioblastoma at cellular resolution. Sci. Adv. 9: eadi8986.
https://doi.org/10.1126/sciadv.adi8986

Dissociation of the melanoma tumor tissues for flow cytometry and tumor-infiltrating lymphocyte (TIL) studies
Bennion, D. *et al.* (2024) $CD8^+$ T cell-derived Fgl2 regulates immunity in a cell-autonomous manner via ligation of FcγRIIB. Nat. Commun. 15: 5280
https://doi.org/10.1038/s41467-024-49475-8

Dissociation of the gastric adenocarcinoma into single cells for scRNA sequencing
Kumar, V. *et al.* (2022) Single-cell atlas of lineage states, tumor microenvironment, and subtype-specific expression programs in gastric cancer. Cancer Discov. 12: 670–691.
https://doi.org/10.1158/2159-8290.CD-21-0683

Dissociation of human ovarian tumor tissue into single cells for scRNA sequencing
Vázquez-García, I. *et al.* (2022) Ovarian cancer mutational processes drive site-specific immune evasion.
Nature 612: 778–786.
https://doi.org/10.1038/s41586-022-05496-1

Xenograft tumor

Tumor Dissociation Kit, human (130-095-929)

Dissociation of the melanoma xenograft into single cells to enrich human tumor cells for cell culture
Yaeger, R. *et al.* (2024) A next-generation BRAF inhibitor overcomes resistance to BRAF inhibition in patients with BRAF-mutant cancers using pharmacokinetics-informed dose escalation. Cancer discovery 14: 1599–1611.
https://doi.org/10.1158/2159-8290.CD-24-0024

Dissociation of the human malignant peripheral nerve sheath tumor-derived xenografts into single cells for flow cytometry
Larsson, A. T. *et al.* (2023) *Ex vivo* to *in vivo* model of malignant peripheral nerve sheath tumors for precision oncology.
Neuro. Oncol. 25: 2044–2057.
https://doi.org/10.1093/neuonc/noad097

Dissociation of human breast cancer-derived xenograft and organoid into single cells for scRNA sequencing
Guillen, K. P. *et al.* (2022) A human breast cancer-derived xenograft and organoid platform for drug discovery and precision oncology. Nat. Cancer. 3: 232–250.
https://doi.org/10.1038/s43018-022-00337-6

Dissociation of human pancreatic ductal adenocarcinoma-derived xenograft into single cells for cell culture
Cameron, D. P. *et al.* (2023) Coinhibition of topoisomerase 1 and BRD4-mediated pause release selectively kills pancreatic cancer via readthrough transcription. Sci. Adv. 9: eadg5109.
https://doi.org/10.1126/sciadv.adg5109

Dissociation of human small cell lung cancer-derived xenografts into single cells for scRNA sequencing
Stanzione, M. *et al.* (2022) Translesion DNA synthesis mediates acquired resistance to olaparib plus temozolomide in small cell lung cancer. Sci. Adv. 8: eabn1229.
https://doi.org/10.1126/sciadv.abn1229

Mouse tumor

Tumor Dissociation Kit, mouse (130-096-730)

Dissociation of the murine tumor tissue into single cells for flow cytometry
Váraljai, R. *et al.* (2023) Interleukin 17 signaling supports clinical benefit of dual CTLA-4 and PD-1 checkpoint inhibition in melanoma [published correction in Nat. Cancer. 2023; 4: 1395. doi: 10.1038/s43018-023-00632-w]. Nat. Cancer. 4: 1292–1308.
https://doi.org/10.1038/s43018-023-00610-2

Dissociation of the murine tumor tissue into single cells to isolate tumor cells for RNA sequencing
Liu, H. J. *et al.* (2023) mTORC1 upregulates B7-H3/CD276 to inhibit antitumor T cells and drive tumor immune evasion.
Nat. Commun. 14: 1214.
https://doi.org/10.1038/s41467-023-36881-7

Dissociation of murine tumor into single cells to analyze tumor-infiltrating immune cells by scRNA sequencing
Sun, Y. *et al.* (2023) Targeting TBK1 to overcome resistance to cancer immunotherapy. Nature 615: 158–167.
https://doi.org/10.1038/s41586-023-05704-6

Dissociation of murine tumor into single cells for flow cytometry
Moynihan, K. D. *et al.* (2024) IL2 targeted to $CD8^+$ T cells promotes robust effector T-cell responses and potent antitumor immunity. Cancer Discov. 14: 1206–1225.
https://doi.org/10.1158/2159-8290.CD-23-1266

Dissociation of murine tumor into single cells to isolate tumor cells to generate cell line and scRNA sequencing
Wu, M. J. *et al.* (2022) Mutant IDH inhibits IFNγ-TET2 signaling to promote immunoevasion and tumor maintenance in cholangiocarcinoma. Cancer Discov. 12: 812–835.
https://doi.org/10.1158/2159-8290.CD-21-1077

Dissociation of murine tumor into single cells to analyze tumor immune cells by flow cytometry
Huang, L. *et al.* (2022) Engineered exosomes as an *in situ* DC-primed vaccine to boost antitumor immunity in breast cancer. Mol. Cancer 21: 45.
https://doi.org/10.1186/s12943-022-01515-x

Brain tumor

Brain Tumor Dissociation Kit (P) (130-095-942)

Dissociation of the metastatic lesions of murine brain into single cells for scRNA sequencing
Monteiro, C. *et al.* (2022) Stratification of radiosensitive brain metastases based on an actionable S100A9/RAGE resistance mechanism. Nat. Med. 28: 752–765.
https://doi.org/10.1038/s41591-022-01749-8

Dissociation of the murine brain tumor into single cells for scRNA sequencing
Sanchez-Aguilera, A. *et al.* (2023) Machine learning identifies experimental brain metastasis subtypes based on their influence on neural circuits. Cancer Cell 41: 1637–1649.e11.
https://doi.org/10.1016/j.ccell.2023.07.010

Dissociation of the murine brain tumor into single cells for flow cytometry
Chen, X. *et al.* (2023) IDH1 mutation impairs antiviral response and potentiates oncolytic virotherapy in glioma.
Nat. Commun. 14: 6781.
https://doi.org/10.1038/s41467-023-42545-3

Dissociation of the murine brain tumor into single cells for flow cytometry
Wu, L. *et al.* (2024) Tumour microenvironment programming by an RNA-RNA-binding protein complex creates a druggable vulnerability in IDH-wild-type glioblastoma.
Nat. Cell Biol. 26: 1003–1018.
https://doi.org/10.1038/s41556-024-01428-5

Dissociation of the human brain tumor into single cells for cytometry by time of flight (CyTOF)
Alanio, C. *et al.* (2022) Immunologic features in *de novo* and recurrent glioblastoma are associated with survival outcomes. Cancer Immunol. Res. 10: 800–810.
https://doi.org/10.1158/2326-6066.CIR-21-1050

Adult brain

Adult Brain Dissociation Kit, mouse and rat (130-107-677)

Dissociation of murine hippocampal tissue into single cells for bulk RNA sequencing
Zhang, J. R. *et al.* (2024) Augmented microglial endoplasmic reticulum-mitochondria contacts mediate depression-like behavior in mice induced by chronic social defeat stress. Nat. Commun. 15: 5199.
https://doi.org/10.1038/s41467-024-49597-z

Dissociation of murine adult brain into single cells to isolate oligodendrocytes and microglia
Schlett, J. S. *et al.* (2023). NF-κB is a critical mediator of post-mitotic senescence in oligodendrocytes and subsequent white matter loss. Molecular neurodegeneration 18: 24.
https://doi.org/10.1186/s13024-023-00616-5

Dissociation of murine brain into single cells to isolate microglia, astrocytes, and neurons for flow cytometry
Zatcepin, A. *et al.* (2024) Regional desynchronization of microglial activity is associated with cognitive decline in Alzheimer's disease. Mol. Neurodegener. 19: 64.
https://doi.org/10.1186/s13024-024-00752-6

Dissociation of the murine brain into single cells to isolate astrocyte for scRNA sequencing
Shigetomi, E. *et al.* (2024) Disease-relevant upregulation of $P2Y_1$ receptor in astrocytes enhances neuronal excitability via IGFBP2. Nat. Commun. 15: 6525.
https://doi.org/10.1038/s41467-024-50190-7

Dissociation of murine brain into single cells to isolate neuronal and non-neuronal cell fractions for flow cytometry
Hammerschmidt, P. *et al.* (2023) CerS6-dependent ceramide synthesis in hypothalamic neurons promotes ER/mitochondrial stress and impairs glucose homeostasis in obese mice. Nat. Commun. 14: 7824.
https://doi.org/10.1038/s41467-023-42595-7

Lung

Lung Dissociation Kit, mouse (130-095-927)

Dissociation of murine lung into single cells for flow cytometry analysis.
Li, B. *et al.* (2023) Combinatorial design of nanoparticles for pulmonary mRNA delivery and genome editing. Nat. Biotechnol. 41: 1410–1415.
https://doi.org/10.1038/s41587-023-01679-x

Dissociation of murine lung into single cells for fluorescence-activated cell sorting and tagmentation-based whole-genome bisulfite sequencing (T-WGBS)
Chen, Y. *et al.* (2022) Club cells employ regeneration mechanisms during lung tumorigenesis. Nat. Commun. 13: 4557.
https://doi.org/10.1038/s41467-022-32052-2

Dissociation of murine lung into single cells for analysis of macrophage infiltration by flow cytometry
Günes Günsel, G. *et al.* (2022) The arginine methyltransferase PRMT7 promotes extravasation of monocytes resulting in tissue injury in COPD. Nat. Commun. 13: 1303.
https://doi.org/10.1038/s41467-022-28809-4

Dissociation of murine lung into single cells for flow cytometry and scRNA sequencing
Shin, M. *et al.* (2022) Intratracheally administered LNA gapmer antisense oligonucleotides induce robust gene silencing in mouse lung fibroblasts. Nucleic Acids Res. 50: 8418–8430.
https://doi.org/10.1093/nar/gkac630

Dissociation of murine lung to isolate regulatory T cells and determine virus titer by plaque assay
Koch-Heier, J. *et al.* (2024) MEK-inhibitor treatment reduces the induction of regulatory T cells in mice after influenza A virus infection. Front. Immunol. 15: 1360698.
https://doi.org/10.3389/fimmu.2024.1360698

Liver

Liver Dissociation Kit, mouse (130-105-807)

Dissociation of murine liver into single cells for flow cytometry
Uehara, K. *et al.* (2022) Targeted delivery to macrophages and dendritic cells by chemically modified mannose ligand-conjugated siRNA. Nucleic Acids Res. 50: 4840–4859.
https://doi.org/10.1093/nar/gkac308

Dissociation of murine liver into single cells for flow cytometry
Hočevar, S. *et al.* (2022) PEGylated gold nanoparticles target age-associated B cells *in vivo*. ACS Nano. 16: 18119–18132.
doi:10.1021/acsnano.2c04871
https://doi.org/10.1021/acsnano.2c04871

Dissociation of murine liver into single cells to isolate hepatic endothelial cells for ELISA assay
Große-Segerath, L., *et al.* (2024) Identification of myeloid-derived growth factor as a mechanically-induced, growth-promoting angiocrine signal for human hepatocytes. Nat. Commun. 15: 1076.
https://doi.org/10.1038/s41467-024-44760-y

Dissociation of murine liver into single cells for fluorescence-activated cell sorting
Fujimoto, M. *et al.* (2022) Liver group 2 innate lymphoid cells regulate blood glucose levels through IL-13 signaling and suppression of gluconeogenesis. Nat. Commun. 13: 5408.
https://doi.org/10.1038/s41467-022-33171-6

Dissociation of murine liver into single cells to isolate liver sinusoidal endothelial cells for fluorescence-activated cell sorting
Eberhard, D. *et al.* Semaphorin-3A regulates liver sinusoidal endothelial cell porosity and promotes hepatic steatosis. (2024) Nat. Cardiovasc. Res. 3: 734–753.
https://doi.org/10.1038/s44161-024-00487-z

Liver Perfusion Kit, mouse and rat (130-128-030)

Ex vivo perfusion of murine liver to isolate hepatocyte for flow cytometry and scRNA sequencing
Nikopoulou, C. *et al.* (2023) Spatial and single-cell profiling of the metabolome, transcriptome and epigenome of the aging mouse liver. Nat. Aging. 3: 1430–1445.
https://doi.org/10.1038/s43587-023-00513-y

Ex vivo perfusion of murine liver to isolate hepatocyte for cell culture and immunostaining
Poggel, C. *et al.* (2022) Isolation of hepatocytes from liver tissue by a novel, semi-automated perfusion technology. Biomedicines. 10: 2198.
https://doi.org/10.3390/biomedicines10092198

Ex vivo perfusion of murine liver to isolate liver intrahepatic immune cells
Conceição-Neto, N. *et al.* (2023) Sustained liver HBsAg loss and clonal T- and B-cell expansion upon therapeutic DNA vaccination require low HBsAg levels. Vaccines. 11: 1825.
https://doi.org/10.3390/vaccines11121825

Ex vivo perfusion of murine liver to isolate intrahepatic lymphocytes
Van Gulck, E. *et al.* (2024) Retreatment with HBV siRNA results in additional reduction in HBV antigenemia and immune stimulation in the AAV-HBV mouse model. Viruses. 16: 347.
https://doi.org/10.3390/v16030347

Ex vivo perfusion of murine liver to isolate hepatocyte and non-parenchymal cells
De Pooter, D. *et al.* (2024) Robust isolation protocol for mouse leukocytes from blood and liver resident cells for immunology research. PLoS One. 19: e0304063.
https://doi.org/10.1371/journal.pone.0304063

Neural tissue

Neural Tissue Dissociation Kit (P) (130-092-628)

Dissociation of murine brain into single cells to isolate and culture oligodendrocytes
Andreadou, M., *et al.* (2023) IL-12 sensing in neurons induces neuroprotective CNS tissue adaptation and attenuates neuroinflammation in mice. Nat. Neurosci. 26: 1701–1712.
https://doi.org/10.1038/s41593-023-01435-z

Dissociation of stroke-injured or uninjured murine brain into single cells for fluorescence-activated cell sorting and scRNA sequencing
Scott, E. Y. *et al.* (2024) Integrating single-cell and spatially resolved transcriptomic strategies to survey the astrocyte response to stroke in male mice. Nat. Commun. 15: 1584.
https://doi.org/10.1038/s41467-024-45821-y

Dissociation of murine brain into single cells to isolate microglia for flow cytometry
Arbaizar-Rovirosa, M. *et al.* (2023) Aged lipid-laden microglia display impaired responses to stroke.
EMBO Mol. Med. 15: e17175.
https://doi.org/10.15252/emmm.202217175

Dissociation of murine brain into single cells to isolate microglia for mass spectrometry
Pesämaa, I. *et al.* (2023) A microglial activity state biomarker panel differentiates FTD-granulin and Alzheimer's disease patients from controls. Mol. Neurodegener. 18: 70.
https://doi.org/10.1186/s13024-023-00657-w

Dissociation of murine brain into single cells for cell sorting and flow cytometry
Arbaizar-Rovirosa, M. *et al.* (2023) Transcriptomics and translatomics identify a robust inflammatory gene signature in brain endothelial cells after ischemic stroke.
J. Neuroinflammation. 20: 207.
https://doi.org/10.1186/s12974-023-02888-6

Neural Tissue Dissociation Kit (T) (130-093-231)

Dissociation of subependymal zone of murine brain into single cells for flow cytometry and cell sorting
Domingo-Muelas, A. *et al.* (2023) Post-transcriptional control of a stemness signature by RNA-binding protein MEX3A regulates murine adult neurogenesis. Nat. Commun. 14: 373.
https://doi.org/10.1038/s41467-023-36054-6

Dissociation of murine brain into single cells for flow cytometry and image stream analysis
Cai, W. *et al.* (2022) Neuroprotection against ischemic stroke requires a specific class of early responder T cells in mice.
J. Clin. Invest. 132: e157678.
https://doi.org/10.1172/JCI157678

Dissociation of murine spinal cord into single cells for flow cytometry
Xiong, W. *et al.* (2022) Treg cell-derived exosomes miR-709 attenuates microglia pyroptosis and promotes motor function recovery after spinal cord injury. J. Nanobiotechnology. 20: 529.
https://doi.org/10.1186/s12951-022-01724-y

Dissociation of murine brain into single cells for flow cytometry and scRNA sequencing
Zhang, Y. *et al.* (2023) Novel CH25H^{+} and OASL^{+} microglia subclusters play distinct roles in cerebral ischemic stroke.
J. Neuroinflammation. 20: 115.
https://doi.org/10.1186/s12974-023-02799-6

Dissociation of murine brain into single cells for flow cytometry
Lu, J. *et al.* (2023) Age-related alterations in peripheral immune landscape with magnified impact on post-stroke brain.
Research. 6: 0287.
https://doi.org/10.34133/research.0287

Neural Tissue Dissociation Kit - Postnatal Neurons (130-094-802)

Dissociation of murine brain into single cells to isolate neurons for neuron-glioma co-culture and synaptic puncta assays
Taylor, K. R. *et al.* (2023) Glioma synapses recruit mechanisms of adaptive plasticity. Nature 623: 366–374.
https://doi.org/10.1038/s41586-023-06678-1

Dissociation of murine brain into single cells to isolate microglia and astrocytes for cell culture and quantitative real time PCR (qRT-PCR)
Wang, T. *et al.* (2024) Dimethyl fumarate improves cognitive impairment and neuroinflammation in mice with Alzheimer's disease. J. Neuroinflammation 21: 55.
https://doi.org/10.1186/s12974-024-03046-2

Dissociation of murine brain into single cells to isolate and culture primary neurons
Ortega-Pineda, L. *et al.* (2022) Designer extracellular vesicles modulate pro-neuronal cell responses and improve intracranial retention. Adv. Healthc. Mater. 11: e2100805.
https://doi.org/10.1002/adhm.202100805

Dissociation of murine brain into single cells to isolate and culture primary neurons
Weesner, J. A. *et al.* (2024) Altered GM1 catabolism affects NMDAR-mediated Ca^{2+} signaling at ER-PM junctions and increases synaptic spine formation in a GM1-gangliosidosis model. Cell Rep. 43: 114117.
https://doi.org/10.1016/j.celrep.2024.114117

Dissociation of murine spinal cord into single cells to isolate microglia for qPCR and scRNA sequencing
Komine, O. *et al.* (2024) Genetic background variation impacts microglial heterogeneity and disease progression in amyotrophic lateral sclerosis model mice. iScience. 27: 108872.
https://doi.org/10.1016/j.isci.2024.108872

Neurosphere Dissociation Kit (P) (130-095-943)

Dissociation of developing human eyes and neural retina samples into single cells for scRNA and ATAC sequencing
Dorgau, B. *et al.* (2024) Single-cell analyses reveal transient retinal progenitor cells in the ciliary margin of developing human retina. Nat. Commun. 15: 3567.
https://doi.org/10.1038/s41467-024-47933-x

Dissociation of cultured human striatal organoids into single cells for scRNA sequencing
Chen, X. *et al.* (2022) Human striatal organoids derived from pluripotent stem cells recapitulate striatal development and compartments. PLoS Biol. 20: e3001868.
https://doi.org/10.1371/journal.pbio.3001868

Dissociation of retinal organoids for scRNA sequencing, cell cycle phase distribution analysis, and soft agar colony formation assay
Rozanska, A. *et al.* (2022) pRB-depleted pluripotent stem cell retinal organoids recapitulate cell state transitions of retinoblastoma development and suggest an important role for pRB in retinal cell differentiation. Stem Cells Transl. Med. 11: 415–433.
https://doi.org/10.1093/stcltm/szac008

Dissociation of retinal organoids into single cells for scRNA sequencing
Dorgau, B. *et al.* (2022) Human retinal organoids provide a suitable tool for toxicological investigations: A comprehensive validation using drugs and compounds affecting the retina. Stem Cells Transl. Med. 11: 159–177.
https://doi.org/10.1093/stcltm/szab010

Dissociation of retinal organoids into single cells for scRNA sequencing
Chichagova, V. *et al.* (2023) Incorporating microglia-like cells in human induced pluripotent stem cell-derived retinal organoids. J. Cell Mol. Med. 27: 435–445.
https://doi.org/10.1111/jcmm.17670

Spleen

Spleen Dissociation Kit, mouse (130-095-926)

Dissociation of murine spleen into single cells for flow cytometry
Thisted, T. *et al.* (2024) VISTA checkpoint inhibition by pH-selective antibody SNS-101 with optimized safety and pharmacokinetic profiles enhances PD-1 response. Nat. Commun. 15: 2917.
https://doi.org/10.1038/s41467-024-47256-x

Dissociation of bat spleen into single cells to isolate splenocytes and axillary lymph node for flow cytometry
Guito, J. C. *et al.* (2024) Coordinated inflammatory responses dictate Marburg virus control by reservoir bats. Nat. Commun. 15: 1826.
https://doi.org/10.1038/s41467-024-46226-7

Dissociation of murine spleen into single cells for flow cytometry and *ex vivo* splenocyte restimulation
Atalis, A. *et al.* (2022) Nanoparticle-delivered TLR4 and RIG-I agonists enhance immune response to SARS-CoV-2 subunit vaccine. J. Control. Release. 347: 476–488.
https://doi.org/10.1016/j.jconrel.2022.05.023

Dissociation of murine spleen into single cells for flow cytometry
Hesemans, E. *et al.* (2023) Cu-doped TiO_2 nanoparticles improve local antitumor immune activation and optimize dendritic cell vaccine strategies. J. Nanobiotechnology. 21: 87.
https://doi.org/10.1186/s12951-023-01844-z

Dissociation of murine spleen into single cells to identify splenic hematopoietic cells by flow cytometry
Rodriguez-Muñoz, D. *et al.* (2022) Hypothyroidism confers tolerance to cerebral malaria. Sci. Adv. 8: eabj7110.
https://doi.org/10.1126/sciadv.abj7110

Lamina propria

Lamina Propria Dissociation Kit, mouse (130-097-410)

Dissociation of murine small intestine into single cells to isolate lymphocytes for flow cytometry
Glaubitz, J. *et al.* (2023) Activated regulatory T-cells promote duodenal bacterial translocation into necrotic areas in severe acute pancreatitis. Gut. 72: 1355–1369.
https://doi.org/10.1136/gutjnl-2022-327448

Dissociation of murine colonic and small intestinal lamina propria into single cells to isolate lymphocytes for flow cytometry
Steimle, A. *et al.* (2024) Gut microbial factors predict disease severity in a mouse model of multiple sclerosis. Nat. Microbiol. 9: 2244–2261.
https://doi.org/10.1038/s41564-024-01761-3

Dissociation of murine ilea and colon into single cells to isolate lamina propria cells for CyTOF
Parrish, A. *et al.* (2023) *Akkermansia muciniphila* exacerbates food allergy in fibre-deprived mice. Nat. Microbiol. 8: 1863–1879.
https://doi.org/10.1038/s41564-023-01464-1

Dissociation of murine intestinal tissue to isolate lamina propria mononuclear cells for flow cytometry and RNA extraction
Schmalzl, A. *et al.* (2022) Interferon regulatory factor 1 (IRF-1) promotes intestinal group 3 innate lymphoid responses during *Citrobacter rodentium* infection. Nat. Commun. 13: 5730.
https://doi.org/10.1038/s41467-022-33326-5

Dissociation of murine large intestine into single cells to isolate intestinal leukocyte for cell sorting and flow cytometry
Dittmar, D. J. *et al.* (2024) Donor regulatory T cells rapidly adapt to recipient tissues to control murine acute graft-versus-host disease. Nat. Commun. 15: 3224.
https://doi.org/10.1038/s41467-024-47575-z

Whole skin

Whole Skin Dissociation Kit, human (130-101-540)

Dissociation of human skin into single cells for flow cytometry and massively parallel single-cell RNA sequencing (MARS)
Gur, C. *et al.* (2022) LGR5 expressing skin fibroblasts define a major cellular hub perturbed in scleroderma. Cell 185: 1373–1388.e20.
https://doi.org/10.1016/j.cell.2022.03.011

Dissociation of human skin biopsy into single cells for scRNA sequencing
Francis, L. *et al.* (2024) Single-cell analysis of psoriasis resolution demonstrates an inflammatory fibroblast state targeted by IL-23 blockade. Nat. Commun. 15: 913.
https://doi.org/10.1038/s41467-024-44994-w

Dissociation of human skin into single cells to isolate $CD4^+$ and $CD4^-$ cells for bioanalytical methods
Herrera, C. *et al.* (2023) Dose finding study for on-demand HIV pre-exposure prophylaxis for insertive sex in sub-Saharan Africa: results from the CHAPS open label randomised controlled trial. EBioMedicine 93: 104648.
https://doi.org/10.1016/j.ebiom.2023.104648

Dissociation of cryopreserved human skin into single cells for scRNA sequencing
Liu, T. *et al.* (2024) Spatial transcriptomics identifies cellular and molecular characteristics of scleroderma skin lesions: pilot study in juvenile scleroderma. Int. J. Mol. Sci. 25: 9182.
https://doi.org/10.3390/ijms25179182

Dissociation of human diseased and healthy skin into single cells for scRNA sequencing
Werner, G. *et al.* (2023) Single-cell transcriptome analysis identifies subclusters with inflammatory fibroblast responses in localized scleroderma. Int. J. Mol. Sci. 24: 9796.
https://doi.org/10.3390/ijms24129796

Neonatal heart

Neonatal Heart Dissociation Kit, mouse and rat (130-098-373)

Dissociation of neonatal murine heart into single cells to isolate and culture neonatal cardiomyocytes
Liu, Y. *et al.* (2024) Reprogramming the myocardial infarction microenvironment with melanin-based composite nanomedicines in mice. Nat. Commun. 15: 6651.
https://doi.org/10.1038/s41467-024-50854-4

Dissociation of murine heart into single cells to isolate endothelia and fibroblast cells for RNA sequencing
Shamseddine, A. *et al.* (2023) Innate immune signaling drives late cardiac toxicity following DNA-damaging cancer therapies. J. Exp. Med.220: e20220809.
https://doi.org/10.1084/jem.20220809

Dissociation of murine heart into single cells for scRNA sequencing
Shao, Y. *et al.* (2024) ATF3 coordinates the survival and proliferation of cardiac macrophages and protects against ischemia-reperfusion injury. Nat. Cardiovasc. Res. 3: 28–45.
https://doi.org/10.1038/s44161-023-00392-x

Dissociation of murine left heart ventricle into single cells for cell sorting and scRNA sequencing
Bak, S. T. *et al.* (2023) Ploidy-stratified single cardiomyocyte transcriptomics map zinc finger E-box binding homeobox 1 to underly cardiomyocyte proliferation before birth. Basic Res. Cardiol. 118: 8.
https://doi.org/10.1007/s00395-023-00979-2

Dissociation of murine neonatal heart into single cells to culture primary cardiomyocyte
Hashimoto, K. *et al.* (2024) Loss of connectin novex-3 leads to heart dysfunction associated with impaired cardiomyocyte proliferation and abnormal nuclear mechanics. Sci. Rep.14: 13727.
https://doi.org/10.1038/s41598-024-64608-1

Skeletal muscle

Skeletal Muscle Dissociation Kit, mouse and rat (130-098-305)

Dissociation of murine tibialis anterior muscle into single cells for flow cytometry
McNamara, S. L. *et al.* (2023) Anti-inflammatory therapy enables robot-actuated regeneration of aged muscle. Sci. Robot. 8: eadd9369.
https://doi.org/10.1126/scirobotics.add9369

Dissociation of murine hind limb into single cells to isolated endothelial cells from skeletal muscle
Bartoli, F. *et al.* (2022) Endothelial Piezo1 sustains muscle capillary density and contributes to physical activity. J. Clin. Invest. 132: e141775.
https://doi.org/10.1172/JCI141775

Dissociation of murine muscle into single cells to isolate fibro/adipogenic progenitor cells for cell culture
Aykul, S. *et al.* (2022) Anti-ACVR1 antibodies exacerbate heterotopic ossification in fibrodysplasia ossificans progressiva (FOP) by activating FOP-mutant ACVR1. J. Clin. Invest. 132: e153792.
https://doi.org/10.1172/JCI153792

Dissociation of human skeletal muscle biopsies into single cells for flow cytometry
Wüst, R. *et al.* (2022) Efficient co-isolation of microvascular endothelial cells and satellite cell-derived myoblasts from human skeletal muscle. Front. Bioeng. Biotechnol. 10: 964705.
https://doi.org/10.3389/fbioe.2022.964705

Dissociation of murine hindlimb into single cells to isolate primary myogenic progenitor cell for cell culture
Burke, B. I. *et al.* (2023) ApoE isoform does not influence skeletal muscle regeneration in adult mice. Front. Physiol. 14: 1302695.
https://doi.org/10.3389/fphys.2023.1302695

Umbilical cord

Umbilical Cord Dissociation Kit, human (130-105-737)

Dissociation of human placenta into single cells for scRNA sequencing
Garcia-Flores, V. *et al.* (2022) Maternal-fetal immune responses in pregnant women infected with SARS-CoV-2. Nat. Commun. 13: 320.
https://doi.org/10.1038/s41467-021-27745-z

Dissociation of human placenta into single cells for scRNA sequencing
Garcia-Flores, V. *et al.* (2023) Preparation of single-cell suspensions from the human placenta. Nat. Protoc. 18: 732–754. *https://doi.org/10.1038/s41596-022-00772-w*

Dissociation of human umbilical cord into single cells for flow cytometry
Beckenkamp, L. R. *et al.* (2024) Manufacturing parameters for the creation of clinical-grade human-induced pluripotent stem cell lines from umbilical cord mesenchymal stromal cells. Stem Cells Transl. Med. 13: 454–461. *https://doi.org/10.1093/stcltm/szae010*

Dissociation of murine uterus and decidua into single cells for scRNA sequencing
Garcia-Flores, V. *et al.* (2023) A single-cell atlas of murine reproductive tissues during preterm labor. Cell Rep. 42: 111846. *https://doi.org/10.1016/j.celrep.2022.111846*

Dissociation of human placenta into single cells for scRNA sequencing
Yang, J. *et al.* (2023) Single-cell RNA-seq reveals developmental deficiencies in both the placentation and the decidualization in women with late-onset preeclampsia. Front. Immunol. 14:1142273. *https://doi.org/10.3389/fimmu.2023.1142273*

Adipose tissue

Adipose Tissue Dissociation Kit, mouse and rat (130-105-808)

Dissociation of murine perivascular adipose tissue into single cells to isolate PVAT-derived preadipocyte for cell culture
Adachi, Y. *et al.* (2022) Beiging of perivascular adipose tissue regulates its inflammation and vascular remodeling. Nat. Commun. 13: 5117. *https://doi.org/10.1038/s41467-022-32658-6*

Dissociation of murine inguinal white adipose tissue into single cells for scRNA sequencing, mass cytometry, and flow cytometry
Sinton, M. C. *et al.* (2023) IL-17 signalling is critical for controlling subcutaneous adipose tissue dynamics and parasite burden during chronic murine *Trypanosoma brucei* infection [published correction in Nat. Commun. 2024; 15: 1833. doi: 10.1038/s41467-024-46299-4]. Nat. Commun. 14: 7070. *https://doi.org/10.1038/s41467-023-42918-8*

Dissociation of murine gonadal white adipose tissue into single cells for flow cytometry
Moon, S. *et al.* (2024) Interleukin-2 improves insulin sensitivity through hypothalamic sympathetic activation in obese mice. J. Neuroinflammation. 21: 250. *https://doi.org/10.1186/s12974-024-03244-y*

Dissociation of murine adipose tissue into single cells to isolate immune cell population for microarray analysis of microRNAs
Kiran, S. *et al.* (2023) miR-10a-3p modulates adiposity and suppresses adipose inflammation through TGF-β1/Smad3 signaling pathway. Front. Immunol. 14: 1213415. *https://doi.org/10.3389/fimmu.2023.1213415*

Dissociation of rat subcutaneous white adipose tissue into single cells to isolate and culture adipose-derived mesenchymal regenerative cells
Kavaliunaite, E. *et al.* (2024) A single injection of ADRCs does not prevent AAA formation in rats in a randomized blinded design. Int. J. Mol. Sci. 25: 7591. *https://doi.org/10.3390/ijms25147591*

Embryoid bodies

Embryoid Body Dissociation Kit, human and mouse (130-096-348)

Dissociation of human pluripotent stem cells (hPSCs) derived cell clusters into single cells for fluorescence-activated cell sorting and cell culture
Majid, Q. A. *et al.* (2024) Generation and characterisation of scalable and stable human pluripotent stem cell-derived microvascular-like endothelial cells for cardiac applications. Angiogenesis. 27: 561–582. *https://doi.org/10.1007/s10456-024-09929-5*

Dissociation of ovaroids into single cells for scRNA sequencing
Pierson Smela, M. D. *et al.* (2023) Directed differentiation of human iPSCs to functional ovarian granulosa-like cells via transcription factor overexpression [published correction in Elife. 2023;12: e87987. doi: 10.7554/eLife.87987]. Elife. 12: e83291. *https://doi.org/10.7554/eLife.83291*

Dissociation of embryoid bodies into single cells for flow cytometry
Kobayashi, M. *et al.* (2022) Expanding homogeneous culture of human primordial germ cell-like cells maintaining germline features without serum or feeder layers. Stem Cell Reports. 17: 507–521. *https://doi.org/10.1016/j.stemcr.2022.01.012*

Dissociation of embryoid bodies into single cells for culture and flow cytometry
Aurigemma, I. *et al.* (2024) Endothelial gene regulatory elements associated with cardiopharyngeal lineage differentiation. Commun. Biol. 7: 351. *https://doi.org/10.1038/s42003-024-06017-8*

Dissociation of spheroid into single cells for cell culture
Meiser, I. *et al.* (2023) Application-oriented bulk cryopreservation of human iPSCs in cryo bags followed by direct inoculation in scalable suspension bioreactors for expansion and neural differentiation. Cells 12: 1914. *https://doi.org/10.3390/cells12141914*

Epidermal tissue

Epidermis Dissociation Kit ACF, human (130-103-464)

Epidermis Dissociation Kit ACF, mouse (130-095-928)

Dissociation of murine fresh wound tissues into single cells for scRNA sequencing
Yang, Y. *et al.* (2023) Tracing immune cells around biomaterials with spatial anchors during large-scale wound regeneration [published correction in Nat. Commun. 2023, 14: 6240. doi: 10.1038/s41467-023-42118-4]. Nat. Commun. 14: 5995. *https://doi.org/10.1038/s41467-023-41608-9*

Dissociation of murine fresh wound tissues into single cells for scRNA sequencing
Li, X. *et al.* (2024) TLR9 activation in large wound induces tissue repair and hair follicle regeneration via γδT cells. Cell Death Dis. 15: 598.
https://doi.org/10.1038/s41419-024-06994-y

Dissociation of healthy murine skin into single cells to isolate and culture skin cells
Schmidt, A. *et al.* (2023) Short- and long-term polystyrene nano- and microplastic exposure promotes oxidative stress and divergently affects skin cell architecture and Wnt/beta-catenin signaling. Part. Fibre Toxicol. 20: 3.
https://doi.org/10.1186/s12989-023-00513-1

Dissociation of mouse skin into single cells to isolate primary skin cells for cell culture
Schmidt, A. (2024) Gas plasma exposure alters microcirculation and inflammation during wound healing in a diabetic mouse model. Antioxidants 13: 68.
https://doi.org/10.3390/antiox13010068

Dissociation of fresh human skin into single cells for scRNA sequencing
Zou, D. D. *et al.* (2023) Single-cell sequencing highlights heterogeneity and malignant progression in actinic keratosis and cutaneous squamous cell carcinoma. Elife 12: e85270.
https://doi.org/10.7554/eLife.85270

Dissociation of human abdominal skin tissue into single cells to isolate keratinocytes for cell culture and immunofluorescence staining
Hermann, M. *et al.* (2023) Secretome of adipose-derived stem cells cultured in platelet lysate improves migration and viability of keratinocytes. Int. J. Mol. Sci. 24: 3522.
https://doi.org/10.3390/ijms24043522

Dissociation of human skin into single cells to isolate and culture keratinocytes
Sörgel, C. A. *et al.* (2022) IGF-I and hyaluronic acid mitigate the negative effect of irradiation on human skin keratinocytes. Cancers 14: 588.
https://doi.org/10.3390/cancers14030588

Dissociation of healthy human skin into single cells for single cell multi-omics sequencing
Solé-Boldo, L. *et al.* (2022) Differentiation-related epigenomic changes define clinically distinct keratinocyte cancer subclasses. Mol. Syst. Biol. 18: e11073.
https://doi.org/10.15252/msb.202211073

Formalin-fixed paraffin-embedded (FFPE) tissue

FFPE Tissue Dissociation Kit (130-118-052)

FFPE Tissue Dissociation Kit for RNA Profiling (130-134-089)

Dissociation of human fresh, cryopreserved and FFPE lung adenocarcinoma samples into single cells for comparative snRNA sequencing analysis
Trinks, A. *et al.* (2024) Robust detection of clinically relevant features in single-cell RNA profiles of patient-matched fresh and formalin-fixed paraffin-embedded (FFPE) lung cancer tissue. Cell Oncol. 47: 1221–1231.
https://doi.org/10.1007/s13402-024-00922-0

Dissociation of FFPE human brain sample into single cells for protein extraction
Kim, A. *et al.* (2023). Disease-specific α-synuclein seeding in Lewy body disease and multiple system atrophy are preserved in formaldehyde-fixed paraffin-embedded human brain. Biomolecules. 13: 936.
https://doi.org/10.3390/biom13060936

Dissociation of human ductal carcinoma *in situ* FFPE tissue into single cells for scRNA sequencing
Lips, E. H. *et al.* (2022) Genomic analysis defines clonal relationships of ductal carcinoma *in situ* and recurrent invasive breast cancer. Nat. Genet. 54: 850–860.
https://doi.org/10.1038/s41588-022-01082-3

Dissociation of human breast cancer FFPE section into single cells for scFFPE sequencing
Janesick, A. *et al.* (2023) High resolution mapping of the tumor microenvironment using integrated single-cell, spatial and *in situ* analysis. Nat. Commun. 14: 8353.
https://doi.org/10.1038/s41467-023-43458-x

Dissociation of breast xenograft FFPE tissue into single cells for flow cytometry
Zhang, S. *et al.* (2022) GIT1 protects against breast cancer growth through negative regulation of Notch. Nat. Commun. 13: 1537.
https://doi.org/10.1038/s41467-022-28631-y

Other tissues

We provide a variety of protocols using the Multi Tissue Dissociation Kits 1–3 to effectively dissociate organs and tissues, including kidney, prostate, mouse embryo, and cell monolayers, etc.

Multi Tissue Dissociation Kit 1 (130-110-201)

Multi Tissue Dissociation Kit 2 (130-110-203)

Multi Tissue Dissociation Kit 3 (130-110-204)

Dissociation of murine skin into single cells to analyze myeloid populations by flow cytometry
Tanaka, T. *et al.* (2023) Dermal macrophages set pain sensitivity by modulating the amount of tissue NGF through an SNX25-Nrf2 pathway. Nat. Immunol. 24: 439–451.
https://doi.org/10.1038/s41590-022-01418-5

Dissociation of lizard tail into single cells to isolate fibroblast and scRNA sequencing
Vonk, A. C. *et al.* (2023) Single-cell analysis of lizard blastema fibroblasts reveals phagocyte-dependent activation of Hedgehog-responsive chondrogenesis. Nat. Commun. 14: 4489.
https://doi.org/10.1038/s41467-023-40206-z

Dissociation of murine skin into single cells to characterize immune cells by flow cytometry
Zamora, A. *et al.* (2024) 15-Lipoxygenase promotes resolution of inflammation in lymphedema by controlling T_{reg} cell function through IFN-β. Nat. Commun. 15: 221.
https://doi.org/10.1038/s41467-023-43554-y

Dissociation of murine pancreatic tissue into single cells for flow cytometry
Glaubitz, J. *et al.* (2022) In mouse chronic pancreatitis $CD25^+FOXP3^+$ regulatory T cells control pancreatic fibrosis by suppression of the type 2 immune response. Nat. Commun. 13: 4502.
https://doi.org/10.1038/s41467-022-32195-2

Dissociation of adult rat and mice hearts to isolate macrophages for flow cytometry
Li, L. *et al.* (2023) M2 macrophage-derived sEV regulate pro-inflammatory CCR2^{+} macrophage subpopulations to favor post-AMI cardiac repair. Adv. Sci. 10: e2202964.
https://doi.org/10.1002/advs.202202964

Dissociation of polyomavirus middle T oncogene tumor into single cells for epigenetic-focused CyTOF (EpiTOF)
Aylon, Y. *et al.* (2022) Breast cancer plasticity is restricted by a LATS1-NCOR1 repressive axis. [published correction: Nat. Commun. 2023; 14: 133. doi: 10.1038/s41467-023-35838-0]. Nat. Commun. 13: 7199.
https://doi.org/10.1038/s41467-022-34863-9

Dissociation of humanized mouse model kidney into single cells for flow cytometry
Doglio, M. *et al.* (2024) Regulatory T cells expressing CD19-targeted chimeric antigen receptor restore homeostasis in Systemic Lupus Erythematosus. Nat. Commun. 15: 2542.
https://doi.org/10.1038/s41467-024-46448-9

Dissociation of murine embryo kidneys into single cells for scRNA sequencing
Song, L. *et al.* (2024) Single-cell multiomics reveals ENL mutation perturbs kidney developmental trajectory by rewiring gene regulatory landscape. Nat. Commun. 15: 5937.
https://doi.org/10.1038/s41467-024-50171-w

Dissociation of induced pluripotent stem cell-derived cardiomyocytes into single cells to isolate and culture cardiomyocytes
Bettini, A. *et al.*(2024) Injectable biodegradable microcarriers for iPSC expansion and cardiomyocyte differentiation. Adv. Sci. 11: e2404355.
https://doi.org/10.1002/advs.202404355

Dissociation of fresh murine kidney into single cells for scRNA sequencing
Chu, L. K. *et al.* (2023) Autophagy of OTUD5 destabilizes GPX4 to confer ferroptosis-dependent kidney injury. Nat. Commun. 14: 8393.
https://doi.org/10.1038/s41467-023-44228-5

Dissociation of fresh murine kidney to prepare renal single cell suspension for scRNA sequencing
Liu, J. *et al.* (2024) Single-cell spatial transcriptomics unveils platelet-fueled cycling macrophages for kidney fibrosis. Adv. Sci. 11: e2308505.
https://doi.org/10.1002/advs.202308505

Dissociation of murine embryo soft palatal tissue into single cells for cell culture and qPCR analysis
Feng, J. *et al.* (2022) TGF-β signaling and Creb5 cooperatively regulate Fgf18 to control pharyngeal muscle development. Elife 11: e80405.
https://doi.org/10.7554/eLife.80405

Extraction of nuclei

Nuclei Extraction Buffer (130-128-024)

Dissociation of fresh murine liver to extract and isolate intact nuclei for liquid chromatography–mass spectrometry (LC–MS) analysis
Lim, L. Q. J. *et al.* (2024) ASS1 metabolically contributes to the nuclear and cytosolic p53-mediated DNA damage response [published correction in Nat. Metab. 2024;6: 1417. doi: 10.1038/s42255-024-01090-z]. Nat. Metab. 6: 1294–1309.
https://doi.org/10.1038/s42255-024-01060-5

Dissociation of murine frozen brain to obtain single nuclei suspension for sequencing
Bormann, D. *et al.* (2024) Single-nucleus RNA sequencing reveals glial cell type-specific responses to ischemic stroke in male rodents. Nat. Commun. 15: 6232.
https://doi.org/10.1038/s41467-024-50465-z

Dissociation of murine brain to obtain intact nuclei for single-nuclei RNA sequencing
Schartz, N. D. *et al.* (2024) C5aR1 antagonism suppresses inflammatory glial responses and alters cellular signaling in an Alzheimer's disease mouse model. Nat. Commun. 15: 7028.
https://doi.org/10.1038/s41467-024-51163-6

Dissociation of monkey spinal cord to obtain intact nuclei for DNA isolation and sequencing
Hanlon, K. S. *et al.* (2024) *In vivo* selection in non-human primates identifies AAV capsids for on-target CSF delivery to spinal cord. Mol. Ther. 32: 2584–2603.
https://doi.org/10.1016/j.ymthe.2024.05.040

Dissociation of murine brain to obtain single cells and intact nuclei suspension
Ocañas, S. R. *et al.* (2023) Microglial senescence contributes to female-biased neuroinflammation in the aging mouse hippocampus: implications for Alzheimer's disease. J. Neuroinflammation. 20: 188.
https://doi.org/10.1186/s12974-023-02870-2

Extraction of mitochondria

Mitochondria Extraction Kit – Tissue (130-097-340)

Homogenization of murine olfactory bulb to extract mitochondria for mitochondria immunoprecipitation and western blot
Puighermanal, E. *et al.* (2024) Cannabidiol ameliorates mitochondrial disease via PPARγ activation in preclinical models. Nat. Commun. 15: 7730.
https://doi.org/10.1038/s41467-024-51884-8

Homogenization of murine heart to extract mitochondria
Zhang, X. *et al.* (2022) Overexpression of cytosolic long noncoding RNA cytb protects against pressure-overload-induced heart failure via sponging microRNA-103-3p. Mol. Ther. Nucleic Acids 27: 1127–1145.
https://doi.org/10.1016/j.omtn.2022.02.002

Homogenization of several murine tissues to extract mitochondria
Bomba-Warczak, E. *et al.* (2021) Long-lived mitochondrial cristae proteins in mouse heart and brain. J. Cell Biol. 220: e202005193.
https://doi.org/10.1083/jcb.202005193

Homogenization of rat brain to extract mitochondria
Chen, M. *et al.* (2022) Baicalein induces mitochondrial autophagy to prevent Parkinson's disease in rats via miR-30b and the SIRT1/AMPK/mTOR pathway. Front. Neurol. 12: 646817.
https://doi.org/10.3389/fneur.2021.646817

Tissue homogenization

Isolation of nucleic acids (RNA and DNA)

Homogenization of frozen human tumor to isolate protein and RNA
Xu, Z. *et al.* (2022) Structural variants drive context-dependent oncogene activation in cancer. Nature. 612: 564–572.
https://doi.org/10.1038/s41586-022-05504-4

Homogenization of frozen murine lung to extract DNA
Baldwin, L. A. *et al.* (2022) DNA barcoding reveals ongoing immunoediting of clonal cancer populations during metastatic progression and immunotherapy response. Nat. Commun. 13: 6539.
https://doi.org/10.1038/s41467-022-34041-x

Homogenization of murine liver tissue to isolate RNA for *in vitro* massively parallel reporter assay
Bravo González-Blas, C. *et al.* (2024) Single-cell spatial multi-omics and deep learning dissect enhancer-driven gene regulatory networks in liver zonation. Nat. Cell Biol. 26: 153–167.
https://doi.org/10.1038/s41556-023-01316-4

Homogenization of human ovarian carcinoma tissue to isolate RNA for small RNA sequencing
Yokoi, A. *et al.* (2023) Spatial exosome analysis using cellulose nanofiber sheets reveals the location heterogeneity of extracellular vesicles. Nat. Commun. 14: 6915.
https://doi.org/10.1038/s41467-023-42593-9

Homogenization of murine inguinal lymph nodes to isolate RNA for qRT-PCR
Carson, C. S. *et al.* (2022) A nanovaccine for enhancing cellular immunity via cytosolic co-delivery of antigen and polyIC RNA. J. Control Release. 345: 354–370.
https://doi.org/10.1016/j.jconrel.2022.03.020

Extraction of proteins

Homogenization of snap-frozen mouse xenograft tumors and skeletal muscle to isolate protein for immunoprecipitation
Dibble, C. C. *et al.* (2022) PI3K drives the de novo synthesis of coenzyme A from vitamin B5. Nature 608: 192–198.
https://doi.org/10.1038/s41586-022-04984-8

Homogenization of murine lymph nodes to isolate protein for protein quantification
Ince, L. M. *et al.* (2023) Influence of circadian clocks on adaptive immunity and vaccination responses. Nat. Commun. 14: 476.
https://doi.org/10.1038/s41467-023-35979-2

Homogenization of frozen brain tumor sample to isolate protein for genome-wide chromosome conformation capture (Hi-C)
Okonechnikov, K. *et al.* (2023) 3D genome mapping identifies subgroup-specific chromosome conformations and tumor-dependency genes in ependymoma. Nat. Commun. 14: 2300.
https://doi.org/10.1038/s41467-023-38044-0

Homogenization of murine joint-footpads to isolate protein for multiplex immunoassay
Lum, F. M. *et al.* (2024) Crosstalk between $CD64^{+}MHCII^{+}$ macrophages and $CD4^{+}$ T cells drives joint pathology during chikungunya. EMBO Mol. Med. 16: 641–663.
https://doi.org/10.1038/s44321-024-00028-y

Homogenization of murine brain to isolate protein for enzyme-linked immunosorbent assay
Ho, Y. J. *et al.* (2023) Oxygen-loaded microbubble-mediated sonoperfusion and oxygenation for neuroprotection after ischemic stroke reperfusion. Biomater. Res. 27: 65.
https://doi.org/10.1186/s40824-023-00400-y

Determination of bacterial or viral load

Homogenization of xenograft brain tumor sample to quantify infectious virus
Chen, X. *et al.* (2023) IDH1 mutation impairs antiviral response and potentiates oncolytic virotherapy in glioma. Nat. Commun. 14: 6781.
https://doi.org/10.1038/s41467-023-42545-3

Homogenization of murine lung sample to determine virus titration using plaque assay
Myeni, S. K. *et al.* (2023) Engineering potent live attenuated coronavirus vaccines by targeted inactivation of the immune evasive viral deubiquitinase. Nat. Commun. 14: 1141.
https://doi.org/10.1038/s41467-023-36754-z

Homogenization of murine lung and brain to quantify viral RNA by RT-qPCR
Krishna, V. D. *et al.* (2024) Impact of age and sex on neuroinflammation following SARS-CoV-2 infection in a murine model. Front. Microbiol. 15: 1404312.
https://doi.org/10.3389/fmicb.2024.1404312

Homogenization of murine liver to determine the quantity of bacterial colony forming units (CFUs)
Zindl, C. L. *et al.* (2024) Distal colonocytes targeted by *C. rodentium* recruit T-cell help for barrier defence. Nature. 629: 669–678.
https://doi.org/10.1038/s41586-024-07288-1

Homogenization of piglet gut to determine bacterial load
Fernández Álvaro, E. *et al.* (2022) The repurposing of Tebipenem pivoxil as alternative therapy for severe gastrointestinal infections caused by extensively drug-resistant *Shigella spp* [published correction in Elife. 2022; 11: e83117. doi: 10.7554/eLife.83117]. Elife 11: e69798.
https://doi.org/10.7554/eLife.69798

Homogenization of murine lung to determine the quantity of bacterial CFUs
Tuz, A. A. *et al.* (2024) Stroke and myocardial infarction induce neutrophil extracellular trap release disrupting lymphoid organ structure and immunoglobulin secretion. Nat. Cardiovasc. Res. 3: 525–540.
https://doi.org/10.1038/s44161-024-00462-8

Homogenization of murine lung to determine the quantity of bacterial CFUs
Sandri, A. *et al.* (2023) *In vivo* inflammation caused by Achromobacter spp. cystic fibrosis clinical isolates exhibiting different pathogenic characteristics. Int. J. Mol. Sci. 24: 7432.
https://doi.org/10.3390/ijms24087432

Notes

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