Stanford

Monther Abu-Remaileh

Assistant Professor of Chemical Engineering and, by courtesy, of Genetics

Bio

BIO

The Abu-Remaileh Lab is interested in identifying novel pathways that enable cellular and organismal adaptation to metabolic stress and changes in environmental conditions. We also study how these pathways go awry in human diseases such as cancer, neurodegeneration and metabolic syndrome, in order to engineer new therapeutic modalities.

To address these questions, our lab uses a multidisciplinary approach to study the biochemical functions of the lysosome in vitro and in vivo. Lysosomes are membrane-bound compartments that degrade macromolecules and clear damaged organelles to enable cellular adaptation to various metabolic states. Lysosomal function is critical for organismal homeostasis—mutations in genes encoding lysosomal proteins cause severe human disorders known as lysosomal storage diseases, and lysosome dysfunction is implicated in age-associated diseases including cancer, neurodegeneration and metabolic syndrome.

By developing novel tools and harnessing the power of metabolomics, proteomics and functional genomics, our lab will define 1) how the lysosome communicates with other cellular compartments to fulfill the metabolic demands of the cell under various metabolic states, 2) and how its dysfunction leads to rare and common human diseases. Using insights from our research, we will engineer novel therapies to modulate the pathways that govern human disease.

ACADEMIC APPOINTMENTS

- Assistant Professor, Chemical Engineering
- Assistant Professor (By courtesy), Genetics
- Member, Bio-X
- Member, Maternal & Child Health Research Institute (MCHRI)
- Faculty Fellow, Stanford ChEM-H
- Member, Wu Tsai Neurosciences Institute

HONORS AND AWARDS

- Cancer Innovation Award, Stanford Cancer Institute (2020)
- Terman Faculty Fellow, Stanford University (2019)
- Innovators Under 35 MENA, MIT Technology Review (2018)
- NCL-Stiftung Foundation Research Award, NCL-Stiftung (2018)
- The Charles A. King Trust Award, The Medical Foundation (2018)
- The EMBO Fellowship, EMBO (2014- 2016)

- Adams Fellowship, Israel Academy of Sciences and Humanities (2009-2013)

PROFESSIONAL EDUCATION

- Molecular Genetics, The Hebrew University of Jerusalem , Gene Regulation in Development and Cancer (2014)
- Postdoctoral training, Whitehead Institute/ MIT , Subcellular Metabolism (2019)

LINKS

- Lab website: http://www.abu-remaileh.com

Teaching

COURSES

2020-21

- Chemical Engineering Laboratory A: CHEMENG 185A (Win)
- Chemical Engineering Laboratory B: CHEMENG 185B (Spr)
- Graduate Practical Training: CHEMENG 299 (Sum)

2019-20

- Graduate Practical Training: CHEMENG 299 (Sum)

STANFORD ADVISEES

Doctoral Dissertation Reader (AC)

Osman Jamil

Postdoctoral Faculty Sponsor

Wentao Dong, Ali Ghoochani

Doctoral Dissertation Advisor (AC)

Uche Medoh, Austin Murchison

Postdoctoral Research Mentor

Wentao Dong, Ali Ghoochani

Doctoral (Program)

Austin Murchison

GRADUATE AND FELLOWSHIP PROGRAM AFFILIATIONS

- Biophysics (Phd Program)
- Cancer Biology (Phd Program)
- Genetics (Phd Program)
- Neurosciences (Phd Program)

Publications

PUBLICATIONS

- **Lysosomal metabolomics reveals V-ATPase- and mTOR-dependent regulation of amino acid efflux from lysosomes.** *Science (New York, N.Y.)*
  Abu-Remaileh, M., Wyant, G. A., Kim, C., Laqtom, N. N., Abbasi, M., Chan, S. H., Freinkman, E., Sabatini, D. M.
  2017; 358 (6364): 807–13

- **Increased lysosomal biomass is responsible for the resistance of triple-negative breast cancers to CDK4/6 inhibition** *SCIENCE ADVANCES*
  Fassl, A., Brain, C., Abu-Remaileh, M., Stukan, I., Butter, D., Stepien, P., Feit, A. S., Bergholz, J., Michowski, W., Otto, T., Sheng, Q., Loo, A., Michael, et al
  2020; 6 (25)

- **Maintaining Iron Homeostasis Is the Key Role of Lysosomal Acidity for Cell Proliferation.** *Molecular cell*
  Weber, R. A., Yen, F. S., Nicholson, S. P., Alwaseem, H., Bayraktar, E. C., Alam, M., Timson, R. C., La, K., Abu-Remaileh, M., Molina, H., Birsoy, K.
  2020

- **Increased lysosomal biomass is responsible for the resistance of triple-negative breast cancers to CDK4/6 inhibition.** *Science advances*
  Fassl, A., Brain, C., Abu-Remaileh, M., Stukan, I., Butter, D., Stepien, P., Feit, A. S., Bergholz, J., Michowski, W., Otto, T., Sheng, Q., Loo, A., Michael, et al
  2020; 6 (25)

- **Increased lysosomal biomass is responsible for the resistance of triple-negative breast cancers to CDK4/6 inhibition.** *Science advances*
  Fassl, A., Brain, C., Abu-Remaileh, M., Stukan, I., Butter, D., Stepien, P., Feit, A. S., Bergholz, J., Michowski, W., Otto, T., Sheng, Q., Loo, A., Michael, et al
  2020; 6 (25): eabb2210

- **The microbiota programs DNA methylation to control intestinal homeostasis and inflammation.** *Nature microbiology*
  Ansari, I., Raddatz, G., Gutekunst, J., Ridnik, M., Cohen, D., Abu-Remaileh, M., Tuganbaev, T., Shapiro, H., Pikarsky, E., Elinav, E., Lyko, F., Bergman, Y.
  2020

- **Structural basis for the docking of mTORC1 on the lysosomal surface.** *Science (New York, N.Y.)*
  Rogala, K. B., Gu, X., Kedir, J. F., Abu-Remaileh, M., Bianchi, L. F., Bottino, A. M., Dueholm, R., Niehaus, A., Overwijn, D., Fils, A. P., Zhou, S. X., Leary, D., Laqtom, et al
  2019; 366 (6464): 468–75

- **WWOX somatic ablation in skeletal muscles alters glucose metabolism.** *Molecular metabolism*
  Abu-Remaileh, M., Abu-Remaileh, M., Akkawi, R., Knani, I., Udi, S., Pacold, M. E., Tam, J., Aqeilan, R. I.
  2019; 22: 132–40

- **MITO-Tag Mice enable rapid isolation and multimodal profiling of mitochondria from specific cell types in vivo.** *Proceedings of the National Academy of Sciences of the United States of America*
  Bayraktar, E. C., Baudrier, L., Özerdem, C., Lewis, C. A., Chan, S. H., Kunchok, T., Abu-Remaileh, M., Cangelosi, A. L., Sabatini, D. M., Birsoy, K., Chen, W. W.
  2019; 116 (1): 303–12

- **High-fat diet enhances stemness and tumorigenicity of intestinal progenitors (vol 531, pg 53, 2016)** *NATURE*
  Beyaz, S., Mana, M. D., Roper, J., Kedrin, D., Saadatpour, A., Hong, S., Bauer-Rowe, K. E., Xifaras, M. E., Akkad, A., Arias, E., Pinello, L., Katz, Y., Shinagare, et al
  2018; 560 (7717): E26

- **Histidine catabolism is a major determinant of methotrexate sensitivity.** *Nature*
  Kanarek, N., Keys, H. R., Cantor, J. R., Lewis, C. A., Chan, S. H., Kunchok, T., Abu-Remaileh, M., Freinkman, E., Schweitzer, L. D., Sabatini, D. M.
  2018; 559 (7715): 632–36

- **NUFIP1 is a ribosome receptor for starvation-induced ribophagy.** *Science (New York, N.Y.)*
  Wyant, G. A., Abu-Remaileh, M., Frenkel, E. M., Laqtom, N. N., Dharamdasani, V., Lewis, C. A., Chan, S. H., Heinze, I., Ori, A., Sabatini, D. M.
  2018; 360 (6390): 751–58

- **Identification of a transporter complex responsible for the cytosolic entry of nitrogen-containing bisphosphonates.** *eLife*
  Yu, Z., Surface, L. E., Park, C. Y., Horlbeck, M. A., Wyant, G. A., Abu-Remaileh, M., Peterson, T. R., Sabatini, D. M., Weissman, J. S., O'Shea, E. K.
  2018; 7

- **Fasting Activates Fatty Acid Oxidation to Enhance Intestinal Stem Cell Function during Homeostasis and Aging.** *Cell stem cell*
  Mihaylova, M. M., Cheng, C. W., Cao, A. Q., Tripathi, S., Mana, M. D., Bauer-Rowe, K. E., Abu-Remaileh, M., Clavain, L., Erdemir, A., Lewis, C. A., Freinkman, E., Dickey, A. S., La Spada, et al
  2018; 22 (5): 769–78.e4

- **mTORC1 Activator SLC38A9 Is Required to Efflux Essential Amino Acids from Lysosomes and Use Protein as a Nutrient.** *Cell*
  Wyant, G. A., Abu-Remaileh, M., Wolfson, R. L., Chen, W. W., Freinkman, E., Danai, L. V., Vander Heiden, M. G., Sabatini, D. M.
  2017; 171 (3): 642–54.e12

- **Physiologic Medium Rewires Cellular Metabolism and Reveals Uric Acid as an Endogenous Inhibitor of UMP Synthase.** *Cell*
  Cantor, J. R., Abu-Remaileh, M., Kanarek, N., Freinkman, E., Gao, X., Louissaint, A., Lewis, C. A., Sabatini, D. M.
  2017; 169 (2): 258–72.e17

- **KICSTOR recruits GATOR1 to the lysosome and is necessary for nutrients to regulate mTORC1.** *Nature*
  Wolfson, R. L., Chantranupong, L., Wyant, G. A., Gu, X., Orozco, J. M., Shen, K., Condon, K. J., Petri, S., Kedir, J., Scaria, S. M., Abu-Remaileh, M., Frankel, W. N., Sabatini, et al
  2017; 543 (7645): 438–42

- **A PHGDH inhibitor reveals coordination of serine synthesis and one-carbon unit fate.** *Nature chemical biology*
  Pacold, M. E., Brimacombe, K. R., Chan, S. H., Rohde, J. M., Lewis, C. A., Swier, L. J., Possemato, R., Chen, W. W., Sullivan, L. B., Fiske, B. P., Cho, S., Freinkman, E., Birsoy, et al
  2016; 12 (6): 452–58

- **High-fat diet enhances stemness and tumorigenicity of intestinal progenitors.** *Nature*
  Beyaz, S., Mana, M. D., Roper, J., Kedrin, D., Saadatpour, A., Hong, S. J., Bauer-Rowe, K. E., Xifaras, M. E., Akkad, A., Arias, E., Pinello, L., Katz, Y., Shinagare, et al
  2016; 531 (7592): 53–58

- **Embryonic Stem Cell (ES)-Specific Enhancers Specify the Expression Potential of ES Genes in Cancer.** *PLoS genetics*
  Aran, D., Abu-Remaileh, M., Levy, R., Meron, N., Toperoff, G., Edrei, Y., Bergman, Y., Hellman, A.
  2016; 12 (2): e1005840

- **An Essential Role of the Mitochondrial Electron Transport Chain in Cell Proliferation Is to Enable Aspartate Synthesis.** *Cell*
  Birsoy, K., Wang, T., Chen, W. W., Freinkman, E., Abu-Remaileh, M., Sabatini, D. M.
  2015; 162 (3): 540–51

- **Chronic inflammation induces a novel epigenetic program that is conserved in intestinal adenomas and in colorectal cancer.** *Cancer research*
  Abu-Remaileh, M., Bender, S., Raddatz, G., Ansari, I., Cohen, D., Gutekunst, J., Musch, T., Linhart, H., Breiling, A., Pikarsky, E., Bergman, Y., Lyko, F.
  2015; 75 (10): 2120–30

- **Aberrant DNA methylation in ES cells.** *PloS one*
  Ludwig, G., Nejman, D., Hecht, M., Orlanski, S., Abu-Remaileh, M., Yanuka, O., Sandler, O., Marx, A., Roberts, D., Benvenisty, N., Bergman, Y., Mendelsohn, M., Cedar, et al
  2014; 9 (5): e96090

- **Oct-3/4 regulates stem cell identity and cell fate decisions by modulating Wnt/#-catenin signalling.** *The EMBO journal*
  Abu-Remaileh, M., Gerson, A., Farago, M., Nathan, G., Alkalay, I., Zins Rousso, S., Gur, M., Fainsod, A., Bergman, Y.
  2010; 29 (19): 3236–48

- **De novo DNA methylation promoted by G9a prevents reprogramming of embryonically silenced genes.** *Nature structural & molecular biology*
  Epsztejn-Litman, S., Feldman, N., Abu-Remaileh, M., Shufaro, Y., Gerson, A., Ueda, J., Deplus, R., Fuks, F., Shinkai, Y., Cedar, H., Bergman, Y.
  2008; 15 (11): 1176–83