No.	Department	Research themes	Abstract	Website, report, etc.
1	Molecular Physiology	Real-time measurements of local drug actions by diamond microsensors in vivo or in vitro		https://www.med.niigata-u.ac.jp/ph2/enyakubutsu.html See PDF, Molecular Physiology paper
2	Cellular physiology	1. Aging and mitochondrial quality control 2. Physiological role of mitochondrial autophagy	Mitochondria produce reactive oxygen species (ROS) via electron leakage from the respiratory chain during ATP synthesis. Thus, mitochondria are constantly exposed to ROS and oxidative damage. Damaged mitochondria bring about further production of ROS, potentially lading to cellular damage and hypofunction of the whole body. The functionality of mitochondria is known to be maintained at the early and middle stages of the animal life course, but it gradually declines during the aged stage, suggesting that mitochondrial function is preserved by mechanism(s) whose activity is weakened during the aged stage. We hypothesize that mitochondrial autophagy (mitophagy) is the major mechanism that eliminates damaged mitochondria to maintain a population of healthy and functional mitochondria. Mitophagy is a process that selectively degrades mitochondria via autophagy. In mammalian cell culture and yeast, it has been revealed that mitophagy contributes to the maintenance or recovery of mitochondrial function by eliminating damaged or excess mitochondria. However, it is currently unclear whether mitophagy plays a role in maintaining and restoring mitochondrial function also at the whole-body level because of the difficulty in observing mitophagy in the animal body and in generating mitophagy-deficient animal models. We attempt to demonstrate that mitophagy prevents mitochondrial dysfunctioning at the whole-body level during aging. Furthermore, we aim to establish method(s) to suppress the age-dependent hypofunction of the whole body by artificially controlling mitophagy and thus contribute to develop the strategy of prevention or treatment for the age-dependent diseases. Our research makes it possible to develop prophylactic or therapeutic drugs targeting mitophagy against age-related diseases, which are now becoming attention-getting problems in our aging society.	
3	Bacteriology	Development of control strategies, such as, vaccine, diagnosis, and drug, against tuberculosis and nontuberculous mycobacterial diseases		https://www.med-niigatauniv-bacteriol.org/english/ C-terminal intrinsically disordered region-dependent organization of the mycobacterial genome by a histone-like protein. Savitskaya A, Nishiyama A, Yamaguchi T, Tateishi Y, Ozeki Y, Nameta M, Kon T, Kaboso SA, Ohara N, Peryanova OV, Matsumoto S. Sci Rep. 2018 May 29;8(1):8197
4	Pharmacology	(A) Lymphatic vascular development and embryonic edema in the mouse	(A) Lymphatic vessels comprise a secondary vascular system in mammals and play important roles in tissue fluid homeostasis, immune response, and fat absorption. We have been studying molecular mechanisms underlying lymphatic network formation in mouse embryonic skin model. Defective lymphatic development as well as cardiac anomaly and enhanced vascular permeability in mice cause embryonic edema which looks like an increased nuchal translucency during human pregnancy. To look for gene mutations causing embryonic edema, we have established a novel screening in the mouse.	
		(B) Blood vessel-derived factors regulating lymphatic vascular patterning	(B) Lymphatic vascular development is regulated, at least in part, by blood vessels. We have previously reported that the artery-derived ligand Semaphorin 3G serves as a repulsive guidance cue in regulation of lymphatic vascular patterning. This repulsive factor may be useful to set up a novel strategy for disease treatment. The platelet circulating in the blood is also of our interest since it has been shown to play a crucial role in lymph-blood partitioning.	
		(C) Roles of transcription factors in endothelial cells during blood and lymphatic vascular formation and maintenance	(C) Transcription factors have been shown to control vascular formation by regulating endothelial cell differentiation and integrity. We have identified Ets family transcription factors as regulators of blood and lymphatic vascular endothelial integrity by loss-of-function study of these genes. We will further examine their roles in vascular formation and maintenance during embryonic stages and in pathological conditions such as tumor progression using knockout mice.	
		(D) Roles of angiocrine factors secreted through endothelial-to-mesenchymal transition during inflammation and cancer progression	(D) Endothelial-to-mesenchymal transition (EndMT) is a process in which endothelial cells lose their characteristics and transdifferentiate into mesenchymal cells. The cells which have undergone EndMT have been shown to function as cancer-associated fibroblasts (CAFs) during cancer progression. We have found angiocrine factors secreted from the CAFs which may promote cancer progression. We will investigate the molecular mechanism how the angiocrine factors are secreted from the CAFs.	
5	Pathology, Brain Research Institute	Clinicopathological study on pathomechanisms underlying neurodegenerative disorders.	Mission To provide the highest quality pathology services and scientific evidence focused on the advancement of developments in the field of neuropathology. Vision As an academic pathology department, we aim to deliver a high degree of professionalism in clinicopathological diagnostic services and neuropathology research, utilizing comprehensive and innovative approaches and building departmental competence to meet the needs of patients, institutions, and society. Our approach will involve taking full advantage of opportunities to advance both the science and practice of neuropathology through individual and collaborative research, which hopefully will produce leading practitioners and researchers.	https://pathology-bri-niigata-u.jp/en/
6	System Pathology for Neurological Disorders, Brain Research Institute	Restoring neural circuits and functions after brain and spinal cord injury	CNS injuries due to stroke or trauma disrupt neural circuits and severely impairs neural functions. The brain has very limited capacity to reconstruct the circuit once it is damaged, and therefore none of effective therapies have been developed so far. We previously demonstrated that spared motor and autonomic circuits are dynamically reorganized after injuries and contribute to the recovery process of functions (Ueno et al., Nat Neurosci (2016), Brain (2012)). The results suggest that controlling rewiring of remnant circuits would lead to form proper neural connections and recovery. The goal of studies in our lab is to understand the process of rewiring and its underlying molecular mechanisms, to explore strategies to promote reconstruction of neural circuits that achieve functional recovery. To this end, we will analyze neural systems of both normal and injured brain and spinal cord, using cutting-edge techniques including, mouse genetics, viral tracers, optogenetics, chemogenetics, and 3D behavior analysis. The study will pave the way to develop novel strategies to regenerate circuits and restore neural functions.	Lab HP: http://www.bri.niigata-u.ac.jp/~system_neurodis/ueno/home-e.html Selected publications: 1. Ueno M, et al. Corticospinal circuits from the sensory and motor cortices differentially regulate skilled movements through distinct spinal interneurons. Cell Rep 23: 1286-1300, 2018 2. Gu Z, Ueno M, et al., Control of species-dependent cortico-motoneuronal connections underlying manual dexterity. Science 357: 400-4, 2017 3. Ueno M et al., Silencing spinal interneurons inhibits immune suppressive autonomic reflexes caused by spinal cord injury. Nat Neurosci. 19:784-7, 2016 4. Ueno M et al., Layer V cortical neurons require microglial support for survival during postnatal development. Nat Neurosci. 16: 543-551, 2013 5. Ueno M et al., Intraspinal rewiring of the corticospinal tract requires target-derived BDNF and compensates lost function after brain injury. Brain 135: 1253-67, 2012