Japanese Society for the Promotion of Science (JSPS) Science Dialog Program
Guest lecture at the Hyogo Prefectural Kobe High School

Title: “Mysteries of metabolism in the retina and in hibernation”

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Abstract

My name is Michael Country, and I am a Canadian scientist working at RIKEN, Japan. My research is about metabolism, which is the study of how cells get energy to survive. In this talk, I’ll discuss the benefits of studying and working abroad. I’ll give a couple tips to improve your English. I’ll also discuss three of my favourite research projects. First, in Canada, I studied goldfish eyes. Goldfish can survive for hours without oxygen. This is amazing, right? If humans could do this, we wouldn’t die from heart attacks or strokes. I studied goldfish metabolism in the retina, which is the neural tissue in the back of the eye that lets you see. I showed that mitochondria sense when oxygen is low, and they keep Ca^{2+} low to avoid cell death. Secondly, I collaborated with a friend in Denmark to compare blood supply in animal eyes. The retina needs to get blood for energy. But it also needs to be transparent, and blood is dark so it prevents light from entering. How can you get oxygen to the eye without blood vessels? We named this problem the “opto-respiratory showed how fish, reptiles, birds, and mammals solve this problem, and we named this the opto-respiratory compromise (opto- means “light”). And lastly, in America and Japan, I have been studying how animals hibernate. We know the brain starts the process of hibernation. But after it starts in that one part of the brain (the hypothalamus), what is the next step? Does the brain cause a hormone to be released into the blood? Or does it change brain activity in the rest of the brain, kind of like how we sleep? I’ll describe an experiment I’m doing to learn how animals hibernate. If we answer this question, maybe we can make humans hibernate too, which could save lives during heart attacks, strokes, and organ transplantation.

Word List

Acid (protons)	酸(プロトン)	Lactic acid	乳酸
Agonist	アゴニスト	Layer	層
Ancestor	祖先	Mammals	哺乳類
Anoxia	無酸素	Metabolism	代謝
Antagonist	アンタゴニスト	Mitochondria	ミトコンドリア
ATP	ATP	Neural	神経
Baseline	ベースライン	Neuron	神経細胞
Birds	鳥類	Optic nerve	視神経
Blind spot	盲点	Optics	光学系
Blindness (or “go blind”)	失明	Organ transplantation	臓器移植
Blood	血液	Oxygen	酸素
Blood vessels (arteries, veins)	血管(動脈、静脈)	Photoreceptors (rods and cones)	視細胞（杆体・錐体）

Brain	脳	Phylogeny	系統樹
Ca2+ imaging	Ca2+イメージング	Postdoctorate	ポスドク
Calcium	カルシウム	Primates	霊長類
Capillaries	毛細血管	Ratio	比率
Central nervous system	中枢神経系	Receptor	レセプター
Collaboration	共同研究	Reptiles	爬虫類
Cross section	断面図	Respiration	呼吸
Demand (and supply)	需要（and 供給)	Response	反応
Diabetes	糖尿病学	Retina	網膜
Diffusion	拡散	Sensitivity	感度
Dissection	解剖	Specialize	専門分野する
Electroretinogram	網膜電図	Stem cells	幹細胞
Equation	方程式	Stroke	脳卒中
Evolution	進化	Surface area	表面積
Fellowship	ポスドク奨学金	Surgery	手術
Fiber (dietary fiber)	食物繊維	Thickness	厚み
Fish	魚類	Tissue	組織
Fluorescence (or fluorescent)	蛍光（蛍光性）	Tolerance	忍容性
Flourescent dyes	蛍光色素	Torpor	冬眠
Genetics	遺伝学	Trait	特性
Goldfish	金魚	Trout	マス
Gradient (e.g. oxygen gradient, electrochemical gradient)	勾配（例：酸素勾配、電気化学的勾配）	Vascular	血管がある
Heart attack	心臓発作	Avascular	血管がない
Hemoglobin	血液グロビン	Vertebrate	脊椎動物
Hibernate (or hibernation)	冬眠	X axis	X 軸 (横)
Hormone	ホルモン	Y axis	Y 軸(縦)
Hypometabolism	低代謝	Zoology	動物学
Hypothermia	低体温症		
Hypoxia	低酸素		
Inducible pluripotent stem cells	誘導性多能性幹細胞		