BIOGRAPHICAL SKETCH

**DO NOT EXCEED FIVE PAGES**.

NAME: Krzysztof Czaja

eRA COMMONS USER NAME czajawsu07

POSITION TITLE: Associate Professor

EDUCATION/TRAINING (Begin with baccalaureate or other initial professional education, such as nursing, include postdoctoral training and residency training if applicable. Add/delete rows as necessary.)

| INSTITUTION AND LOCATION | DEGREE(if applicable) | Completion DateMM/YYYY | FIELD OF STUDY |
| --- | --- | --- | --- |

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| --- | --- | --- | --- |
| Academy of Agriculture and Technology, Olsztyn, Poland | D.V.M. | 03/1993 | Veterinary Medicine |
| Academy of Agriculture and Technology, Olsztyn, Poland | PhD | 05/1997 | Neuroanatomy |
| The Institute for Plastination and The Anatomical Institute of Heidelberg University, Germany | Plastination Specialist | 09/1997 | Plastination Methods (PEM 27, P 40) |
| University of Warmia and Mazury, Olsztyn, Poland | Post-doc | 08/1998 | Neuroscience |
| United States Department of Agriculture, Animal Physiology Research Unit, Athens, GA, USA | Post-doc | 06/2003 | Transsynaptic Tracing |
| WSU, VCAPP Department, Pullman WA, USA | Post-doc | 06/2007 | Feeding Behavior |

# A. Personal Statement

I have a broad background in neuroanatomy, with specific training and expertise in neural regulation in obesity. My Ph.D. degree in Neuroanatomy and postdoctoral training in neuroscience and feeding behavior has prepared me for independent research. My lab is focused on the diet-induced plasticity in the viscerosensory pathways and role of the microbiota and vagus nerve in the gut-brain communication. I have obtained extramural funds to conduct the independent projects and establish a Neural Plasticity Research Program for the Department of Biomedical Sciences and Diagnostic Imaging at University of Georgia. I successfully administered several projects, collaborated with other researchers, and published 48 peer-reviewed publications. The following publications present the results produced at University of Georgia in last two years:

Neuroanatomical localization of galanin in zebrafish telencephalon and anticonvulsant effect of galanin overexpression. Podlasz P, Jakimiuk A, Kasica-Jarosz N, Czaja K, Wasowicz K. ACS Chem Neurosci. 2018 Aug 10. doi: 10.1021/acschemneuro.8b00239. [Epub ahead of print] PubMed PMID: 30095254.

Taste and odor preferences following Roux-en-Y surgery in humans. Kittrell H, Graber W, Mariani E, Czaja K, Hajnal A, Di Lorenzo PM. PloS one. 2018; 13(7):e0199508.

Glutamate-dependent regulation of food intake is altered with age through changes in NMDA receptor phenotypes on vagal afferent neurons. Minaya DM, Larson RW, Podlasz P, Czaja K. Physiology & behavior. 2018; 189:26-31.

Efficacy of lateral- versus medial-approach hip joint capsule denervation as surgical treatments of the hip joint pain; a neuronal tract tracing study in the sheep. Sienkiewicz W, Dudek A, Czaja K, Janeczek M, Chrószcz A, Kaleczyc J. PloS one. 2018; 13(1):e0190052.

Diet-driven microbiota dysbiosis is associated with vagal remodeling and obesity. Sen T, Cawthon CR, Ihde BT, Hajnal A, DiLorenzo PM, de La Serre CB, Czaja K. Physiology & behavior. 2017; 173:305-317.

Relationship of neuropeptide FF receptors with pubertal maturation of gilts. Thorson JF, Heidorn NL, Ryu V, Czaja K, Nonneman DJ, Barb CR, Hausman GJ, Rohrer GA, Prezotto LD, McCosh RB, Wright EC, White BR, Freking BA, Oliver WT, Hileman SM, Lents CA. Biology of reproduction. 2017; 96(3):617-634.

Energy-dense diet triggers changes in gut microbiota, reorganization of gut‑brain vagal communication and increases body fat accumulation. Vaughn AC, Cooper EM, DiLorenzo PM, O'Loughlin LJ, Konkel ME, Peters JH, Hajnal A, Sen T, Lee SH, de La Serre CB, Czaja K. ANE. 2017; 77(1):18-30.

# B. Positions and Honors

***Positions & Employment:***

**1992-1993** Research Associate, Academy of Agriculture and Technology, Olsztyn, Poland

**1993-1997** Clinician, Small Animal Clinic, ul. Korczaka 2, Olsztyn, Poland

**1995-2001** Member, Warmia and Mazury Veterinary Chamber, Olsztyn, Poland

**1997-1998** Postdoctoral Fellow, Academy of Agriculture and Technology, Olsztyn, Poland

**1998-2004** Assistant Professor, University of Warmia and Mazury, Olsztyn, Poland

**2002-2004** Secretary, Public Council of Hospitals: Voivodeship Representative, Voivodeship Ecological Council, Olsztyn, Poland

**2004-2008** Research Assistant Professor, Washington State University, VCAPP, Pullman, WA

**2008-2014** Assistant Professor, Washington State University, VCAPP, Pullman, WA

**2014-2015** Associate Professor, Washington State University, IPN, Pullman, WA

**2015-present** Associate Professor, University of Georgia, VBDI, Athens, GA

***Other Experience and Professional Memberships***

**Journal Editor**

* *Neural Regeneration Research*: Guest Editor
* *Neural Plasticity*: Guest Editor
* *Polish Annals of Medicine:* Editorial Board Member
* *Journal of Animal Science and Research:* Editorial Board Member

**Journal Article Reviewer**

* *Neuroscience*
* *Neuroscience Letters*
* *Journal of Animal Science*
* *Acta Neurobiologiae Experimentalis*
* *PLOS One*
* *Brain Research Bulletin*
* *Anatomical Record*
* *Journal of Comparative Neurology*
* *Journal of Neuroinflammation*

**Grant Reviewer**

* Grant Review Committee, Alabama Agricultural Experiment Station, Auburn University (2007)
* Litigation support, University of Georgia, Athens, GA (2008)
* PONCIN 2012 Fellowship Review.
* National Science Center of Poland (NCN panel NZ4) project: 2012/07/B/NZ4/01427 (2012)
* National Science Foundation Proposal No. – 1557971 (2015)

***Honors & Awards:***

* **1993** Outstanding Veterinary Medicine Graduate Student, University of Warmia and Mazury, Poland
* **1998** Outstanding PhD Thesis, Prime Minister of Poland
* **1999** Award of Olsztyn Science Forum, President of City of Olsztyn, Poland
* **1999** USDA Award for Polish-American Science Promotion, Athens, GA, USA
* **2000** Presidential Award, University of Warmia and Mazury Olsztyn, Poland
* **2009** Awarded the WSU Honors College Faculty Thesis Advisor of the Year 2009, Pullman WA, USA
* **2009** 2009 Mentor of the Year Awards Program, Pullman WA, USA
* **2012** Outstanding Performance and Lasting Contributions as a Faculty Advisor, GPSA, WSU

# C. Contribution to Science

My early work and recent collaboration study was dealing with immunohistochemical characterization of sources of innervation of the female reproductive organs. We showed that neurons supplying the oviduct and uterus may be involved in the hormonal control and transmission of sensory impulses. Identification and characterization of specific populations of neurons and neurotransmitters which were the result of our study, will contribute to understanding mechanisms involved in the regulation of reproduction in females.

M.Majewski, W.Sienkiewicz, J.Kaleczyc, B.Mayer, **K.Czaja**, M.Lakomy, The distribution and co-localization of immunoreactivity to nitric oxide synthase, vasoactive intestinal polypeptide and substance P within nerve fibres supplying bovine and porcine female genital organs, Cell Tissue Res. 281 (1995) 445-464.

**K.Czaja**, W.Sienkiewicz, A.Vittoria, A.Costagliola, A.Cecio, Neuroendocrine cells in the female urogenital tract of the pig, and their immunohistochemical characterization, Acta Anat. 157 (1996) 11-19.

**K.Czaja**, Distribution of primary afferent neurons innervating the porcine oviduct and their immunohistochemical characterization, Cells Tissues Organs 166 (2000) 275-282.

Thorson JF, Heidorn NL, Ryu V, **Czaja K**, Nonneman DJ, Barb CR, Hausman GJ, Rohrer GA, Prezotto LD, McCosh RB, Wright EC, White BR, Freking BA, Oliver WT, Hileman SM, Lents CA. Relationship of neuropeptide FF receptors with pubertal maturation of gilts. Biology of Reproduction. (2017); 96(3):617-634. PMID:28339619

Next, I was involved in the studies on the role of leptin in the regulation of body fat. They were focused mainly on the location of leptin receptors in the autonomic ganglia and the hypothalamus. The results revealed that in addition to neuroendocrine functions, leptin may affect peripheral tissues by acting on receptors located in sympathetic ganglion neurons. The final element of this project was to demonstrate that hypothalamic neurons are connected transsynapticaly to adipose tissue and that they contain leptin receptors.

**K.Czaja**, M.Lakomy, W.Sienkiewicz, J.Kaleczyc, Z.Pidsudko, C.R.Barb, G.B.Rampacek, R.R.Kraeling, Distribution of neurons containing leptin receptors in the hypothalamus of the pig, Biochem. Biophys. Res. Commun. 298 (2002) 333-337.

**K.Czaja**, M.Lakomy, J.Kaleczyc, C.R.Barb, G.B.Rampacek, R.R.Kraeling, Leptin receptors, NPY, and tyrosine hydroxylase in autonomic neurons supplying fat depots in a pig, Biochem. Biophys. Res. Commun. 293 (2002) 1138-1144.

**K.Czaja**, R.R.Kraeling, C.R.Barb, Are hypothalamic neurons transsynaptically connected to porcine adipose tissue?, Biochem. Biophys. Res. Commun. 311 (2003) 482-485.

**K.Czaja**, C.R.Barb, R.R.Kraeling, Hypothalamic neurons innervating fat tissue in the pig express leptin receptor immunoreactivity, Neurosci. Lett. 425 (2007) 6-11.

In the following project I was studying the role of afferent sensory neurons in the regulation of food intake. Aim: to determine the molecular mechanism of transmission of information on the state of the digestive tract to the hypothalamus by glutamatergic neurons located in NG (ganglion of the vagus nerve) and the nucleus of the solitary tract (medulla oblongata). Our results revealed that different subpopulations of afferent sensory neurons innervating gastrointestinal tract show specific phenotypes of the NMDA receptor. Our studies also showed that activation of the NMDA receptors in the hindbrain is necessary to reduce the appetite by CCK. In conclusion this research revealed that hindbrain neurons containing NMDA receptors are the critical elements in control and modulation of satiety signals influencing food intake and energy balance.

**K.Czaja**, R.C.Ritter, G.A.Burns, Vagal afferent neurons projecting to the stomach and small intestine exhibit multiple N-methyl-D-aspartate receptor subunit phenotypes, Brain Res 1119 (2006) 86-93.

**K.Czaja**, R.C.Ritter, G.A.Burns, N-methyl-D-aspartate receptor subunit phenotypes of vagal afferent neurons in nodose ganglia of the rat, J. Comp Neurol. 496 (2006) 877-885.

J.Wright, C.A.Campos, T.Herzog, M.Covasa, **K.Czaja**, R.C.Ritter, Reduction of food intake by cholecystokinin requires activation of hindbrain NMDA-type glutamate receptors, Am. J Physiol Regul. Integr. Comp Physiol 301 (2011) 448-455.

Campos,C.A.; Wright,J.S.; **Czaja,K**.; Ritter,R.C., CCK-induced reduction of food intake and hindbrain MAPK signaling are mediated by NMDA receptor activation. Endocrinology 153 (2012) 2633-2646.

I also designed and performed series of studies investigating degeneration and regeneration after injury of unmyelinated sensory neurons innervating gastrointestinal tract. The results show that capsaicin induces a cascade of events leading to an activation of endogenous multipotent cells in the sensory ganglia. These cells enter the cell cycle, divide and differentiate to form new glia and functional neurons,however, the molecular mechanism of the neurogenic action of capsaicin needs further investigations. Complete understanding of neurogenic capsaicin action and the ability to manipulate the population of endogenous ganglionic progenitors is a fundamental step towards the use of an alternative reserve of stem cells to repair a damaged nervous system. This knowledge will help to develop methods to repair damaged CNS.

**K. Czaja**, G.A. Burns, R.C. Ritter, Capsaicin-induced neuronal death and proliferation of the primary sensory neurons located in the nodose ganglia of adult rats, Neuroscience 154 (2008) 621-630.

V. Ryu, Z. Gallaher, **K. Czaja**, Plasticity of nodose ganglion neurons after capsaicin- and vagotomy-induced nerve damage in adult rats, Neuroscience 167 (2010) 1227-1238.

Z.R. Gallaher, R.M. Larios, V. Ryu, L.K. Sprunger, **K. Czaja**, Recovery of viscerosensory innervation from the dorsal root ganglia of the adult rat following capsaicin-induced injury, J Comp Neurol. 518 (2010) 3529-3540.

Z.R. Gallaher, V. Ryu, R.M. Larios, L.K. Sprunger, **K. Czaja**, Neural proliferation and restoration of neurochemical phenotypes and compromised functions following capsaicin-induced neuronal damage in the nodose ganglion of the adult rat, Front Neurosci 5 (2011) 12.

My recent studies were designed to understand the brain plasticity after injury to the vagus nerve. We used neurotoxic (capsaicin), mechanical (vagotomy) and surgical (gastric bypass) approaches to determine the response of the CNS to peripheral damage. Results of the studies revealed that peripheral damage to the vagus nerve triggers synaptic reorganization in the hindbrain and long-lasting microglia activation in the brain feeding centers. The significance of our studies is two-fold. First, this research provides a deeper understanding of the effects of obesity and gastric bypass surgery on the neural circuitry underlying gustatory signaling in the brainstem. Second, the results advance the understanding of mechanisms by which RYGB surgery causes weight loss by establishing the role of gastric vagotomy in taste signaling. This knowledge will facilitate the development of novel anti-obesity treatments that could achieve at least some of the weight loss caused by RYGB, without surgical risks.

Ronchi G, Ryu V, Fornaro M, **Czaja K** (2012) Hippocampal plasticity after a vagus nerve injury in the rat. Neural Regeneration Research 7:1055-1063

Gallaher ZR, Ryu V, Herzog T, Ritter RC, **Czaja K** (2012) Changes in microglial activation within the hindbrain, nodose ganglia, and the spinal cord following subdiaphragmatic vagotomy. Neurosci Lett 513:31-36

Peters JH, Gallaher ZR, Ryu V, **Czaja K** (2013) Withdrawal and restoration of central vagal afferents within the dorsal vagal complex following subdiaphragmatic vagotomy. J Comp Neurol 521:3584-3599

Ballsmider LA, Vaughn AC, David M, Hajnal A, Di Lorenzo PM, **Czaja K** (2015) Sleeve gastrectomy and Roux-en-Y gastric bypass alter the gut-brain communication. Neural Plast 2015:601985

My current project (NIH; 1R01DC013904, started in April 2015) investigates vagal influence on brainstem plasticity and neural coding of taste. Our long-term goal is to understand the neural mechanisms that determine taste alterations following diet-induced obesity (DIO) and RYGB. Specifically, we want to detail the neuroanatomical, neurochemical and neurophysiological sequelae of reorganization of subdiaphragmatic vagal afferents, resulting from obesity and following RYGB, as they relate to gustatory signaling in nucleus of the solitary tract (NTS). Our central hypothesis is that damage to the gastric branches of the vagus, a consequence of RYGB, induces synaptic plasticity and circuit reorganization in the intermediate (feeding) and rostral (gustatory) NTS. The proposed work is innovative because it connects the role of vagus nerve damage-induced plasticity within the NTS with taste alterations following DIO and RYGB. Results, of the proposed project, will provide a deeper understanding of the effects of obesity and RYGB on the neural circuitry underlying gustatory signaling in the brainstem. This knowledge will enable more systematic and targeted manipulations, aimed at revealing mechanisms by which RYGB reduces consumption of high-caloric foods.

Kittrell H, Graber W, Mariani E, **Czaja K**, Hajnal A, Di Lorenzo PM. Taste and odor preferences following Roux-en-Y surgery in humans. PloS One. (2018);13(7):e0199508. PMID: 29975712

Minaya DM, Larson RW, Podlasz P, **Czaja K**. Glutamate-dependent regulation of food intake is altered with age through changes in NMDA receptor phenotypes on vagal afferent neurons. Physiology & Behavior. (2018); 189:26-31. PMID: 29476874

Sen T, Cawthon CR, Ihde BT, Hajnal A, DiLorenzo PM, de La Serre CB, **Czaja K**. Diet-driven microbiota dysbiosis is associated with vagal remodeling and obesity. Physiology & Behavior. (2017); 173:305-317. NIHMSID: NIHMS858064; PMID: 28249783

Vaughn AC, Cooper EM, DiLorenzo PM, O'Loughlin LJ, Konkel ME, Peters JH, Hajnal A, Sen T, Lee SH, de La Serre CB, **Czaja K**. Energy-dense diet triggers changes in gut microbiota, reorganization of gut‑brain vagal communication and increases body fat accumulation. Acta Neurobiologiae Experimentalis. (2017); 77(1):18-30. PMID: 28379213

**Complete List of Published Work in MyBibliography:**

# <https://www.ncbi.nlm.nih.gov/sites/myncbi/krzysztof.czaja.1/bibliography/51964337/public/?sort=date&direction=descending>.

# D. Additional Information: Research Support and/or Scholastic Performance

# *Ongoing Research Support*

* **NIH**/ 1R01DC013904; Krzysztof Czaja (PI) 04/01/2015-03/31/2019

**Title:** Vagal influence on brainstem plasticity and neural coding of taste.

The central hypothesis is that damage to the gastric branches of the vagus, a consequence of RYGB, induces synaptic plasticity and circuit reorganization in the intermediate (feeding) and rostral (gustatory) NTS. **Role: PI**

* **NIH**/ 5T35OD010433; Susan Sanchez (PI) 04/01/2006-03/31/2022

**Title:** Georgia veterinary scholars summer research program.

The aim of the Georgia Veterinary Scholars Research Program (GVSP) at the University of Georgia College of Veterinary Medicine (UGA-CVM) is to immerse academically talented veterinary students from across the US in cutting edge research inspiring them toward careers in biomedical research, and fostering in them a deeper understanding of the myriad roles, and vital need, for veterinarians in research. **Role: Mentor**

* **NIH/** 1R21DK110511; Claire De La Serre (PI) 08/01/2016-07/31/2018

**Title:** Microbiome-Vagal-Brain signaling: impact on the reward system and food intake

We aim to demonstrate that microbiota to brain communication is vagally mediated. The results will support the development of microbiota-based therapies aimed at food addiction and weight loss. Microbiota and vagal signaling could be more easily manipulated with fewer side effects than central targets.
**Role: Co-Investigator, Credit: 15%**

# *Completed Research Support*

* **NIH**/ 5R01DK092651; James Peters (PI) 07/01/2011-06/30/2016;

**Title:** Asynchronous glutamate release in vagal afferent to NTS neurotransmission

The aims of the project are: delineate the mechanisms of TRPV1 activation resulting in asynchronous glutamate release, determine the extent to which other thermo- TRPs participate in asynchronous neurotransmission, and utilize selective antagonists and genetic KO mouse models to determine the contribution of asynchronous glutamate release in the control of food intake. **Role: Collaborator**,

* **USDA** AFRI 2010-03243, Clay Lents (PI) 07/01/2010-06/30/2014

**Title:** *Rfamide Peptides Integrate The Effect Of Nutrition On The Gonadotropic Axis Of The Gilt*

This project aims to determine the role of Kiss and RFRP-3 in modulation of GnRH input from the arcuate (ARC) and paraventricular (PVN) nuclei to the anterior pituitary gland and LH secretion along with reproductive cycle. **Role:** **Co-Investigator**

* **NIH**/ 2R01DK052849; Robert C Ritter (PI) 07/2008 – 06/2014

**Title:** *The role of glutamate in the control of food intake*

This project aims to determine the role of NMDA-type glutamate receptors in the control of meal size by the vagus nerve. **Role:** **Co-PI**

* **NFL** Charities Medical Grant; Krzysztof Czaja (PI) 08/08/12-31/12/14;

**Title:** Can the Endogenous Neural Stem Cells Repair An Injured Nervous System?

The objective of this application is to characterize injury-induced neurogenesis within the sensory ganglia following neurotoxic capsaicin, nerve axotomy and peripheral nerve crush. **Role: PI**