NRC *newsletter*

Mapping out brain circuits for feeding and glucose homeostasis

By Qingchun Tong, Ph.D.

Tong

Abstract: Obesity and its associated complications are imposing an enormous burden on our society, while its effective treatment is still lacking. A better understanding of the mechanisms regulating energy balance is required to develop new therapeutic strategies. Neurons in the hypothalamus receive and integrate signals for nutritional status, and then adjust food intake and energy expenditure accordingly to maintain energy balance. The research focus of my group is to understand how neurocircuitry in the hypothalamus regulates energy balance. We use a combination of novel techniques such as light-controlled activation of neurons and mouse genetic models to link neural pathways to feeding behaviors.

About one-third of the population in the United States is obese, posing a great economic burden to our society. However, it is difficult to achieve long-term weight loss success. The available therapeutic drugs for body weight management have limited efficacy or significant side effects, largely due to a limited understanding of the ways in which the brain controls feeding and metabolism. A major goal of my lab is to use neuron-specific manipulation in mice to activate or inactivate specific groups of neurons, or key genes in the brain, in order to delineate neurocircuits important for feeding and energy expenditure. Ultimately, we want to use the brain as the drug target because it is the brain that coordinates the other organs.

To achieve these goals, we are using an optogenetic approach with which it is possible to activate or inhibit a specific group of neurons with millisecond resolution. This technique, which uses light to control neuronal activity, provides a direct assessment of inter-neuronal communication. We are generating new mouse tools, and are combining mouse genetics with optogenetics to identify novel types of neurons in the brain, which control body weight regulation and feeding.

The connectome of the rabbit retina

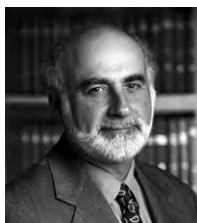*By David W. Marshak, Ph.D.*

Marshak

Abstract: We recently received a grant from the UTHealth BRAIN Initiative to support our research on the retinal connectome, a complete description of all the types of neurons in a representative volume of the retina and their synaptic connections. This is not only essential as a first step toward understanding vision and its disorders, but it is also consistent with two goals of the national BRAIN Initiative, identifying neuronal types and describing how they contribute to neural circuits.

It may not be obvious how basic research on neurons in the eye would ultimately explain how the brain works or lead to cures for neurological and psychiatric diseases. Like the brain and the spinal cord, the retina is part of the central nervous system. It arises from an outgrowth of the neural tube early in development, and its neurons and glial cells are very similar to those in the brain. Neurons in the retina show many of the same forms of synaptic plasticity that have been described in the brain. For example, they change the strength of their chemical and electrical synapses in order to remain sensitive to contrast over an enormous range of ambient light intensities. The main difference however is that the retina does not store any information; the changes in synaptic strength are all completely reversible. The retina carries out sophisticated processing of visual information using neural circuits very similar to those in the brain. There are approximately thirty types of retinal ganglion cells, the neurons that convey visual information to the brain through their axons in the optic nerve. Each type has a distinctive morphology and is sensitive to different

UTHealth | **Neuroscience Research Center**
The University of Texas
Health Science Center at Houston

Director's Column

From the Director, John H. Byrne, Ph.D.

The 2014-2015 academic year has been very productive and filled with new ventures for the NRC. Of great significance was our announcement and funding of the UTHealth BRAIN Initiative. Based on the national Brain Research through Advancing Innovative Neurotechnologies (BRAIN) Initiative announced in 2013, UTHealth developed our own funding opportunity to seed pilot projects in the seven high-priority research areas identified by the NIH, the focus of which is to advance the understanding of the relationship among cells, circuits and behavior. Our goal at UTHealth is to greatly contribute to the acceleration of the development and application of new technologies that will provide insight into nervous system function in health and disease.

Funds for these seed grants were generously made available by UTHealth President Giuseppe Colasurdo. Along with the UTHealth Center for Clinical and Translational Sciences (CCTS; which is supported by an NIH Clinical and Translational Science Award), the NRC was able to award eight projects from the UTHealth Medical School. The short-term goal is to allow our researchers to collect enough preliminary data to apply for the federal neuroscience Initiative. The long-term goal of the UTHealth Initiative is to facilitate scientific research and collaborative efforts in the neurosciences, creating an atmosphere of scientific exchange through multiple routes. Collaborative interdisciplinary research was highly encouraged for these proposals, and is currently being carried out as you will see from the list of awardees. From the pool of 23 applications, eight awards were made each at $50,000 for a year with the possibility of a second year of support pending suitable progress. The awardees include:

Dr. Valentin Dragoi, Professor of Neurobiology and Anatomy, and Dr. Roger Janz, Associate Professor of Neurobiology and Anatomy, are co-principal investigators on a project aimed to develop and test new optogenetic tools, which will allow them to manipulate large-scale neuronal circuits.

Dr. Nicholas Justice, Assistant Professor at the Center for Metabolic and Degenerative Disease, and co-investigator Dr. Jeffrey Chang, Assistant Professor of Integrative Biology and Pharmacology, received funding to better understand causes of stress and chronic anxiety-related disease by examining the transcriptomic analysis of corticotropin releasing factor neurons, which initiate the endocrine stress response.

Dr. David Marshak, Professor of Neurobiology and Anatomy, and co-investigator Dr. Stephen Mills, Professor of Ophthalmology and Visual Science received funding for a project titled, "Structure and function of G5 retinal ganglion cells: A connectomics approach."

Dr. John Redell, Assistant Professor of Neurobiology and Anatomy, and his co-investigators Dr. Pramod Dash, Professor of Neurobiology and Anatomy, and Dr. Badri Roysam, Chair of the University of Houston Department of Electrical and Computer Engineering, received funding to examine disruption of circuit connectivity following a mild traumatic brain injury, and how it relates to behavioral outcome.

Dr. Christophe Ribelayga, Assistant Professor of Ophthalmology and Visual Science, and co-principal investigator Dr. Jiaqian Wu, Assistant Professor of Neurosurgery, are conducting an investigation to characterize a functional link between a specific neuron in the retina and visual contrast sensitivity.

Dr. Claudio Soto, Professor of Neurology, is creating an innovative model to study the pathogenesis of Alzheimer's disease so that future studies may be used to design novel therapeutic strategies.

Dr. Qingchun Tong, an Associate Professor at the Center for Metabolic and Degenerative Disease, and

his co-investigator Dr. Benjamin Arenkiel, Assistant Professor in the Departments of Molecular and Human Genetics, and Neuroscience at Baylor College of Medicine, are planning to define the neurocircuit from the lateral hypothalamus to the paraventricular hypothalamic nucleus, a circuit that regulates feeding and obsessive behaviors.

Dr. Eric Wagner, Associate Professor of Biochemistry and Molecular Biology, and co-investigator Dr. Pramod Dash, are working on a project to decipher a global role of 3'UTR length in learning and behavior in combination with RNA-seq technology.

In addition to our announcement, the UT System has also created its own seed grant funding opportunity to align trans-institutional, multi-disciplinary research partnerships and teams to be competitive for future funding opportunities of the national BRAIN Initiative. This program, spearheaded by Patti Hurn,

UT System Vice Chancellor for Research, and Tom Jacobs, Associate Vice Chancellor, is expected to award approximately $5M in total funding for up to 50 applicants. The UT System is considering additional initiatives, which include: a national recruitment initiative to recruit young leaders in neurotechnology research to Texas; a neurotechnology development fund; hosting Texas BRAIN meetings; promoting UT centers committed to advancing studies in human subjects; and providing direct funding streams for planning meetings to help build research partnerships and teams.

We are confident that these funding opportunities will facilitate UTHealth's contributions to the overall goals of the national BRAIN Initiative and we look forward to reporting our investigator's progress in the future.
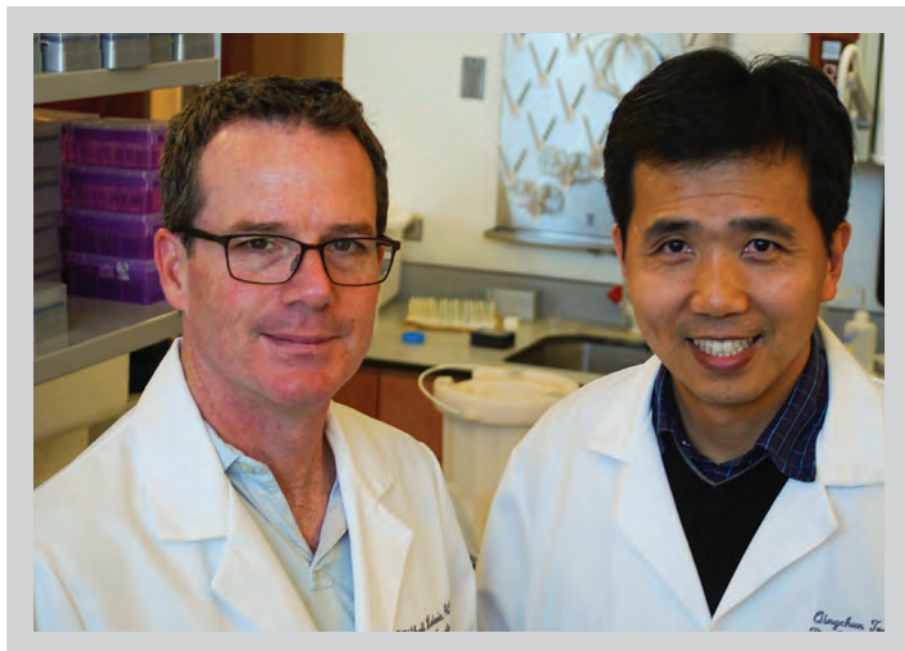
Research proposals from UTHealth NRC faculty members, Drs. Nicholas Justice (left) and Qingchun Tong (right), were among eight research projects awarded seed grants for neuroscience research through the UTHealth BRAIN Initiative.

news&information

The NRC awards two exemplary students annually for their contributions to neuroscience.

The 2015 Distinguished Medical Student in the Neurosciences Award (*above, left*) was awarded to Dr. Christopher Conner, a fourth-year medical student, and MD/PhD student, who has pursued a wide range of neuroscience research opportunities including language processing in epilepsy patients. Dr. Conner will perform his residency here at UTHealth in neurosurgery.

The 2015 Graduate Student Brain Awareness Outreach Award (*above, right*) was awarded to Mr. Charles Beaman, an MD/PhD student currently working towards his Ph.D. in neuroscience. Mr. Beaman has been described by his mentor as "an exceptionally patient and impassioned educator," volunteering his time at UTHealth and throughout the Houston community.

Congratulations to NRC Members:

For information on the eight proposals which were awarded seed funds from the UTHealth BRAINInitiative, please see the Director's Column.

Tatiana Barichello, Ph.D., Assistant Professor of Psychiatry and Behavioral Sciences, received the American Association of Immunologists Early Career Faculty Travel Grant. This award recognizes the professional promise of an early career investigator by assisting the award recipient with travel to their annual meeting.

Carmen W. Dessauer, Ph.D., Professor of Integrative Biology and Pharmacology, has been appointed to the National Advisory Council for the NIH Institute for General Medical Sciences (NIGMS). The Council serves to advise, assist, and make recommendations to the Secretary of Health and Human Services and the Director of NIGMS on matters related to the activities and policies of NIGMS.

Angela Heads, Ph.D., a postdoctoral fellow in the laboratories of **Scott Lane, Ph.D.** and **Joy M. Schmitz, Ph.D.,** both Professors of Psychiatry and Behavioral Sciences, received a travel award from the UTHealth Postdoctoral Association. The award was presented at the Dean's Excellence in Research Symposium.

Vasanthi Jayaraman, Ph.D., Professor of Biochemistry and Molecular Biology, received a grant from the NIH National Institute of General Medical Sciences to study TARP modulation of AMPA receptors.

Ying Liu, M.D., Ph.D., Assistant Professor of Neurosurgery, received an award from Mission Connect/TIRR Foundation to examine the use of Human iPSC derived astrocyte progenitors in treating acute and subacute spinal cord injury.

Katherine Loveland, Ph.D., Professor of Psychiatry and Behavioral Sciences, along with Noriko Porter, Ph.D., a visiting scientist, received the Abe Fellowship to support their cross-cultural research on parents of children with autism. This study is expected to contribute to a broader understanding of autism as it affects families across the globe and to lead to culturally-sensitive approaches to intervention and supports.

Gislaine Zilli Reus, Ph.D., a postdoctoral fellow in the laboratory of **Joao de Quevedo, M.D., Ph.D.,** Professor of Psychiatry and Behavioral Sciences, received the Society of Biological Psychiatry's 2015 Domestic Travel Fellowship Award to attend their annual meeting. Dr. Reus also received an award from the Anxiety and Depression Association of America for their Career Development Leadership Program.

David Sandberg, M.D., Associate Professor of Pediatric Surgery and Neurosurgery, was awarded the 2015 Men of Distinction Award for research on local delivery of chemotherapy to malignant brain tumors in children.

Claudio Soto, Ph.D., Professor of Neurology, received a NIH National Institute of Allergy and Infectious Diseases grant to study the mechanisms implicated in the transmission of prion disease with particular emphasis on the study of human prion diseases (Program Project grant led by Witold Surewicz, Ph.D., Case Western Reserve University).

Angela Stotts, Ph.D., Professor of Family and Community Medicine, received an R01 grant from the National Heart, Lung, and Blood Institute to study motivational incentives to reduce second hand smoke in NICU infant's homes. A supplement to this award was provided to promote diversity among researchers to Yolanda Villarreal, Ph.D., a postdoctoral fellow in the laboratory.

Qingchun Tong, Ph.D., Associate Professor at the Center for Metabolic and Degenerative Diseases, recently received two awards: One from the American Heart Association Southwest Division to study the role of GABAergic action on POMC neurons in body weight regulation; and a second from the American Diabetes Association to study the role of arcuate GABAergic neurons in glucose homeostasis.

Jiaqian Wu, Ph.D., Assistant Professor of Neurosurgery, received an R01 from the National Institute of Neurological Disorders and Stroke to identify novel potential therapeutic targets for chronic Spinal Cord Injury gliosis using purified astrocytes in mouse contusive SCI models, and to test their functions.

attributes of the visual environment, such as color and motion, and the differences between types arise largely from the neural circuits that provide their inputs. This focus on neural circuits rather than individual neurons is also the fundamental principle underlying the BRAIN Initiative, whose working hypothesis is that diseases of the brain frequently involve disruption of neural circuits.

Our long-term goal is to build the retinal connectome of a baboon, whose retinas are virtually identical to those of humans, however the serial sections we prepared have not yet been imaged. In addition, we are beginning with the first retinal connectome from the rabbit retina. The rabbit is the species in which the types of retinal neurons have been most completely characterized, both by anatomical and physiological techniques. The approach we are taking was developed by my collaborator, Dr. Robert E. Marc, while he was on the faculty of UTHealth and further refined after he moved to the University of Utah School of Medicine. The project is supported by the National Eye Institute, as part of the National Institutes of Health Blueprint for Neuroscience Research. The underlying principle is that each type of neuron in the retina can be identified using a panel of antibodies applied to serial, thin sections of the retina. The first step is to incubate the living retina in a culture medium containing a small cation, agmatine, and to stimulate it with light or pharmacological agents. If a cell has a ligand-gated channel that admits large cations, such as the glutamate receptor found at excitatory synapses, and those channels are open,

In*the*Spotlight

Pictured above *(left to right)*: Drs. Jair Soares, Bruce McEwen and Jack Byrne.

2015 Distinguished Lecture in the Neurosciences - February 12, 2015
Dr. Bruce S. McEwen

The Distinguished Lecture Series is always one of our most highly anticipated events. This annual event brings internationally renowned scientists to the NRC to deliver a lecture on their most eminent work.

Dr. Bruce S. McEwen delivered the annual Distinguished Lecture in the Neurosciences titled, "The Brain on Stress: Novel Epigenetic Mechanisms of Brain Plasticity." Dr. McEwen is the Alfred E. Mirsky Professor at The Rockefeller University and Head of the Harold and Margaret Milliken Hatch Laboratory of Neuroendocrinology.
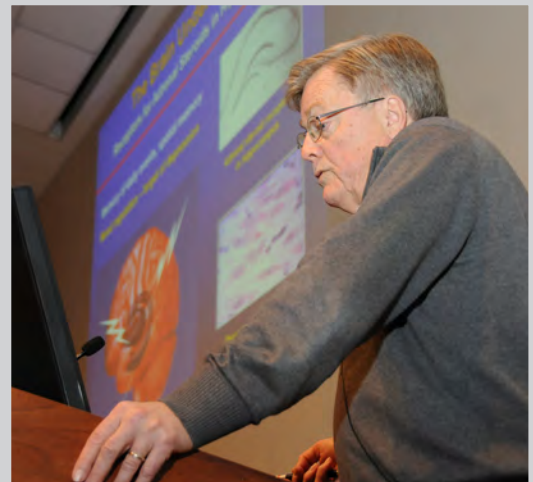
Feeding is a complex behavior and can be influenced by a number of social and humoral factors including both the psychological and nutritional status. Individuals with eating disorders (EDs) often suffer from excessive preoccupations with food intake and body image. Similarly, patients with psychological obsessive-compulsive disorders (OCD) experience recurrent and intrusive thoughts, which are followed by repetitive behaviors, or compulsions. Indeed, a high co-occurrence of ED and OCD occurs in clinical populations and these populations share common core features and etiology. However, the neural basis for these disorders and their co-occurrence is not clear.

Using a combination of Cre-loxP technology, which allows us to achieve neuron-specific manipulation, and optogenetic approaches, we aim to link the function of specific groups of neurons to feeding behavior. From previous work, we found that activation of a novel group of neurons in the lateral hypothalamus, a region previously identified as a hunger center, induced intense feeding and self-grooming, a behavior which is commonly associated with OCD (Fig. 1). We are now in the process of generating a variety of animal models which exhibit disrupted neurotransmitter release from this specific group of neurons, or deletion of relevant receptors from the putative downstream neurons, to map out the neural pathways that are responsible for feeding and/or self-grooming behavior. Because self-grooming is a typical repetitive behavior, which is commonly used to model compulsive behavior in human OCD, this line of research will be important to reveal the potential neurological basis underlying the occurrence of EDs and OCDs.
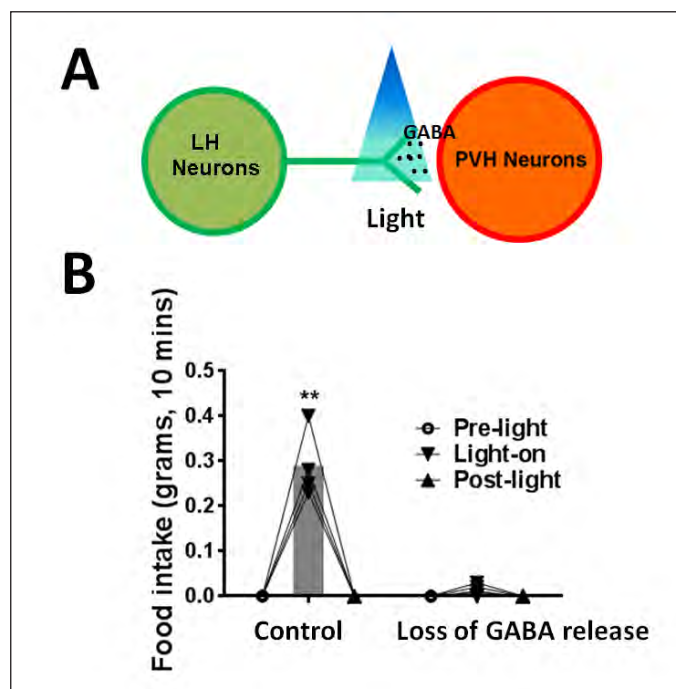
Another major direction of the lab is to map out key neurons and their pathways in the maintenance of glucose homeostasis. Uncontrolled hyperglycemia is a hallmark of diabetes, a debilitating condition affecting nearly 10% of Americans. The brain, through autonomic output pathways, modulates peripheral organs including the pancreas, liver and muscle to maintain glucose homeostasis. Insulin (for type 1 diabetes) and insulin sensitizers (for type 2 diabetes), which mainly target peripheral organs, are the only available treatment options for diabetic patients; however, these treatments have considerable side effects or limited efficacy. Thus, it is imperative to identify novel brain-based therapeutic targets. Recent research suggests that the action of leptin, an adipose tissue-derived hormone important for body weight regulation, is sufficient to restore normal blood sugar levels in type 1 diabetes in an insulin-independent manner. Importantly, leptin action in the brain appears not to cause hypoglycemia, a life-threatening side effect associated with insulin therapy. Thus, it is important to map out key neural pathways in the brain that mediate leptin action on normal blood sugar restoration.

Based on the assumption that leptin action has to be mediated by leptin receptor (LepR)-expressing neurons, we have generated mice with disruption release of glutamate and GABA, key neurotransmitters in the brain, specifically from LepR neurons. Using these mice, we will be able to examine the potential roles of these neurotransmitters in mediating the action of leptin. In addition, we are also using animal models with a deficiency in key molecules important for known leptin signaling pathways, such as the leptin-activated transcription factor, p-STAT3, to explore the relative importance of cellular signaling pathways in mediating the action of leptin. Furthermore, we also aim to identify important components of autonomic output pathways that mediate leptin action. This will allows us to use interventions which mimic the brain action in controlling peripheral organs to regain glucose homeostasis in diabetes.

In summary, using a range of cutting-edge techniques, our goal is to understand the basic mechanisms for neurons in controlling feeding and glucose metabolism, and to reveal potential brain-based therapeutic targets for eating disorders, obesity and diabetes.

About the Author
Qingchun Tong obtained his bachelor degree in Biology in Anhui Normal University at his hometown, master degree in Physiology at Shanghai Institute of Physiology of Chinese Academy of Sciences and Ph.D. degree in Neural and Behavioral Sciences from SUNY Downstate Medical Center. After postdoctoral training at Harvard Medical School, he moved to the Institute of Molecular Medicine of UTHealth to start his independent career as an Assistant Professor in 2009, and is now an Associate Professor and a member of Neuroscience Research Center.
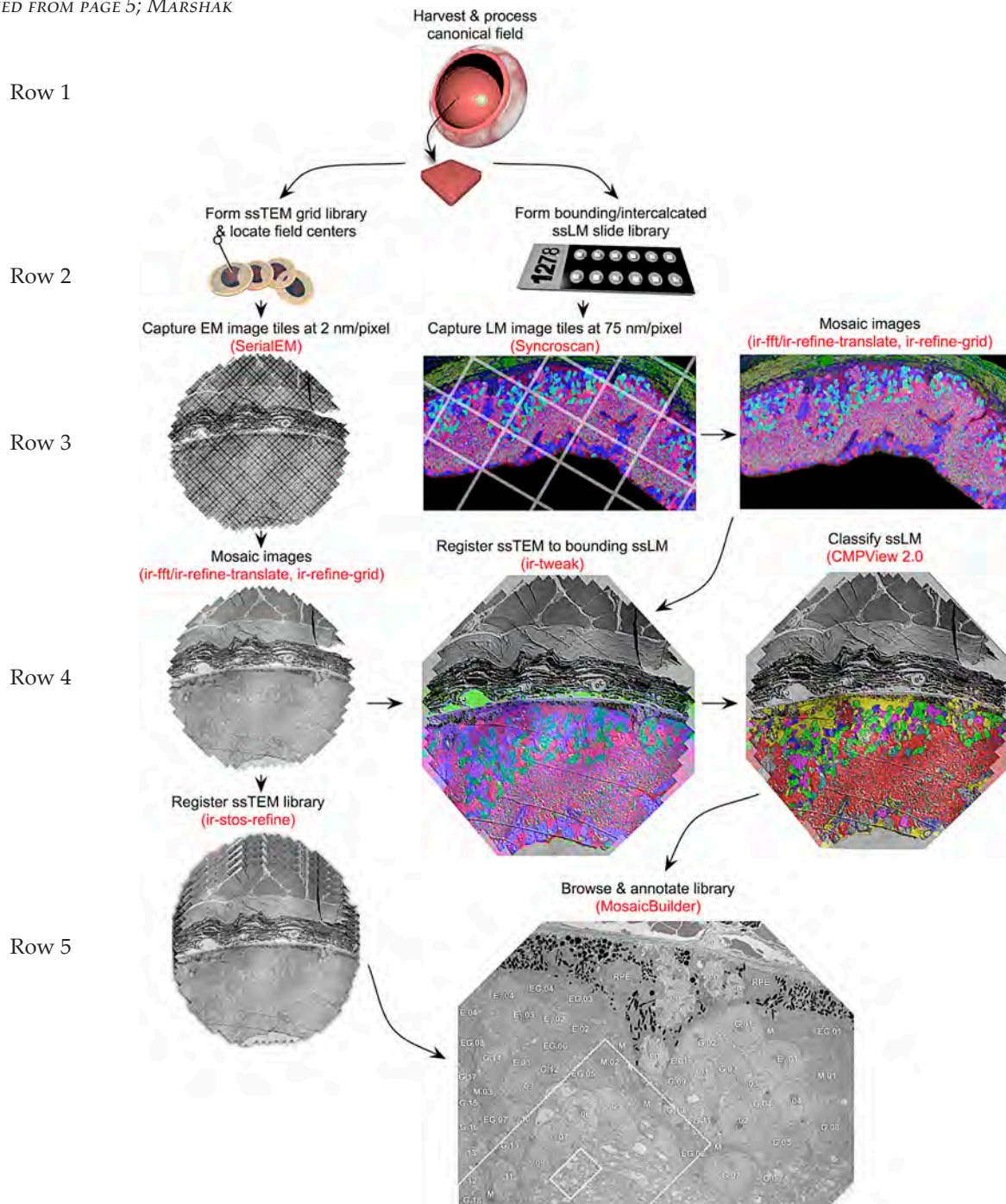

Fig. 1. Activation of LH GABAergic neurons leads to voracious feeding. A: diagram showing expression of ChR2 in LH fibers that project to the PVH and light stimulation evokes GABA release onto PVH neurons. B. Activation of LH fibers in the PVH evoked voracious feeding, which was abrogated by loss of GABA release.

Row 1

Row 2

Row 3

Row 4

Row 5

Fig. 1. *The first step in building the retinal connectome was to select a region of rabbit retina large enough to contain at least one of each type of retinal neuron and embed it in epoxy resin (top). Ultrathin, serial sections are prepared and collected on grids for transmission electron microscopy or on slides for labeling with a panel of antibodies to small molecules and analysis by light microscopy (second row). Individual images are captured, combined into mosaics and superimposed (rows 2 and 3). Specific types of neurons are classified based on the unique combinations of small molecules that they contain, a process called computerized molecular phenotyping (CMP; row 3, right). To facilitate tracing of axons and dendrites through the neuropil, the serial electron microscopic mosaics are aligned (row 4, left). The two sets of data are combined and then annotated using Viking (bottom row).*

Anderson JR, Jones BW, Yang J-H, Shaw MV, Watt CB, et al. (2009) A computational framework for ultrastructural mapping of neural circuitry. PLoS Biol 7(3): e1000074. doi:10.1371/journal.pbio.1000074 (located on page 1 of the article)

it will accumulate agmatine. Thus, the level of agmatine indicates the history of excitatory input to the neuron. The tissue is then fixed, cross-linking the agmatine and other small molecules with intracellular proteins. The tissue is embedded in epoxy resin, and serial sections are cut in a horizontal plane. The sections through the nuclear layers, where the neuronal cell bodies are found, are labeled with the panel of antibodies. For the most part, the antibodies are directed against small molecules, including agmatine and the amino acids glutamate, aspartate, glycine, glutamine, taurine and gamma-aminobutyric acid (GABA). The same cell body appears in many consecutive sections, and the levels of each antigen are calculated from the intensity of the labeling. Many types of cells contain each antigen, but each type of neuron has a distinctive set of levels for each antigen. For example, the cholinergic amacrine cells also contain high levels of GABA and accumulate very high levels of agmatine after stimulation. In addition, some antibodies against larger molecules work under these conditions, including antibody to tyrosine hydroxylase, a marker for dopaminergic neurons.

The sections through the outer and inner plexiform layers, where the vast majority of synapses are located, are analyzed by automated transmission electron microscopy. A section is loaded into the microscope by hand, but the stage movements, focusing and image acquisition are all done automatically using Serial EM software developed by Dr. David Mastronarde at the University of Colorado. The individual images are then combined into mosaics representing the entire section. Other groups that construct connectomes are using a newer technique called serial blockface imaging, and this method has the advantage that the serial sections are automatically collected in register. The surface of the block is imaged by scanning electron microscopy and then a section is removed, either by a microtome within the microscope or by milling with a beam of ions. One disadvantage of this approach is that the sections are lost after they are imaged and not available for further analysis. Another, more serious problem is that the resolution of the scanning electron microscope is only 5-10 nanometers, but a resolution of 2 nanometers is essential to recognize electrical synapses, which are common in the retina, and other important ultrastructural details. Another advantage of transmission electron microscopy is that the instruments are widely available, unlike those used for blockface imaging, and it will be possible to collect images for connectomes at many different sites in the future.

Using techniques originally developed for satellite imaging, Dr. Marc and his collaborators in Utah have worked out an elegant solution to the problem of registering the mosaics from one section to the next. They have also developed an interface called Viking that allows users anywhere to annotate the images, following individual axons and dendrites through the inner plexiform layer and marking their synaptic connections and other features. I have had many years of experience looking at serial sections of the retina in the electron microscope, but my first experience with Viking was remarkable. I could locate an interesting feature in a profile of a neuron and with

one mouse click, move to the corresponding area on the next section in the series and so on until reaching the end, a process that took many hours of work in the past. I felt as though I was walking through the neuropil, myself. To create this illusion, Viking generates sets of images of individual sections much like those used in the Google Earth program. The user initially sees a low-resolution image, and as he or she zooms in, higher and higher resolution images are substituted, giving the users the impression that the entire dataset is on their computer, even though it resides on servers at Google. Because the image files are relatively small, they can be transmitted via the http protocol and are accessible to everyone who has been vetted by the curators in Utah. Our laboratory at UTHealth was one of the first to use the system remotely. The first step was a week-long training session in the Marc Laboratory, where the dataset is housed on high-speed servers and also curated. Based on that experience, we prepared a detailed, illustrated guide to the system so that other investigators can skip this step in the future. Contributions from many investigators will be essential for the foreseeable future. The datasets generated from the images are enormous because they contain thousands of cells with very complex morphologies. The automated systems designed to recognize profiles of neuronal processes in serial sections have not proven reliable enough to reconstruct neurons or recognize their synapses correctly. In the future, we hope that investigators trying to answer specific questions about the retina will follow our example and continue annotating the connectomes in the future.

About the Author
David W. Marshak, Ph.D. first became interested in the retina as an undergraduate at Cornell University. He did his graduate work in the Department of Anatomy at the University of California, Los Angeles, much of it in the same laboratory where Robert E. Marc was a postdoctoral fellow. They were both trained by William K. Stell, whose work on correlated light and electron microscopy provided the foundation for their collaboration years later. David continued his training with another distinguished neuroscientist, John E. Dowling, in the Department of Molecular and Cellular Biology at Harvard University. He joined the Department of Neurobiology and Anatomy at UTHealth in 1984.

Brain Awareness Week *2015*

The UTHealth NRC hosted two events in association with Brain Awareness Week 2015, an international event promoted by the Dana Foundation. These events are held annually, and are free and open to the public. A very special thanks to our many dedicated volunteers and public advocacy groups that were involved in these successful events.

Brain Night at The Health Museum
March 19, 2015

Brain Night is an event designed for elementary and middle school children and their families which included fifteen different brain-related demonstrations. Volunteers consisted of UTHealth graduate students, postdoctoral fellows and faculty members, as well as faculty, staff and students from the Memorial Hermann Ironman Sports Medicine Institute, Children's Learning Institute, Texas Woman's University and Rice University. Over 300 children and their family members learned the importance of helmet-safety, held a real human brain, received a neurological examination, built neurons with pipe-cleaners, and much more.

20th Annual Public Forum
April 11, 2015
"The Brain on Drugs"

This event featured a panel discussion moderated by Dr. Joy M. Schmitz, UTHealth addiction expert and director of the Center for Neurobehavioral Research on Addictions and was held at the UTHealth Cooley University Life Center. The panel included Drs. Scott Lane and Michael Weaver from UTHealth, and Dr. Dawnelle Schatte from Baylor College of Medicine.

Our moderator and panelists led a great discussion on drug addiction, marijuana legalization, brain changes with drug use, talking to your children about drugs, and more. We were thrilled that Congresswoman Sheila Jackson Lee attended this event, allowing for a lively discussion between neuroscientists, a national politician, and community members. Local support groups were made available after the Forum to provide continued support following the event.

Upcoming Events

Neurobiology of Disease
Seminar Course: Stress and the Brain
Tuesdays, Noon to 1:00 pm,
September 1 to December 15, 2015

UTHealth Medical School Building 7.037.
The course co-directors are Joy M. Schmitz, Ph.D.,
and Scott Lane, Ph.D., both Professors from the
UTHealth Department of Psychiatry and Behavioral
Sciences. Lectures are open to graduate and medical
students, postdoctoral fellows and residents for credit.
All others are welcome to attend the weekly seminars.
Lectures will be given by UTHealth faculty experts
with a special guest lecture. Course contacts:
Joy.M.Schmitz@uth.tmc.edu and
Scott.D.Lane@uth.tmc.edu.

Neuroscience
Poster Session:
Saturday,
December 5, 2015,
9 am to Noon

UTHealth Cooley University Life Center,
7400 Cambridge St., Houston, TX.

More details to come. For questions,
please email nba-nrc@uth.tmc.edu.

**For upcoming neuroscience events
in the Texas Medical Center, please
check our online events calendar at
https://med.uth.edu/nrc/events.**

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The Neurofax includes seminars, grand rounds, research
colloquia, symposia, and local or national conferences that
are sponsored by UTHealth, the Texas Medical Center,
and other Houston area universities and research institu-
tions. To submit your event to this calendar, please send
an email to **nba-nrc@uth.tmc.edu** and include the Event
Name, Contact, Date, Time and Location.

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engaged in neuroscience research
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accomplishments and outreach efforts
performed at UTHealth. Past issues
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