GENERAL STATEMENT

Animal survival relies in part on neural circuits that ensure vital information is perceived, processed and transformed into necessary responses. Brainstem catecholamine neurons are crucial to each of these steps in the neural systems that orchestrate cardio-respiratory (homeostatic or autonomic) regulation, the processing and storing of sensory information, and cognitive behaviors. Linking the spatial connectivity of brainstem catecholaminergic circuitry to genetically labeled cell types and defining their functional roles will be key to further understanding these physiological and behavioral processes and their place in disease.

While the brainstem catecholaminergic system consists of a relatively small number of neurons, they project throughout almost all of the brain and spinal cord. Thus, it is not clear how subsets of these neurons may functionally segregate between cardio-respiratory modulation, sensory discrimination and cognitive processes, including how they may overlap or impinge upon each other. My long-term goal is to build a genetic framework for identifying brainstem catecholaminergic neuron subsets upon which sensory, cognitive and homeostatic functions can be definitively assigned. This work will produce a genetic–functional circuitry map to facilitate studies of suspected brainstem catecholamine dysfunctions ranging from neurological disorders such as congenital central hypoventilation syndrome, attention deficit hyperactivity disorder and depression to neurodegenerative diseases including Alzheimer’s disease, Dementia with Lewy bodies and Parkinson’s disease.

RESEARCH HISTORY

As a postdoctoral fellow in the Dymecki lab, I developed a new intersectional genetic mouse line, RC::FPDi’ (Fig. 1), to examine the function of highly specific, genetically defined neurons in awake and freely behaving animals. RC::FPDi produces the synthetic Di receptor (a modified hM4 GPCR; Bryan Roth Lab) in neurons that express Cre and/or Flp recombinase transgenes. After a simple intraperitoneal injection of the biologically inert ligand, Clozapine-N-Oxide, activation of the Di receptor initiates a GIRK mediated hyperpolarizing current to suppress neuron firing. The result is an acute perturbation in genetically specified neurons that is inducible, reversible and free from the developmental confounds of constitutive neuronal disruption.

Using the unique capabilities of the RC::FPDi mouse line, my colleagues and I were able to definitively show that serotonergic neurons are required for normal chemosensory drive in respiratory control (the breathing response to sensing blood CO2 levels). Additionally, upon repeated acute serotonergic neuron suppression, mice became reproducibly hypothermic at room temperature, but nonetheless recovered. These findings inform upon possible mechanistic explanations to life-threatening or fatal syndromes including serotonin syndrome and sudden infant death syndrome, where serotonergic dysfunction is believed to play a role. RC::FPDi is designed to target cell types based on their expression of Cre and/or Flp transgenes. Therefore RC::FPDi offers the potential to leverage the large number of available transgenic recombinase lines for use in a broad range of neuron function and neuropathology studies across the central nervous system.

RESEARCH PLAN

My immediate goals are to use intersectional genetic fate-mapping to delineate molecularly distinct subtypes of brainstem catecholaminergic neurons as defined by expression of co-neurotransmitters, neurotransmitter receptors, and developmental gene expression. To add functional definitions to this intersectional genetic fate-map, RC::FPDi and RC::PFTox’ alleles will be used to disrupt electrical and neurochemical communication in vivo (Fig. 1). Animals will be assessed for a range of autonomic behaviors. Parallel to these studies, behavioral assays that examine sensory input discrimination and processing will be used. The results of these experiments will link specific behavioral outcomes to genetically defined neuronal populations. This functional-genetic framework can now be used to more fully characterize pre- and postsynaptic partners of brainstem catecholaminergic neurons in the circuits controlling these behaviors. Additionally, the genetic profiles of targeted neurons will inform upon the underlying molecular mechanisms involved in the development and function of these circuits.

To expand the functional-genetic framework, I will subdivide genetically delineated brainstem catecholaminergic neurons by their projection targets. These spatially and genetically delineated neurons will be recorded in vivo to assess their task- or condition-specific firing pattern. I will use the
retrogradely transported Canine Adenovirus, CAV8 (Fig. 1) to access neurons by their projection target. Presynaptic infection of target areas with a CAV containing a Cre/Flp9,10 intersectional conditional cassette will produce the light activated channelrhodopsin11 only in those catecholaminergic neurons that meet all the conditions of expressing Cre and Flp transgenes as well as projecting to the viral injection site. Immuno-histochemical staining of channelrhodopsin can then be used to map selected projections onto both anatomical and genetic brainstem catecholaminergic landmarks.

To record the activity pattern of genetically specified catecholaminergic projections during behavioral tasks, the firing of channelrhodopsin labeled single neurons can be initially matched to depolarizing light pulses during in vivo recordings before the assays. Additionally, by using pulsed light on the same neuron sets during behavioral tests, the effect of neuron activation on behavior can be specifically examined. Once this conditional optogenetic system is established, additional approaches using in vivo imaging of target area activity (prefrontal cortex, for example) within a virtual reality track ball system should be applicable to study behavior. The additional layer of target projections and their firing patterns in the functional – genetic framework will illuminate how target innervation and neuron activity characteristics (for example tonic vs. phasic firing patterns) influence behavioral outcomes.

My long term vision is to establish an ever-growing framework for defining neuron identity and function that will form a launch pad for advancing studies in development, disease models and potential therapeutic approaches for a range of neuropathological conditions. Toward that goal, I will develop chromatin and RNA profiles of targeted neurons across developmental stages and behavioral challenges. To profile selected neurons, I will leverage the unique intersectional targeting vectors developed in the Dymecki lab to create a series of mouse lines that conditionally express affinity tagged (GFP) molecules to enable targeted purification of various chromatin and RNA species from specified neurons. Examples include Histon3.3-GFP (active promoters), PolII-GFP (active transcription), Ago4-GFP (miRNA), and L10-GFP12 (translating mRNA). Profiling results will produce a set of genes that expands neuron molecular identities and informs upon development, circuit formation as well as information processing. Defining neurons in a genetic-functional framework will provide a new level of specificity toward understanding disease mechanisms and developing effective therapeutics that target only the necessary genes, molecules or neurons and minimize potential side effects.

Selected References

Academic Job Search

Preparing application materials
Academic job search

• Presentation will cover applications for a tenure track assistant professorship at a school or institution where the research program will be paramount.

• For applications aimed at undergraduate or teaching colleges/universities, some recalibration will be needed.
  – More emphasis on the teaching philosophy and experience.
Academic job search

• My presentation will be based on
  – what worked for me.
  – what I’ve learned from talking to new professors, search committees, and having been on several search committees.

• As there is typically no feedback from search committees, I cannot tell you what in my application may not have worked.
My perspective on the academic job search

• Your application is the culmination of > 29 years of education
My perspective on the academic job search

• Your application is the culmination of > 29 years of education
  – K-12
  – 4 yrs undergrad
  – 6 yrs graduate school
  – 6 yrs postdoc
My perspective on the academic job search

• Your application is the culmination of > 29 years of education
  – K-12
  – 4 yrs undergrad
  – 6 yrs graduate school
  – 6 yrs postdoc

• At this point, you’re expected to have figured out…
My perspective on the academic job search

• This is the culmination of > 29 years of education

• At this point, you’re expected to have figured out…

• Your application materials should reflect that from:
  – writing style, copy editing, clean figures
  to:
  – sound and impactful science

Russell Ray, BCM 2017
My perspective on the academic job search

• Thus, your material should be:
  – Clear
  – Concise
  – Easy to read and understand

• If not, it makes reading difficult and raises questions:
  – How much help will you need to write grants and papers?
  – How well can you manage your data (integrity)?
  – Are there deeper problems?
My perspective on the academic job search

• If you need it, get help
  – This series is a great resource!
  – Speak to search committees in your department and Dept. Chair.
    • What do they look for/prioritize?
    • How do recent applicants compare to your potential package?
  – Speak to recent hires @BCM.
  – Speak to people recently hired out from your department to other schools.
My perspective on the academic job search

• **Proof, Practice, Repeat**
  – Feedback at all stages is critical
    • Build a cohort that can work through multiple rounds of review/critique for all your materials.
      – Buy ‘em lots of pizza and beer
    • After your materials are more refined, seek review from professors that can give you higher level feedback.
    • Once your presentation materials are finalized, practice your talks until they are nearly rote*.

*But don’t beat the emotion out of your talk

Russell Ray, BCM 2017
My perspective on the academic job search

• Bringing this all together:
  – When you interview, it will be the most important day of your life professionally up to that point, and perhaps personally (top three at least).
  
  – For the greatest chance at success, be absolutely committed to the process and start it on time.
Academic job search timeline

First 3-7 Years

- Publish
- Network
- Cultivate references
Academic job search timeline

April-May
- Decide to find a job

August-October
- Job ads released
- Send out materials

January-April
- Interviews

May-July
- Prepare application materials

October – January
- Develop job talk
- Develop chalk talk
- Practice, Practice, Practice
- Schedule interviews

March - June
- Second Interviews
- Offers
- Negotiating

At the end of this whole process, you will be surprised by how much work is involved!

Russell Ray, BCM 2017
Assistant Professor or Associate Professor of Physiology & Biophysics

The University of California Irvine (UCI) Department of Physiology and Biophysics invites applications for a full-time faculty position in the department as part of our cluster hire initiative. The academic appointment will be at the Assistant or Associate Professor levels, which confer membership in the UCI Academic Senate. The department seeks a PhD, MD, or MD-PhD who will be expected to establish an outstanding extramurally funded independent research program in developmental neuropathology. This appointment will be one of several new positions being created as part of the Developmental Neuropathology cluster hire initiative at UCI to enhance and expand existing strengths in the area of developmental neuropathology. The cluster aims to create a synergistic, interdepartmental concentration in developmental systems neuropathology that utilizes multidisciplinary systems biology approaches to more deeply understand and address pathologies of the developing human brain. The program will leverage outstanding existing resources and strengths of UCI Health, School of Medicine, and partners across the UCI campus, including the Center for Complex Biological Systems (CCBS), Alzheimer Disease Research Center (ADRC), Institute for Memory Impairments and Neurologic Disorders (MIND), the Center for Autism Research and Translation (CART) and the Sue and Bill Gross Stem Cell Research Center (SCRC). In addition, candidates will be expected to support institutional and departmental teaching and mentoring missions to medical and graduate students, residents, fellows, and young faculty. Salary and rank will be commensurate with experience and expectations.

Inquiries about the position should be directed to Professor Geoffrey Abbott, Ph.D. Search Committee Chair; Department of Physiology and Biophysics, School of Medicine; D340 Medical Science I; University of California, Irvine, CA, 92697-4566.

https://recruit.ap.uci.edu/apply/JPF04165

Applicants should complete the application profile and upload the following application materials electronically to be considered for the position:

1. Cover letter
2. Curriculum vitae
3. Summary of research interests (up to 3 pages)
4. Summary of teaching philosophy
5. Names and contact information for 3-5 referees
6. PDFs of 3-5 recent publications
7. Statement of Contributions to Diversity

Applications will be considered until the position is filled.

The University of California, Irvine is an Equal Opportunity/Affirmative Action Employer advancing inclusive excellence. All qualified applicants will receive consideration for employment without regard to race, color, religion, sex, sexual orientation, gender identity, national origin, disability, age, protected veteran status, or other protected categories covered by the UC nondiscrimination policy.

Supporting documents
- Application Form
Assistant Professor or Associate Professor of Physiology & Biophysics

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Supporting documents
- Application Form

<table>
<thead>
<tr>
<th>Employer</th>
<th>University of California Irvine (UCI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location</td>
<td>Irvine, California, USA</td>
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<td>Salary</td>
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<td>Posted</td>
<td>August 16, 2017</td>
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<tr>
<td>Discipline</td>
<td>Life Sciences, Biophysics, Cell Biology, Developmental Biology, Epigenetics, Immunology, Molecular Biology, Neuroscience, Physiology, Proteomics, Structural Biology, Virology</td>
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<tr>
<td>Position Type</td>
<td>Full Time</td>
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<tr>
<td>Organization Type</td>
<td>Academia</td>
</tr>
<tr>
<td>Job Type</td>
<td>Faculty, Group Leader/Principal Investigator</td>
</tr>
</tbody>
</table>

This is a research focused application
Teaching will be a component, but the research program is the most important criteria.
Applications materials are clearly listed here.
Application Materials

• Cover Letter
• Curriculum Vitae
• Research Statement
• Teaching Statement
• Diversity Statement
• Letters/References
• Publications/Reprints
Application Materials

• Two extremes on application materials
  – Write a highly specialized package for each job, making as many changes as possible to fit.
    • Areas where customizations can be made are limited
    • Can work well if you have the time and are applying to a small number of jobs < 10
  – Write a general proposal and use it largely unchanged
    • Works well for high number of applications
Application Materials

• Minimally, write up a base set of documents that can be rapidly customized and/or used for multiple applications and to easily copy and paste into online forms.

  • Cover Letter
  • Curriculum Vitae
  • Research Statement
  • Teaching Statement
  • Diversity Statement
  • Letters/References
  • Publications/Reprints
Application Materials

- Cover Letter
- Curriculum Vitae
- Research Statement
- Teaching Statement
- Diversity Statement
- Letters/References
- Publications/Reprints
Cover Letter

• Goal: give as much concise and critical information into one page as possible with general language.
• The cover letter is your elevator pitch, and sets the tone for reading the rest of your application.

Harvard Medical School
DEPARTMENT OF GENETICS

October 30th, 2011

Dear Members of the Search Committee,

I am writing to apply for a McNair Scholar position in the Center on Addiction, Learning, Memory (CALM) within the Department of Neuroscience at Baylor College of Medicine. Specifically, I am a postdoctoral research fellow in the laboratory of Susan Dymecki at Harvard Medical School, Department of Genetics.

Presently, I am a postdoctoral research fellow in the laboratory of Susan Dymecki in the Department of Genetics at Harvard Medical School, where my research focus has been to use intersectional genetic techniques to molecularly and functionally characterize brainstem neural circuitry in the mouse. To functionally assess brainstem circuitry, I developed a mouse line, RC::FPDi, for inducible and reversible perturbation of highly specific, genetically defined neurons in awake and freely behaving mice (NRSA Grant: 5F32HD063257). Using RC::FPDi, my colleagues and I were able to target, acutely perturb, and thus define the role of serotonergic neurons in controlling both respiration and body temperature (Ray et al., Science, 2011). These findings offer possible mechanistic explanations for life-threatening and fatal syndromes such as serotonin syndrome and sudden infant death syndrome where serotonergic dysfunction may play a role.

As an independent investigator, I will continue to use the mouse model to investigate the genetic underpinnings of brainstem catecholaminergic circuitry and its role in autonomic, sensory and cognitive functions. In the longer term, I will use this genetic-functional framework to segregate and characterize key circuits toward the goal of understanding their part in neurological disease mechanisms. I believe that the experience and tools I possess uniquely situate me to study this system at great depth.

Please see my included application, which contains my curriculum vitae, research statement, and teaching statement. Letters of recommendation will be submitted directly by Drs. Susan Dymecki, Mario Capecchi, Clifford Tabin, Eugene Nattie and Hannah Kinney. Please notify me if any additional information is required.

Sincerely,

Russell Ray

Russell Ray, BCM 2017
Cover Letter

• Use “Official” Letterhead (easily made yourself)
• If information is given, address it to a specific person mentioned in the ad, otherwise, “Dear Members of the Search Committee”

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Russell Ray

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Cover Letter

• Typically, you can cover everything in four paragraphs.

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Sincerely,

Russell Ray
Cover Letter

• Paragraph 1: who you are and your focus
  – Now is the time to put yourself out there…
  – Name drop your PI, and School
  – I study, my research focus is…

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Sincerely,

Russell Ray
Cover Letter

• Paragraph 2: What makes you special
  – Big picture, what you did and why it matters
  – (Not so) subtly bring up your publications and national awards.

brainstem neural circuitry in the mouse.

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Cover Letter

• Paragraph 3: What you will do with your own lab
  – Again big picture, what you want to do
    • This section may be subtly re-worded to fit each application
  – Include both immediate goals (1-3yrs) and longer term vision

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Sincerely,

Russell Ray
Cover Letter

• The letter is your whole package in a nutshell.
• Needs to generate enthusiasm to keep them reading.
• Most important
  – What you have done, why it matters
  – What you want to do short and long term
• Self promotion is a fine line.
  – Don’t over do it. Really only say you were the first to … if you really were.
Application Materials

- Cover Letter
- **Curriculum Vitae**
- Research Statement
- Teaching Statement
- Diversity Statement
- Letter/References
- Publications/Reprints
Curriculum Vitae

• An easy to read outline of your work
• No statements or long introductions
  – It’s a C.V. not a résumé
  – Those things will be be covered in your other materials
• No sex, birthdate, pictures, or personal information.
• Good use of white space
  – Easy on the eyes, remember this is 1/100-200 applications being reviewed.
CURRICULUM VITAE

Russell Scott Ray

Harvard Medical School
Department of Genetics
77 Avenue Louis Pasteur, NRB 358
Boston MA 02115
Telephone: 617 432 4813
Fax: 617 432 7595
Email: ray@genetics.med.harvard.edu
Webpage: http://genepath.med.harvard.edu/~dymecki/

Professional

2008-Current
Harvard Medical School, Department of Genetics
Boston MA, United States
Postdoctoral Research Fellow

Education

2000–2008
University of Utah, Department of Human Genetics
Salt Lake City UT, United States
Doctor of Philosophy

1999–2000
Consejo Superior de Investigaciones Científicas, Instituto Cajal
Madrid, Spain
Fulbright Graduate Research Award (non-degree tenure)

1995–1999
Southern Oregon University
Ashland OR, United States
Bachelor of Arts: Biology
Minors: Chemistry and German

1996–1998
Eberhard-Karls-Universitaet Tuebingen
Tuebingen, Germany (2.5 Year Study Abroad)

Postdoctoral Research Training

5/08-Current
Harvard University, Department of Genetics
Boston MA, United States
Supervisor: Susan Dymecki, M.D., Ph.D.
Project:
I developed a new mouse line RC::FPDi, capable of perturbing the function of highly specific, genetically selected neurons in an acute, reversible and repeatable fashion. Because neuron perturbation is inducible upon simple ligand application, the system works well in conscious, unrestrained mice. Applying RC::FPDi to brainstem serotonergic neurons, my colleagues and I demonstrated the requirement of the serotonergic system in chemosensory regulation of respiration and in thermoregulation.

Graduate Research Training

8/00–4/08
University of Utah, Department of Human Genetics
Salt Lake City UT, United States
Supervisor: Mario Capecchi, Ph.D.
Project:
I worked to establish a base model system by collecting a number of gravid Myotis lucifugus (bat) specimens from multiple sites across the United States. These specimens were used for an embryo series, primary cell cultures, genetic library resources and the molecular characterization of the genome. I then cloned and sequenced the 40 kb HoxD gene cluster Global Control Region (GCR) from M. lucifugus and a distantly related bat
Curriculum Vitae

• Sections
  – Header
  – Professional Career
  – Education
  – Training
  – Funding
  – Honors
  – Service and Teaching
  – Publications
Curriculum Vitae

• Sections
  – Header

Russell S. Ray, Ph.D. - Curriculum Vitae

CURRICULUM VITAE

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77 Avenue Louis Pasteur, NRB 358
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October 2011

Russell Ray, BCM 2017
Curriculum Vitae

• Sections

– Professional Career

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Salt Lake City UT, United States
Doctor of Philosophy
Curriculum Vitae

• Sections

   – Education

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<td>2000–2008</td>
<td>University of Utah, Department of Human Genetics</td>
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<td></td>
<td>Salt Lake City UT, United States</td>
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<td>Doctor of Philosophy</td>
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<td>1999–2000</td>
<td>Consejo Superior de Investigaciones Cientificas, Instituto Cajal</td>
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<td>Madrid, Spain</td>
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<td></td>
<td>Fulbright Graduate Research Award (non-degree tenure)</td>
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<td>1995–1999</td>
<td>Southern Oregon University</td>
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<td></td>
<td>Ashland OR, United States</td>
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<td>Bachelor of Arts: Biology</td>
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<td>Minors: Chemistry and German</td>
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<td>1996–1998</td>
<td>Eberhard-Karls-Universitaet Tuebingen</td>
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<td>Tuebingen, Germany (2.5 Year Study Abroad)</td>
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Curriculum Vitae

• Sections
  – Postdoc

1996–1998
Eberhard-Karls-Universitaet Tuebingen
Tuebingen, Germany (2.5 Year Study Abroad)

Postdoctoral Research Training
5/08 - Current
Harvard University, Department of Genetics
Boston MA, United States
Supervisor: Susan Dymecki, M.D., Ph.D.
Project:
I developed a new mouse line RC::FPDi, capable of perturbing the function of highly specific, genetically selected neurons in an acute, reversible and repeatable fashion. Because neuron perturbation is inducible upon simple ligand application, the system works well in conscious, unrestrained mice. Applying RC::FPDi to brainstem serotonergic neurons, my colleagues and I demonstrated the requirement of the serotonergic system in chemosensory regulation of respiration and in thermoregulation.

Graduate Research Training
8/00–4/08
University of Utah, Department of Human Genetics
Salt Lake City UT, United States
Supervisor: Mario Capecchi, Ph.D.
Project:
I worked to establish a base model system by collecting a number of gravid Myotis lucifugus (bat) specimens from multiple sites across the United States. These specimens were used for an embryo series, primary cell cultures, genetic library resource and the molecular characterization of the genome. I then cloned and sequenced the 40 kb HoxD gene cluster Global Control Region (GCR) from M. lucifugus and a distantly related bat.
Curriculum Vitae

• Sections
  – Graduate Research Training

  works well in conscious, unrestrained mice. Applying RC::FPDi to brainstem serotonergic neurons, my colleagues and I demonstrated the requirement of the serotonergic system in chemosensory regulation of respiration and in thermoregulation.

| Graduate Research Training | 8/00–4/08 | University of Utah, Department of Human Genetics  
Salt Lake City UT, United States  
Supervisor: Mario Capecchi, Ph.D.  
Project:  
I worked to establish a base model system by collecting a number of gravid Myotis lucifugus (bat) specimens from multiple sites across the United States. These specimens were used for an embryo series, primary cell cultures, genetic library resources and the molecular characterization of the genome. I then cloned and sequenced the 40 kb HoxD gene cluster Global Control Region (GCR) from M. lucifugus and a distantly related bat species.  

| 08/99–06/99 | Consejo Superior de Investigaciones Científicas, Instituto Cajal  
Madrid, Spain  
Supervisor: Angela Nieto Toledano, Ph.D.  
Project:  
I examined the expression patterns of Eph Receptors and Ephrins in Xenopus laevis by using degenerate/consensus PCR methods to clone frog gene family members. The cloned cDNAs were used for sequence comparisons and to generate probes for in situ hybridization analysis.  

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Curriculum Vitae

• Sections
  – Undergraduate/Short Term

  Rhinolophus ferrumequinum. I developed bioinformatic cross species trian
gulation heuristics to uncover multiple sequence changes to the Chiropteran GCR. To address
these sequence changes, transgenic reporter assays were used to demonstrate that the
Chiropteran GCR has novel expression domains in the limb and lacks conserved
expression domains in the central nervous system.

  08/99–06/99
  Consejo Superior de Investigaciones Científicas, Instituto Cajal
  Madrid, Spain
  Supervisor: Angela Nieto Toledano, Ph.D.
  Project:
  I examined the expression patterns of Eph Receptors and Ephrin
  genes in Xenopus laevis by using degenerate/consensus PCR methods to clone frog gene family members. The
  cloned cDNAs were used for sequence comparisons and to generate probes for
  in situ hybridization analysis.

  Undergraduate Research Training
  07/96–07/98
  Max-Planck Institut fuer Entwicklungsbiologie, Abteilung Genetik
  Tuebingen, Germany
  Supervisor: Christiane Nuesslein-Volhard, Ph.D.
  Project:
  My work included identifying, collecting, mapping and cloning novel developmental
  mutations from high throughput zebrafish mutagenesis screens. Further, I created and
  characterized a zebrafish reference mapping panel and took part in multiple group
  efforts to expand zebrafish meiotic and radiation hybrid maps.

  Summer/Short Term Research Training
  06/00–08/00
  Max-Planck Institut fuer Entwicklungsbiologie, Abteilung Genetik
  Tuebingen, Germany
  Supervisor: Robert Geisler, Ph.D.
  Research Area: Developmental Genetics

  07/99–08/99
  University of Utah, Huntsman Cancer Institute
  Salt Lake City UT, United States

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Curriculum Vitae

• Sections
  – Research Funding
  – Honors, Awards, Scholarships etc.

Supervisor: Darlene Southworth, Ph.D.
Research Area: Developmental Plant Biology

07/98–09/98
University of Utah, Department of Anatomy and Neurobiology
Salt Lake City UT, United States
Supervisor: Chi-Bin Chien, Ph.D.
Research Area: Developmental Neurobiology

Research Funding
2010-Current  Ruth L. Kirschstein National Research Service Award
2004         National Human Genome Research Institute BAC Library White Paper
2002–2005  National Institutes of Health Developmental Biology Training Grant
1999         Fulbright Research Fellowship, Madrid, Spain

Honors, Awards and Scholarships
2011        Harvard Postdoctoral Poster Travel Award
2010        Harvard Postdoctoral Research Travel Award
2010        Harvard Office of Sustainability Grant

Page 2 of 2
Curriculum Vitae

• Sections
  – Research Funding
  – Honors, Awards, Scholarships etc.

<table>
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<th>Honors, Awards and Scholarships</th>
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<th>Leadership and Service</th>
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<td>2005–2006</td>
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Russell Ray, BCM 2017
Curriculum Vitae

• Sections
  – Service/Teaching

1998 and 1998  Oregon Laurels Scholarship
1996 and 1997  Baden-Wuerttemberg Alumni Association Stipend

Leadership and Service
2005–2006  University of Utah Dept. Hum. Gen. Graduate Student Committee: Member

Teaching
2011  Seeding Labs – Novartis Fellowship Program, Instructor: Summer Grant Writing Course
2001  University of Utah Teaching Assistantship, Biol 5215: Advanced Cell Biology Laboratory

Publications (Reverse Chronological)
Impaired respiratory and body temperature control upon acute serotonergic neuron inhibition.

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Curriculum Vitae

• Sections
  – Publications/Invited Talks/Patents

2001 University of Utah Teaching Assistantship, Biol 5215: Advanced Cell Biology Laboratory

Publications (Reverse Chronological)
Impaired respiratory and body temperature control upon acute serotonergic neuron inhibition.  
(*=equal contribution)  
Science. 2011 Jul 29;333(6042):637-42. PMID: 21798952  

Mapping cell fate and function using recombinase-based intersectional strategies. (Review)  
Dymecki SM, Ray RS, Kim JC.  

Rautenlippe Redux -- toward a unified view of the precerebellar rhombic lip. (Peer Reviewed Review)  
Ray RS, Dymecki SM.
Research Statement

• Ideally, build a narrative that frames your training and education as a continual and well focused path to your future research project and career endeavors
  – General Statement
  – Research History
  – Research Plan

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Research Statement

• Statement should be concise; 2 pgs. is a good base
  – Some ask for 3 or 4 pages; or 2-4 pages
• Again, the person who reads this will have read/has to read 100+ other applications
• Use basic font/margins
  – Arial 11pts, 0.5” margins, spacing @exactly 12pts.
• Not too much jargon
• Cleanly drawn images
Research Statement

• General statement
  – Similar to an abstract or even aims page
  – What your system is and why it is important
  – What is the outstanding question that you’re trying to answer
  – How you intend to answer that question
  – What are the outcomes if you are successful
Research Statement

• General statement

GENERAL STATEMENT
Animal survival relies in part on neural circuits that ensure vital information is perceived, processed and transformed into necessary responses. Brainstem catecholamine neurons are crucial to each of these steps in the neural systems that orchestrate cardio-respiratory (homeostatic or autonomic) regulation\(^1\), the processing and storing of sensory information\(^2,3\) and cognitive behaviors\(^4\). Linking the spatial connectivity of brainstem catecholaminergic circuitry to genetically labeled cell types and defining their functional roles will be key to further understanding these physiological and behavioral processes and their place in disease.

While the brainstem catecholaminergic system consists of a relatively small number of neurons, they project throughout almost all of the brain and spinal cord. Thus, it is not clear how subsets of these neurons may functionally segregate between cardio-respiratory modulation, sensory discrimination and cognitive processes, including how they may overlap or impinge upon each other. My long-term goal is to build a genetic framework for identifying brainstem catecholaminergic neuron subsets upon which sensory, cognitive and homeostatic functions can be definitively assigned. This work will produce a genetic–functional circuitry map to facilitate studies of suspected brainstem catecholamine dysfunctions ranging from neurological disorders such as congenital central hypoventilation syndrome, attention deficit hyperactivity disorder and depression to neurodegenerative diseases including Alzheimer’s disease, Dementia with Lewy bodies and Parkinson’s disease.

RESEARCH HISTORY

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Research Statement

• Research history
  – Step through your most important work
  – How does this work prepare you for this job
  – Same as above
    • What are you studying
    • Why is important
    • Gap in knowledge
    • How you answered it
    • What your answer means
  – This sets the stage for your research plan
Research Statement

• Research history

RESEARCH HISTORY
As a postdoctoral fellow in the Dymecki lab, I developed a new intersectional genetic mouse line, \( RC::FPDi^2 \) (Fig. 1), to examine the function of highly specific, genetically defined neurons in awake and freely behaving animals. \( RC::FPDi \) produces the synthetic Di receptor (a modified hM4 GPCR; Bryan Roth Lab\(^5\)) in neurons that express Cre and/or Flp recombinase transgenes. After a simple intraperitoneal injection of the biologically inert ligand, Clozapine-N-Oxide, activation of the Di receptor initiates a GIRK mediated hyperpolarizing current to suppress neuron firing. The result is an acute perturbation in genetically specified neurons that is inducible, reversible and free from the developmental confounds of constitutive neuronal disruption.

Using the unique capabilities of the \( RC::FPDi \) mouse line, my colleagues and I were able to definitively show that serotonergic neurons are required for normal chemosensory drive in respiratory control (the breathing response to sensing blood CO\(_2\) levels). Additionally, upon repeated acute serotonergic neuron suppression, mice became reproducibly hypothermic at room temperature, but nonetheless recovered. These findings inform upon possible mechanistic explanations to life-threatening or fatal syndromes including serotonin syndrome and sudden infant death syndrome, where serotonergic dysfunction is believed to play a role. \( RC::FPDi \) is designed to target cell types based on their expression of Cre and/or Flp transgenes. Therefore \( RC::FPDi \) offers the potential to leverage the large number of available transgenic recombinase lines for use in a broad range of neuron function and neuropathology studies across the central nervous system.
Research Statement

• One page mini grant with a whole lot more…
  – What is the key points of your plan
    • The biology you are studying
    • How you will study it (innovative techniques)
    • Impact of successful outcomes
Research Statement

• One page mini grant with a whole lot more…
  – Start with your immediate goals
    • Always use the future tense with an assertive voice.
    • You don’t need specific aims, but your experiments and what they are asking should be very clearly outlined
    • Space is limited so focus on the most impactful science and techniques
Research Statement

• One page mini grant with a whole lot more...
  – Follow with your long term goals
    • 5-10 year or whole career plan
    • Your really big question or aim
      – e.g. Build a system for highly highly discriminatory neuron delineation
      – e.g. Determine the key developmental events to establish the critical circuits in respiratory control
Research Statement

• Research plan

neuropathology studies across the central nervous system.

RESEARCH PLAN

My immediate goals are to use intersectional genetic fate-mapping to delineate molecularly distinct subtypes of brainstem catecholaminergic neurons as defined by expression of co-neurotransmitters, neurotransmitter receptors, and developmental gene expression. To add functional definitions to this intersectional genetic fate-map, RC::FPDi and RC::PFTox alleles will be used to disrupt electrical and neurochemical communication in vivo (Fig. 1). Animals will be assessed for a range of autonomic behaviors. Parallel to those studies, behavioral assays that examine sensory input discrimination and processing will be used. The results of these experiments will link specific behavioral outcomes to genetically defined neuronal populations. This functional-genetic framework can now be used to more fully characterize pre- and postsynaptic partners of brainstem catecholaminergic neurons in the circuits controlling these behaviors. Additionally, the genetic profiles of targeted neurons will inform upon the underlying molecular mechanisms involved in the development and function of these circuits.

To expand the functional-genetic framework, I will subdivide genetically delineated brainstem catecholaminergic neurons by their projection targets. These spatially and genetically delineated neurons will be recorded in vivo to assess their task- or condition-specific firing pattern. I will use the
• Clean Images
• Have a legend but don’t need it
Research Statement

• Customizations
  – How your work fits in with the mission of the department.
  – Point out where you might collaborate with specific members of the department.
Research Statement

• Take home for the reader:
  – Your ability to succeed based on your track record
  – What you have done and why it matters
  – Your short and long term goals for your lab
    • Your burning question
    • How your work will impact the field
    • How you will answer it
Teaching Statement

• Not as much about teaching philosophy but key elements to cover your statement.
  – Teaching/TAing undergraduate students – didactic
  – Teaching/TAing graduate students – didactic
  – Mentoring in the lab
  – Assistantships at professional courses e.g. WH, CSL, etc.
  – Other community outreach…
Teaching Statement

• Not as much about teaching philosophy but key elements to cover all bases
  – Philosophy
  – Professional experience
  – Personal experience or anecdote

TEACHING PHILOSOPHY
One of the most impactful and enjoyable teaching experiences in my life actually took place while I was in high school. Each year my high school biology teacher made a point to take local sixth grade classes on a field trip to the Tule Lake National Wild Life Refuge. As an assistant on this trip, it fell upon me to teach a group of sixth graders the science of scatology, or poop science, as it was more than once called. Throughout the day, I was to take students around to collect droppings from various animals and explain how the droppings could be used to tell us a lot about the animal, including the differences between birds and mammals, what the animal ate and how it lived. The teaching experience culminated at the end of the week, with the students presenting their bagged collections on a large board in front of an assembly of parents, teachers and school administrators. Though the
Diversity Statement

• Again, recalling personal and professional experiences that are germane can be helpful
• Detail your philosophy on diversity

COMMITMENT TO DIVERSITY

Throughout my research tenure, I have both welcomed and benefited from diversity in the workplace. Having colleagues of differing experiences and backgrounds creates an enriching environment and offers valuable perspectives different from my own. From my early research experiences in Germany and Spain through my current position in Boston, I have continually benefited from multinational and multicultural lab environments and working with both men and women.

The Dymecki lab has a strong record of encouraging both minority and women scientists/students in their early career stages to work and participate in the lab. As a postdoctoral fellow in the Dymecki lab, I have had the opportunity to work with and train several of these students in summer research positions. Each has been a valuable experience in my growth as a teacher and mentor.

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References

• Apart from picking the right people, this is out of your hands
• So make your choices wisely
  – Postdoc advisor
  – Graduate advisor
  – Department chair
  – Collaborator (preferably outside)
References

• Seek those that can give you a genuine recommendation through a substantive working relationship

• Better a strong letter from a close collaborator rather than a generic letter from a Nobel laureate

• Ask for a letter early in the process.
  – Especially if you are going to apply to many places