

CURRICULUM VITAE

Name: Abdallah Mtanios HAYAR, Ph. D.
Date of birth: 1969
Citizenship: Lebanese, American
Marital status: Married to [Souraya](#) (Registered Nurse at UAMS), Children: Tony (born on 7/20/2010)
Current position: Associate Professor (Tenure)
Work address: Department of Neurobiology and Developmental Sciences
University of Arkansas for Medical Sciences
4301 West Markham Street #847, Biomed II, Room 659-2
Little Rock, AR 72205
Tel. 501-686-6362, Fax: 501-526-7928
E-mails: abdallah@hayar.net, amhayar@uams.edu
Personal website: <http://hayar.net> (Please visit my website for the most updated information)
Home address: 7208 Marguerite Ln
Little Rock, AR 72205
Tel. 501-661-1014 (Home), Tel. 901-336-8812 (Cell)

AWARDED DEGREES

1987: Baccalaureate in Experimental Sciences, Collège des Frères, Tripoli, Lebanon.
1987-91: Bachelor of Sciences (B.S.) major Biology, [American University of Beirut](#), Beirut, Lebanon.
1991-92: *Maîtrise de Physiologie Animale*, University Louis Pasteur, Strasbourg, France.
1992-93: DEA (M.S.) *de Neurobiologie et Physiologie des Systèmes de Communication*. University Louis Pasteur, Strasbourg, France. Director: Prof. Ken Marshall.
1993-96: Ph.D. in Neurosciences, Department of Physiology, [University Louis Pasteur](#), Strasbourg, France. Director: [Prof. Paul Feltz](#).
Thesis title: GABAergic and noradrenergic responses in silent and spontaneously active neurons of the rat rostral ventrolateral medulla *in vitro*. **Committee:** Profs. Alan North, Pascal Bousquet, Jean Champagnat, Rémy Schlichter.

POSITIONS

1993 : “Cadre de Laboratoire” for 3 months at Sanofi Research, Montpellier, France.
1997-1999: Research Associate, Dept. of Pharmacology, University of Virginia.
1999-2003: Research Assistant Professor, Dept. of Anatomy & Neurobiology, University of Maryland.
2003-2005: Research Assistant Professor, Dept. of Anatomy & Neurobiology, University of Tennessee.
2006-2008: Associate Professor (Tenure Track), Dept. Neurobiology & Developmental Sciences, University of Arkansas for Medical Sciences.
2008 (July): Associate Professor (Tenure), Dept. Neurobiology & Developmental Sciences, University of Arkansas for Medical Sciences.

LANGUAGES

English (fluent), French (fluent), Arabic (mother tongue).

AFFILIATIONS

- Society for Neuroscience (U.S.A.), member since 1996.
- Arkansas Chapter of the Society for Neuroscience, member since 2008.
- Association for Chemoreception Sciences (AChemS), member since 1999.
- American Physiological Society (U.S.A.), member (1998-2005).
- Société des Neurosciences (France), member (1994-2002).
- International Society for Autonomic Neuroscience, member (1998-2002).
- Graduate Faculty of the University of Maryland Graduate School, member (2001-2003).
- Washington-Baltimore Computational Neuroscience Interest Group, member (2001-2003).
- Graduate Faculty of the University of Arkansas for Medical Sciences Graduate School, member since 2007.

HONORS & AWARDS

- 2015: Nominee, Excellence in Diversity and Inclusion award
- 2010 & 2011: Nominee, Educational Technology Excellence Award (Univ. of Arkansas for Medical Sciences)
- 2010: Nominee, “Secretary” for the Association for Chemoreception Sciences (AChemS)
- April (2006): Young Investigator Award for Research in Olfaction. Prize: \$2000.
- France (1994-1996): University Louis Pasteur scholarship for international doctoral students.
- Lebanon (1988-1991): Fares Foundation scholarship for undergraduate studies.

FUNDING / RESEARCH PROJECTS:

Recently submitted grants (2015)

1. **1R03AA024912-01** (PI: Abdallah Hayar) 04/01/2016 – 03/31/2017 3.00 calendar
Submitted on 06/12/2015
NIH/NIAAA \$50,000/ 1 year
Role: PI
Title: “Mechanisms of alcohol toxicity at the developmental stage”
The goal of this proposal is to use electrophysiological and imaging techniques to examine how developmental alcohol exposure affects cerebellar circuits.
2. **1R03AA024910-01** (PI: Abdallah Hayar) 04/01/2016 – 03/31/2017 3.00 calendar
Submitted on 06/12/2015
NIH/NIDCD \$50,000/ 1 year
Role: PI
Title: “Investigating the function of spinal central pattern generator at sub millisecond temporal resolution”
The goal of this proposal is to establish a new sensitive assay to evaluate motor coordination dysfunction. Moreover, we propose to find out the impact of ethanol intoxication on motor coordination.
3. **14-15RadStep2-0021** (PI: Antino Allen) 05/01/2016 – 04/31/2020 0.60 calendar

Revised on 06/19/2015

NASA \$1,694,128/ 4 years

Role: co-I

Title: "Effects of space radiation on the $\alpha 3$ isoform of neuronal sodium-potassium ATPase"

The purpose of this proposal is to expose mice to different doses of protons, high-energy particles and X-ray irradiation and then behavioral, electrophysiological and morphological studies will be conducted to evaluate the functional and degenerative changes in these neurons.

4. **1R03NS098285-01** (PI: Abdallah Hayar) 07/01/2016 – 06/30/2017 1.80 calendar
Submitted on 10/15/2015
NIH/NINDS \$50,000/ 1 year
Role: PI
Title: "The role of the alpha 3 isoform of neuronal sodium-potassium ATPase in controlling the activity of Purkinje cells"
In this proposal, we will use a transgenic mouse model to examine the function of the $\alpha 3$ subunit of the sodium-potassium ATPase which exhibits mutation in rapid-onset dystonia-parkinsonism.
5. **1R03NS098078-01** (PI: Abdallah Hayar) 07/01/2016 – 06/30/2018 4.20 calendar
Submitted on 10/15/2015
NIH/NINDS \$100,000/ 2 years
Role: PI
Title: "Investigating brain hemorrhage by ultra-fast imaging of small blood vessels"
By seeking a better understanding of the mechanisms leading to brain hemorrhage, the results of this research project will allow us to develop new strategies in the prevention and treatment of cerebral hemorrhage.
6. **1R01DC015481-01** (PI: Abdallah Hayar) 07/01/2016 – 06/30/2018 6.00 calendar
Submitted on 10/01/2015
NIH/NIDCD \$200,000/ 2 years
Role: PI
Title: "Bursting and Synchrony in a Network of Coupled Neurons in the Olfactory Bulb"
The purpose of this project is to unravel the fundamental network mechanisms responsible for encoding and processing odor information. In particular, this research will help us understand the synaptic organization of olfactory bulb glomeruli and the role of glomerular circuitry in olfactory coding in normal and pathological conditions.
7. **P30GM110702 CTN pilot study** (PI: Abdallah Hayar) 05/01/2016 – 04/30/2017 3.00 calendar
Submitted on 10/23/2015
NIH \$50,000/ 1 year
Role: PI
Title: "A mouse model to study the cellular mechanisms involved in dystonia"
This research project will provide insight into the fundamental mechanisms leading to dystonia and it will help us develop strategies to cure or more effectively treat people who are affected by this neurological disorder.

Past funding

1. **Center for Translational Neuroscience Recruitment Funds:** \$100,000 08/1/2006 - 07/31/2007.

2. **239 G1-31595-01-E: UAMS Tobacco Settlement Funds: \$75,000** 07/1/2006 - 06/30/2007.
3. **239 G1-33648-01: UAMS Tobacco Settlement Funds: \$150,000** 07/01/2008 – 06/30/2009.
4. **R03DC006356-04** (PI: Abdallah Hayar) 05/1/2004 – 04/30/2009 3.00 calendar
NIH/NIDCD \$50,000/year
Role: PI
Title: “Synchronous bursting among juxtglomerular neurons” ([NIH RePORTER Abstract](#)).
The goal of this project is to provide new insight into the intrinsic synaptic organization of the glomeruli and the role of glomerular circuitry in olfactory coding
5. **R01 DC007123-06** (PI: Abdallah Hayar) 07/01/2005 – 06/30/2012 5.36 calendar
NIH / NIDCD \$187,171/year
Role: PI
Title: “External tufted cells coordinate olfactory bulb activity” ([NIH RePORTER Abstract](#)).
The major goal of this project is to determine the role of external tufted cells in coordinating the activity of glomerular interneurons and output mitral cells via chemical and electrical synapses.
6. **231 G1–35435–01:** (PI: Abdallah Hayar) 01/01/2009 – 12/31/2010 0.00 calendar
Arkansas Bioscience Institute (ABI) \$38,500/year, UAMS costs: \$14,500.00/year
Role: PI, co-PI: Roger Buchanan, Arkansas State University
Title: “Novel treatment for smoking dependence and relapse”.
The goal of this study is to determine how repetitive trans-cranial magnetic stimulation (rTMS) alters the effects of chronic exposure to cigarette smoke on the rat P13 potential.
7. **P20 GM103425-09** (PI: Edgar Garcia-Rill) 08/01/2009 – 04/30/2014 3.00 calendar
NIH/National Center for Research Resources \$1,229,518/year
Role: Electrophysiology Core Director
Title: “Center for Translational Neuroscience” ([NIH RePORTER Abstract](#)).
The major goals of this project are to implement a Career Development Program for five Project Principal Investigators (PIs) who are close to nationally competitive levels using grant support and mentoring activities undertaken by established investigators.
8. **R01HL097107-01:** (PI: Sung Rhee) 04/01/2010–03/31/2015, 1.20 calendar
NIH/NHLBI \$250,000/year
Role: co-I from 04/01/2010–06/31/2012
Title: “PSD95 scaffolding of vascular K⁺ channels in hypertension” ([NIH RePORTER Abstract](#)).
This project will investigate a novel scaffolding molecule in the muscle cells of small cerebral arteries that may ensure that potassium channels are expressed in adequate numbers and in the right location in the muscle cells of cerebral arteries to optimize blood flow to the brain.
9. **R01 DC007876-02** (PI: Kathryn Hamilton) 04/01/2009 – 03/31/2012 2.00 calendar
NIH / NIDCD \$41,400/year
Role: PI on a subcontract with Louisiana State University.
Title: “Contribution of EPL interneurons to olfactory processing” ([NIH RePORTER Abstract](#)).
The goal of this project is to characterize the cell types of this external plexiform layer using modern, quantitative anatomical methods and electrophysiological recording methods and to understand the contributions of the cells in this layer to olfactory discrimination.
10. **R01 NS020246-21** (PI: Edgar Garcia-Rill) 12/01/2008 – 11/30/2013 2.40 calendar

NIH / NINDS

\$250,000/year

Role: Co-I from 12/01/2008 – 6/30/2012

Title: “Central Modulation of Rhythms”

[\(NIH RePORTER Abstract\)](#).

The long-term objective of this project is to investigate the mechanisms controlling changes in state mediated by brainstem, particularly mesopontine, mechanisms. The development of neurochemical control of local, ascending and descending pedunculopontine nucleus projections is the main area of study.

PUBLICATIONS

Note: The number of times each reference was cited was updated on 11/26/2015 using Web of Science database.

1. Light KE, **Hayar A**, Pierce DR (2015). Electrophysiological and immunohistochemical evidence for an increase in GABAergic inputs and HCN channels in Purkinje Cells that survive developmental ethanol exposure. *Cerebellum* 14(4):398-412. ([Abstract](#)) ([PDF, 6176 KB](#)). Impact factor: 2.8, cited 0 time.
2. Lin XB, Pierce DR, Light KE, **Hayar A** (2013). The fine temporal structure of the rat licking pattern: What causes the variability in the interlick intervals and how is it affected by the drinking solution? *Chem Senses* 38:685-704. ([Abstract](#)) ([PDF, 15374 KB](#)). Impact factor: 3.2, cited 3 times.
3. Simon C, **Hayar A**, Garcia-Rill E (2012). Developmental changes in glutamatergic fast synaptic neurotransmission in the dorsal subcoeruleus nucleus. *Sleep* 35:407-417. ([Abstract](#)) ([PDF, 804 KB](#)). Impact factor: 5.9, cited 1 time.
4. Simon C, **Hayar A**, Garcia-Rill E (2011). Responses of Developing Pedunculopontine Neurons to Glutamate Receptor Agonists. *J Neurophysiol* 105:1918-1931. ([Abstract](#)) ([PDF, 4434 KB](#)). Impact factor: 3.8, cited 3 times.
5. Pierce DR, **Hayar A**, Williams DK, Light KE (2011). Olivary climbing fiber alterations in PN40 rat cerebellum following postnatal ethanol exposure. *Brain Res* 10:54-65. ([Abstract](#)) ([PDF, 1477 KB](#)). Impact factor: 2.5, cited 6 times.
6. Pierce DR, **Hayar A**, Williams DK, Light KE (2010). Developmental Alterations in Olivary Climbing Fiber Distribution Following Postnatal Ethanol Exposure in the Rat. *Neuroscience* 169:1438-1448. ([Abstract](#)) ([PDF, 1753 KB](#)). Impact factor: 3.5, cited 6 times.
7. Simon C, Kezunovic N, Ye M, Hyde J, **Hayar A**, Williams DK, Garcia-Rill E (2010). Gamma band unit activity and population responses in the pedunculopontine nucleus (PPN). ([Abstract](#)) ([PDF, 4643 KB](#)). *J Neurophysiol* 104:463-474. Impact factor: 3.8, cited 24 times.
8. **Hayar A**, Charlesworth A, Garcia-Rill E (2010). Oocyte triplet pairing for electrophysiological investigation of gap junctional coupling. *J Neurosci Methods* 188:280-286. ([Abstract](#)) ([PDF, 1054 KB](#)). Impact factor: 2.5, cited 0 time.
9. Ye M, **Hayar A**, Strotman B, Garcia-Rill E (2010). Cholinergic modulation of fast synaptic transmission of pedunculopontine thalamic projecting neurons. *J Neurophysiol* 103:2417-2432. ([Abstract](#)) ([PDF, 5388 KB](#)). Impact factor: 3.8, cited 17 times.
10. Dong HW, **Hayar A**, Callaway J, Yang X-H, Nai Q, Ennis M (2009) Group I mGluR activation enhances Ca²⁺-dependent nonselective cation currents and rhythmic bursting in main olfactory bulb external tufted cells. *J Neuroscience* 29:11943-11953. ([Abstract](#)) ([PDF, 1836 KB](#)). Impact factor: 7.9, cited 15 times.
11. Heister D, **Hayar A**, Garcia-Rill E (2009) Cholinergic modulation of GABAergic and glutamatergic transmission in the dorsal Subcoeruleus: mechanisms for REM sleep control. *Sleep* 32:1135-1147. ([Abstract](#)) ([PDF, 469 KB](#)) Impact factor: 5.9, cited 13 times.

12. Dong HW, Heinbockel T, Hamilton KA, **Hayar A**, Ennis M (2009) Metabotropic glutamate receptors and dendrodendritic synapses in the main olfactory bulb. *Ann N Y Acad Sci* 1170:224-238. ([Abstract](#)) ([PDF, 539 KB](#)). Impact factor: 2.6, cited 5 times.
13. Ye M, **Hayar A**, Garcia-Rill E (2009) Cholinergic responses and intrinsic membrane properties of developing thalamic parafascicular neurons. *J Neurophysiol* 102:774-785. ([Abstract](#)) ([PDF, 3485 KB](#)) Impact factor: 3.8, cited 4 times.
14. Nai Q, Dong HW, **Hayar A**, Linster C, Ennis M (2009) Noradrenergic regulation of GABAergic inhibition of main olfactory bulb mitral cells varies as a function of concentration and receptor subtype. *J Neurophysiol* 101:2472-2484. ([Abstract](#)) ([PDF, 1033 KB](#)) Impact factor: 3.8, cited 26 times.
15. **Hayar A**, Gu C, Al-Chaer ED (2008) An improved method for patch clamp recording and calcium imaging of neurons in the intact dorsal root ganglion in rats. *J Neurosci Methods* 173:74-82. ([Abstract](#)) ([PDF, 943 KB](#)). Impact factor: 2.5, cited 8 times.
16. Garcia-Rill E, Charlesworth A, Heister DS, Ye M, **Hayar A** (2008) The developmental decrease in REM Sleep: The role of transmitters and electrical coupling. *Sleep* 31:673-690. ([Abstract](#)) ([PDF, 1227 KB](#)). Impact factor: 5.9, cited 35 times.
17. Karpuk N, **Hayar A** (2008) Activation of postsynaptic GABAB receptors modulates the bursting pattern and synaptic activity of olfactory bulb juxtaglomerular neurons. *J Neurophysiol* 99:308-319. ([Abstract](#)) ([PDF, 322 KB](#)). Impact factor: 3.65, cited 7 times.
18. Garcia-Rill E, Heister DS, Ye M, Charlesworth A, **Hayar A** (2007) Electrical coupling: novel mechanism for sleep-wake control. *Sleep* 30:1405-1414. ([Abstract](#)) ([PDF, 217 KB](#)). Impact factor: 4.47, cited 50 times.
19. **Hayar A**, Ennis M (2007) Endogenous GABA and glutamate finely tune the bursting of olfactory bulb external tufted cell. *J Neurophysiol* 98:1052-1056. ([Abstract](#)) ([PDF, 209 KB](#)). Impact factor: 3.8, cited 12 times.
20. Dong HW, **Hayar A**, Ennis M (2007) Activation of metabotropic glutamate receptors (mGluRs) enhances synaptic inhibition of olfactory bulb mitral cells (MCs) via actions on GABAergic interneurons in the glomerular layer (GL) and granule cell layer (GCL). *J Neuroscience* 27:5654-5663. ([Abstract](#)) ([PDF, 3304 KB](#)). Impact factor: 7.9, cited 18 times.
21. Heister DS, **Hayar A**, Charlesworth A, Yates C, Zhou YH, Garcia-Rill E (2007) Evidence for electrical coupling in the SubCoeruleus (SubC) nucleus. *J Neurophysiol* 97:3142-3147. ([Abstract](#)) ([PDF, 222 KB](#)). Impact factor: 3.8, cited 28 times.
22. Karnup SV, **Hayar A**, Shipley MT, Kurnikova MG (2006) Spontaneous field potentials in the glomeruli of the olfactory bulb: the leading role of juxtaglomerular cells. *Neuroscience* 142:203-221. ([Abstract](#)) ([PDF, 1454 KB](#)). Impact factor: 3.5, cited 18 times.
23. Ennis M, Zhu M, Heinbockel T, **Hayar A** (2006) Olfactory nerve-evoked, metabotropic glutamate receptor-mediated synaptic responses in rat olfactory bulb mitral cells. *J Neurophysiol* 95:2233-2241. ([Abstract](#)) ([PDF, 408 KB](#)). Impact factor: 3.8, cited 18 times.
24. **Hayar A**, Bryant JL, Boughter JD, Heck DH (2006) A low-cost solution to measure mouse licking in an electrophysiological setup with a standard analog-to-digital converter. *J Neurosci Methods* 153:203-207. ([Abstract](#)) ([PDF, 309 KB](#)). Impact factor: 2.5, cited 22 times.
25. **Hayar A**, Shipley MT, and Ennis M (2005) Olfactory bulb external tufted cells are synchronized by multiple intraglomerular mechanisms. *J Neuroscience* 25: 8197-8208 ([PDF, 934 KB](#)). Impact factor: 7.9, cited 59 times.

26. Hamilton KA, Heinbockel T, Ennis M, Szabo G, Erdelyi F, **Hayar A** (2005) Properties of external plexiform layer interneurons in mouse olfactory bulb slices. *Neuroscience* 133:819-829 ([Abstract](#)) ([PDF, 544 KB](#)). **Impact factor: 3.5, cited 25 times.**
27. **Hayar A**, Karnup S, Ennis M, Shipley MT (2004b) External tufted cells: A major excitatory element that coordinates glomerular activity. *J Neuroscience* 24:6676-6685 ([Abstract](#)) ([PDF, 989 KB](#)). **Impact factor: 7.9, cited 105 times.**
28. **Hayar A**, Karnup S, Shipley MT, Ennis M (2004a) Olfactory bulb glomeruli: external tufted cells intrinsically burst at theta frequency and are entrained by patterned olfactory input. *J Neuroscience* 24:1190-1199 ([Abstract](#)) ([PDF, 526 KB](#)). **Impact factor: 7.9, cited 104 times.**
29. Aungst JL, Heyward PM, Puche AC, Karnup SV, **Hayar A**, Szabo G, Shipley MT (2003) Center-surround inhibition among olfactory bulb glomeruli. *Nature* 426:623-629 ([Abstract](#)) ([PDF, 798 KB](#)). **Impact factor: 32.9 cited 227 times.**
30. Guyenet PG, Stornetta RL, Schreihof AM, Pelaez NM, **Hayar A**, Aicher S, Llewellyn-Smith IJ (2002) Opioid signalling in the rat rostral ventrolateral medulla. *Clin Exp Pharmacol Physiol* 29:238-242. Review. ([Abstract](#)) ([PDF, 58 KB](#)). **Impact factor: 2.1, cited 25 times.**
31. Ennis M., Zhou F-M., Ciombor KJ, Aroniadou-Anderjaska V, **Hayar A**, Borrelli E, Zimmer LA., Margolis F, Shipley MT (2001) Dopamine D2 Receptor-Mediated Presynaptic Inhibition of Olfactory Nerve Terminals. *J Neurophysiol* 86:2986-2997. ([Abstract](#)) ([PDF, 195 KB](#)) **Impact factor: 3.8, cited 132 times.**
32. **Hayar A**, Heyward PM, Heinbockel T, Shipley MT, Ennis M (2001) Direct excitation of mitral cells by activation of alpha1-adrenergic receptors in rat olfactory bulb slices. *J Neurophysiol* 86:2173-2182 ([Abstract](#)) ([PDF, 199 KB](#)). **Impact factor: 3.8, cited 45 times.**
33. **Hayar A**, Guyenet P (2000) Prototypical imidazoline-1 receptor ligand moxonidine activates alpha2-adrenoceptors in bulbospinal neurons of the RVL. *J Neurophysiol* 83:766-776 ([Abstract](#)) ([PDF, 256 KB](#)). **Impact factor: 3.8, cited 13 times.**
34. **Hayar A**, Guyenet P (1999) Alpha2-Adrenoceptor-mediated presynaptic inhibition in bulbospinal neurons of rostral ventrolateral medulla. *Am J Physiol: Heart and Circulatory Physiology* 277:H1069-H1080 ([Abstract](#)) ([PDF, 457 KB](#)). **Impact factor: 3.7, cited 20 times.**
35. **Hayar A**, Guyenet P (1998) Presynaptic and postsynaptic effects of methionine-enkephalin on identified bulbospinal neurons of the RVL. *J Neurophysiol* 80:2003-2014 ([Abstract](#)) ([PDF, 319 KB](#)). **Impact factor: 3.8, cited 46 times.**
36. **Hayar A**, Poulter MO, Pelkey K, Feltz P, Marshall KC (1997) Mesencephalic trigeminal neuron responses to gamma-aminobutyric acid. *Brain Res* 753:120-127 ([Abstract](#)) ([PDF, 678 KB](#)). **Impact factor: 2.5, cited 26 times.**
37. **Hayar A**, Feltz P, Pigué P (1997) Adrenergic responses in silent and putative inhibitory pacemaker-like neurons of the rat rostral ventrolateral medulla in vitro. *Neuroscience* 77:199-217 ([Abstract](#)) ([PDF, 722 KB](#)). **Impact factor: 3.5, cited 12 times.**
38. Jung M, Michaud JC, Steinberg R, Barnouin MC, **Hayar A**, Barnouin MC, Mons G, Souilhac J, Emonds-Alt X, Soubrie P, Le Fur G (1996) Electrophysiological, behavioural and biochemical evidence for activation of brain noradrenergic systems following tachykinin NK3 receptor stimulation. *Neuroscience* 74:403-414 ([Abstract](#)) ([PDF, 356 KB](#)). **Impact factor: 3.5, cited 42 times.**

39. **Hayar A**, Piguet P, Feltz P (1996) GABA-induced responses in different electrophysiologically identified neurons in the rat rostro ventrolateral medulla. *Brain Res* 709:173-183 ([Abstract](#)) ([PDF, 1149 KB](#)). Impact factor: 2.5, cited 8 times.

BOOK CHAPTERS

40. Ennis M, Hamilton KA, **Hayar A** (2007) Neurochemistry of the main olfactory system, In: [Handbook of Neurochemistry and Molecular Neurobiology](#), 3rd Edition (Lajtha A, Editor-in-Chief), Vol. 20, pp 137-204, Sensory Neurochemistry (Johnson DA, Volume Editor), Heidelberg: Springer, ([PDF, 987 KB](#)).
41. Ennis M, **Hayar A** (2008) Physiology of the Main Olfactory Bulb, in Allan I. Basbaum, Akimichi Kaneko, Gordon M. Shepherd and Gerald Westheimer, editors *The Senses: A Comprehensive Reference*, Vol 4, Olfaction and Taste, Stuart Firestein and Gary K. Beauchamp. San Diego: Academic Press; pp. 641-686. (Proof, [PDF 10 MB](#)).
42. Karnup SV, **Hayar A** (2008) Neuronal modules of the olfactory bulb. In: *New Research on Neuronal Networks* (Momoka Yoshida and Haruka Sato, editors), pp 1-54, Nova Science Publishers Inc., New York. ([PDF, 1288 KB](#)).
43. Mennemeier M, Sheffer C, **Hayar A**, Buchanan R (2012) Translational Sstudies using TMS. In: *Translational Neuroscience: A guide to a successful program* (Edgar Garcia-Rill, editor), pp 43-65, Wiley-Blackwell, Oxford, UK.

MANUSCRIPTS (IN PREPARATION)

44. Lin XB, Pierce DR, Light KE, **Hayar A**. Developmental ethanol exposure accelerates the rhythmic pattern of licking. (in preparation).
45. **Hayar AM**, Hamilton KA. External plexiform layer interneurons integrate synaptic inputs that are correlated with the bursting activity of surrounding mitral/tufted cells. (in preparation).
46. **Hayar A**, Light KE, Pierce DR Coincident inhibitory inputs induce synchronized pauses in the firing of Purkinje cells. *J Neuroscience* (in preparation).
47. **Hayar A** Center-surround interactions among neighboring olfactory bulb glomeruli revealed by optical imaging of the spatiotemporal propagation of spontaneous population activity. *J Neuroscience* (in preparation).
48. Jeradeh-Boursoulian F, **Hayar A** Ethanol Reduces Olfactory Bulb Output by Reducing Excitatory Drive to Mitral/Tufted Cells. *J Neurophysiology* (in preparation).

MEETING ABSTRACTS AND POSTERS

1. Marshall K, **Hayar A**, Feltz P. Responses of mesencephalic trigeminal neurons to γ -aminobutyric acid. *Can. J. Physiol. Pharmacol.* Vol.72 (1994).
2. **Hayar A**, Poulter MO, Feltz P. γ -Aminobutyric acid responses in different electrophysiologically characterized neurons within the rat rostral ventrolateral medulla *in vitro*. (24th Annual Meeting of the Society for Neuroscience, **Miami**, November 1994).
3. **Hayar A**, Feltz P. Réponses pré et postsynaptic GABAergiques dans le noyau rostral ventrolatéral bulbaire de rat *in vitro*. Société des Neurosciences (**France**, Lyon, May 1995).

4. **Hayar A**, Piguet P, Poulter MO, Feltz P. Monophasic and multiphasic GABA responses in neurons of the rat rostral ventrolateral medulla *in vitro*. (25th Annual Meeting of the Society for Neuroscience, **San Diego**, November 1995).
5. **Hayar A**, Piguet P, Feltz, P. Réponses GABAergiques monophasiques et multiphasiques dans les neurones du noyau rostral ventrolatéral bulbaire de rat *in vitro*. (63ème Congrès de la Société de Physiologie, **France**, Strasbourg, December 1995).
6. **Hayar A**, Feltz P, Piguet P. Adrenergic responses in silent and putative inhibitory pacemaker-like neurons of the rat rostral ventrolateral medulla *in vitro*. (European Neuroscience Meeting, **France**, Strasbourg, September 1996).
7. **Hayar A**, Piguet P, Schlichter R. Properties of irregular firing neurons in the rostral ventrolateral medulla *in vitro* and possible involvement in sympathoexcitatory function. (26th Annual Meeting of the Society for Neuroscience, **Washington D.C.**, November 1996).
8. **Hayar A**, Guyenet P. Pre- and postsynaptic inhibitory actions of methionine-enkephalin on identified bulbospinal neurons of the rat rostral ventrolateral medulla. FASEB Journal 12 (5): 4290 Part 2 Suppl. S MAR 20, 1998. (Experimental Biology Meeting, **San Francisco**, April 1998).
9. **Hayar A**, Guyenet P. Presynaptic effects mediated by alpha2-adrenoceptors in the rat rostral ventrolateral medulla *in vitro*. (28th Annual Meeting of the Society for Neuroscience, **Los Angeles**, November 1998).
10. **Hayar A**, Guyenet P. Tyramine releases predominantly serotonin in the lower brainstem of neonate rats *in vitro*. FASEB Journal 13 (4): A473-A473 Part 1 Suppl. S MAR 12, 1999. (Washington D.C., April 1999).
11. **Hayar A**, Guyenet P. Effect of tyramine and other indirectly acting monoamines in the rostral ventrolateral medulla *in vitro*. (29th Annual Meeting of the Society for Neuroscience, **Miami**, October 1999).
12. **Hayar A**, Shipley MT, Ennis M. Direct excitation of mitral cells by activation of alpha1-adrenergic receptors in rat olfactory bulb slices. (**Sarasota**, April 2000).
13. **Hayar A**, Shipley MT, Ennis M. Norepinephrine excites mitral cells by activation of alpha1-adrenergic receptors in rat olfactory bulb slices. Program# 45.3 (30th Annual Meeting of the Society for Neuroscience, **New Orleans**, November 2000, [Abstract](#)).
14. Karnup SV, **Hayar A**, Ennis M, Shipley MT. Morphology & Physiology of juxtglomerular (JG) cells in rat main olfactory bulb (MOB). Program# 623.8 (31st Annual Meeting of the Society for Neuroscience, **San Diego**, November 2001, [Abstract](#)).
15. Heinbockel T, **Hayar A**, Laaris N, Shipley MT, Ennis M. Metabotropic glutamate receptors shape neuronal excitability and synaptic responsiveness in mouse olfactory bulb slices. Program# 623.5 (31st Annual Meeting of the Society for Neuroscience, **San Diego**, November 2001, [Abstract](#)).
16. Aungst J, Karnup SV, **Hayar A**, Shipley MT, Puche AC. Interglomerular circuits in the main olfactory bulb. Program# 561.10 (32nd Annual Meeting of the Society for Neuroscience, **Orlando**, November 2002, [Abstract](#)).
17. **Hayar A**, Heinbockel T, Karnup S, Ennis M, Shipley MT. Activation of metabotropic glutamate receptors enhances synaptic interactions among juxtglomerular neurons in olfactory bulb glomeruli. Program # 168.4 (33rd Annual Meeting of the Society for Neuroscience, **New Orleans**, November 2003, [Abstract](#)).
18. Shipley MT, Karnup S, Ennis M, **Hayar A**. Olfactory bulb external tufted (ET) cells provide monosynaptic excitatory input to periglomerular (PG) and short axon (SA) cells. Program# 489.14 (33rd Annual Meeting of the Society for Neuroscience, **New Orleans**, November 2003, [Abstract](#)).

19. Hamilton KA, Heinbockel T, **Hayar A**, Szabo G, Erdelyi F, Ennis M. Functional properties of interneurons in the external plexiform layer of the olfactory bulb. Program# 821.7 (33rd Annual Meeting of the Society for Neuroscience, **New Orleans**, November 2003, [Abstract](#)).
20. Li C, **Hayar A**, Smith DV. Patch-clamp recording of medullary taste neurons identified by retrograde labeling from the pons. Program# 594.3 (33th Annual Meeting of the Society for Neuroscience, **New Orleans**, November 2003, [Abstract](#)).
21. **Hayar AM**, Ennis M. Activation of metabotropic glutamate receptors (mGluRs) enhances bursting in external tufted cells of the olfactory bulb. Program# 412.11 (34th Annual Meeting of the Society for Neuroscience, **San Diego**, October 2004, [Abstract](#)).
22. **Hayar A**, Shipley MT, Ennis M. The bursting of olfactory bulb external tufted (ET) cells is coordinated by synaptic and gap junction currents. (27th Annual Meeting of the Association for Chemoreception Sciences, **Sarasota**, April 2005, [Abstract](#)).
23. **Hayar A**, Ennis M. Activation of metabotropic glutamate receptors (mGluRs) enhances bursting in external tufted cells of the olfactory bulb. (27th Annual Meeting of the Association for Chemoreception Sciences, **Sarasota**, April 2005, [Abstract](#)).
24. Hamilton KA, **Hayar A**, Ennis M. Spiking properties of EPL interneurons. (27th Annual Meeting of the Association for Chemoreception Sciences, **Sarasota**, April 2005, [Abstract](#)).
25. **Hayar AM**, Shipley MT, Ennis M. The activity of olfactory bulb external tufted cells (ET) is synchronized by various intraglomerular connections. Program# 614.17 (35th Annual Meeting of the Society for Neuroscience, **Washington DC**, November 2005, [Abstract](#)).
26. Dong HW, **Hayar A**, Ennis M. Activation of metabotropic glutamate receptors (mGluRs1) in the glomerular layer (GL) and granule cell layer (GCL) of the olfactory bulb enhances synaptic inhibition of mitral cells (MCs) (28th Annual Meeting of the Association for Chemoreception Sciences, **Sarasota**, April 2006). Chemical Senses Volume: 31 Issue: 5 Pages: A68-A68 Published: JUN 2006
27. Karnup SV, **Hayar A**, Shipley MT, Kurnikova MG. Spontaneous glomerular field potentials in slices of the olfactory bulb. (36th Annual Meeting of the Society for Neuroscience, **Atlanta**, October 2006, [Abstract](#)). Program# 542.7 Poster# P8.
28. Dong HW, **Hayar A**, Ennis M Activation of metabotropic glutamate receptors (mGluRs) enhances synaptic inhibition of olfactory bulb mitral cells (MCs) via actions on GABAergic interneurons in the glomerular layer (GL) and granule cell layer (GCL). (36th Annual Meeting of the Society for Neuroscience, **Atlanta**, October 2006, [Abstract](#)). Program# 542.5, Poster# P6.
29. Ennis M, Shipley MT, **Hayar A**. Glomeruli: dynamic portals into the olfactory brain. American Association of Anatomists, **Washington DC**, April 28 - May 2, FASEB Journal 21 (5): A84-A84 APR 2007.
30. Karpuk, N, **Hayar A**. Activation of postsynaptic GABAB receptors directly modulates the bursting pattern and synaptic activity of olfactory bulb juxtglomerular neurons. (29th Annual Meeting of the Association for Chemoreception Sciences, **Sarasota**, April 2007).
31. Hamilton KA, Ennis M, **Hayar A**. Interneuron EPSC bursts are correlated with tufted cell spike bursts in the superficial external plexiform layer of the olfactory bulb. (29th Annual Meeting of the Association for Chemoreception Sciences, **Sarasota**, April 2007).
32. Dong HW, **Hayar A**, Ennis M . mGluR1 Activation Enhances Nonselective Cation Currents and Rhythmic Bursting in External Tufted (ET) Cells. Chemical Senses 31 (5): A68-A68 JUN 2006. (29th Annual Meeting of the Association for Chemoreception Sciences, **Sarasota**, April 2007).
33. Heister D, **Hayar A**, Garcia-Rill E. Electrical coupling in whole cell recorded SubCoeruleus neurons. Associated Professional Sleep Societies (APSS). Sleep 30: A10-A11 Suppl. S. Meeting Abstract: 30 **Minneapolis**, June 2007.

34. **Hayar A**, Heister D, Garcia-Rill E. Carbachol induces synchronization of IPSCs at theta frequency in whole-cell recorded SubCoeruleus neurons. Associated Professional Sleep Societies (APSS). Sleep 30: A12-A12 35 Suppl. S **Minneapolis**, June 2007.
35. Karpuk N, **Hayar A**. Activation of postsynaptic GABA_B receptors directly modulates the bursting pattern and synaptic activity of olfactory bulb juxtglomerular neurons. (37th Annual Meeting of the Society for Neuroscience, **San Diego**, November 2007).
36. Hayar A. Spontaneous population activity revealed by calcium- and voltage-sensitive dyes in the neuropil of olfactory bulb glomeruli in vitro. (37th Annual Meeting of the Society for Neuroscience, **San Diego**, November 2007).
37. Al-Chaer ED, Gu C, **Hayar A**. An improved method for patch clamp recording of neurons in the intact dorsal root ganglion (DRG). (37th Annual Meeting of the Society for Neuroscience, **San Diego**, November 2007).
38. Dong HW, **Hayar A**, Ennis M. Activation of Group I mGluRs enhances rhythmic bursting and nonselective cation currents in olfactory bulb external tufted cells. (37th Annual Meeting of the Society for Neuroscience, **San Diego**, November 2007).
39. Nai Q, Dong HW, **Hayar A**, Linster C, Ennis M. Activation of $\alpha 1$ and $\alpha 2$ noradrenergic receptors differentially regulate GABAergic inhibition of mitral cells in the main olfactory bulb. (37th Annual Meeting of the Society for Neuroscience, **San Diego**, November 2007).
40. Heister D, **Hayar A**, Garcia-Rill E. Differentiating SubCoeruleus neurons by responses to carbachol and developmental changes in resistance. (37th Annual Meeting of the Society for Neuroscience, **San Diego**, November 2007).
41. Ye M, **Hayar A**, Garcia-Rill E. Electrical Coupling in Pedunculopontine (PPN) Nucleus Neurons. (37th Annual Meeting of the Society for Neuroscience, **San Diego**, November 2007).
42. Burkovetskaya M, **Hayar A**, Karpuk N, Kielian T. Characterization of Astrocyte Activation in Acute Brain Slices from Mice Harboring Brain Abscesses. (American Society for Neurochemistry (ASN) annual meeting, **San Antonio**, March 2008). J Neurochemistry Volume: 104 Pages: 54-55 Supplement: Suppl.1 Published: MAR 2008.
43. Heister D, **Hayar A**, Garcia-Rill E. Cholinergic modulation of fast excitatory and inhibitory input to the dorsal subcoeruleus. Sleep Volume: 31 Pages: A10-A10 Supplement: Suppl. S Meeting Abstract: 31 Published: 2008.
44. Nai Q, Dong HW, **Hayar A**, Linster C, Ennis M. Noradrenergic modulation of GABAergic inhibition of main olfactory bulb mitral cells. Chemical Senses Volume: 33 Issue: 8 Pages: S134-S135 Published: OCT 2008.
45. **Hayar A**, Center-surround interactions among neighboring olfactory bulb glomeruli revealed by optical imaging of the spatiotemporal propagation of spontaneous population activity. (38th Annual Meeting of the Society for Neuroscience, **Washington DC**, November 2008).
46. Pierce DR, **Hayar A**, Wiley CA, Light KE. Rat Purkinje cells that survive postnatal ethanol exposure are altered morphologically and physiologically. (32nd Annual Meeting of the Research Society on Alcoholism, **San Diego**, June 2009). Alcoholism-Clinical and Experimental Research, Volume: 33 Issue: 6 Special Issue: Sp. Iss. S1 Pages: 168A-168A.
47. **Hayar AM**, Light KE, Pierce DR. Coincident inhibitory inputs induce synchronized pauses in the firing of Purkinje cells (39th Annual Meeting of the Society for Neuroscience, **Chicago**, October 2009, [Abstract](#)). Program # 622.3, Poster # F4.
48. Ye M, **Hayar A**, Strotman B, Garcia-Rill E. Cholinergic modulation of fast synaptic transmission of pedunculopontine thalamic projecting neurons (39th Annual Meeting of the Society for Neuroscience, **Chicago**, October 2009, [Abstract](#)). Program # 375.16, Poster # FF16.

49. Jeradeh-Boursouliau F, **Hayar A**. Ethanol Reduces Olfactory Bulb Output by Reducing Excitatory Drive to Mitral/Tufted Cells (32nd Annual Meeting of the Association for Chemoreception Sciences, **St Petersburg, Florida**, April 2010).
50. Yadlapalli K, **Hayar AM**, Al-Chaer ED. Differential Effects of ATP on the Electrophysiological Properties of Postsynaptic Dorsal Horn Neurons in the Rat. (40th Annual Meeting of the Society for Neuroscience, **San Diego**, November 2010, Abstract).
51. Myal S, **Hayar AM**, Buchanan R, Garcia-Rill E. Effect of repetitive transcranial magnetic stimulation (rTMS) on nicotine-induced suppression of P13 auditory evoked potential (41st Annual Meeting of the Society for Neuroscience, **Washington DC**, November 2011). Program # 397.01, Poster # WW59
52. Simon C, **Hayar A**, Garcia-Rill E. Responses of developing pedunculopontine neurons to glutamate receptor agonists. (41st Annual Meeting of the Society for Neuroscience, **Washington DC**, November 2011). Program # 397.04, Poster # WW62.
53. Watts JL, Yadlapalli K, **Hayar AM**, Al-Chaer ED. Minocycline alters neuronal plasticity in rats with colon inflammation. (41st Annual Meeting of the Society for Neuroscience, **Washington DC**, November 2011). Program # 494.03, Poster # SS7.
54. Pierce DR, **Hayar A**, Light KE. Increased HCN1 expression at Basket cell innervation of rat Purkinje cells surviving postnatal ethanol exposure. (34th Annual Meeting of the Research Society on Alcoholism, June 25-29, 2011, **Atlanta**, Georgia). Abstract # 0127, published in Alcoholism: Clinical and Experimental Research. Vol. 35, Issue Supplement s1, page 42A.
55. Pierce DR, Lin XB, Light KE, **Hayar AM**. Rhythmic licking behavior is altered in adult rats that received postnatal ethanol exposure. (35th Annual Meeting of the Research Society on Alcoholism, June 23-27, 2012, **San Francisco**, California).
56. **Hayar AM**, Hamilton KA. External plexiform layer interneurons integrate synaptic inputs that are correlated with the bursting activity of surrounding mitral/tufted cells. (42nd Annual Meeting of the Society for Neuroscience, **New Orleans**, October 2012). Session # 339.
57. Lin XB, Pierce DR, Light KE, **Hayar AM**. The Fine Temporal Structure of the Rat Licking Pattern: What Causes the Variability in the Interlick Intervals and How is it Affected by the Drinking Solution? (35th Annual Meeting of the Association for Chemoreception Sciences, **Huntington Beach, California**, April 2013).
58. Pierce DR, **Hayar A**, Light KE. Ethanol exposure to rat pups days 4-6 decreases Purkinje cell number but appears to increase axonal innervations from Basket cells. (37th Annual Meeting of the Research Society on Alcoholism, June 21-25, 2014, **Bellevue**, Washington). Abstract # 1015, published in Alcoholism: Clinical and Experimental Research. Vol. 38, Issue Supplement s1, page 254A.

SEMINAR PRESENTATIONS

Local seminars

- 01/25/2007: Presentation for candidacy for joint appointment at the Dept. of Physiology and Biophysics. Title: "Synaptic transmission and gap junctions synchronize the bursting activity of olfactory bulb neurons"
- 04/02/2007: Presentation of the progress report for the Center of Translational Neurosciences External Advisory Committee.
- 06/15/2007: Training seminar for CTN summer students. Title: "How to record from single neurons?"
- 05/20/2008: Dean's Research Forum. Title: "Neuronal synchronization: The olfactory bulb model"
- 05/22/2009: Training seminar for CTN summer students. Title: "Introduction to Patch-Clamp Electrophysiology in Brain Slices"

03/18/2010: Dept. of Pharmaceutical Sciences. Title: “Alcohol-induced alterations in cerebellar circuits”

09/27/2010: Center for Translational Neuroscience, Mini-Symposium on Transcranial Magnetic Stimulation.
Title: “TMS investigations in rodents”

National seminars

1. **Hayar A**, Guyenet P. (Slide talk) Pre- and postsynaptic inhibitory actions of methionine-enkephalin on identified bulbospinal neurons of the rat rostral ventrolateral medulla. (Experimental Biology Meeting, **San Francisco**, April 1998).
2. **Hayar AM**, Karnup S, Shipley MT, Ennis M. ([Slide talk](#)) Synchronous activity among juxtglomerular neurons of the rat main olfactory bulb (MOB) *in vitro*. Program# 459.4 (31st Annual Meeting of the Society for Neuroscience, **San Diego**, November 2001).
3. **Hayar A**. ([Seminar](#)) Pre- and postsynaptic inhibitory actions of methionine-enkephalin and norepinephrine on identified bulbospinal neurons of the rat rostral ventrolateral medulla. (Univ. of Wyoming, **Laramie**, June 2002).
4. **Hayar A**. ([Seminar](#)) Synchronous bursting among juxtglomerular neurons of the olfactory bulb is mediated by synaptic and non-synaptic interactions. Developmental Neural Plasticity Unit, NINDS (**NIH, Bethesda**, June 2003).
5. **Hayar A**. Invited speaker for the “Satellite symposium to the 2004 Computational Neuroscience meeting ([CNS*04](#))” July 17, 2004, **Baltimore**.
6. **Hayar A**. ([6 Seminars](#), faculty candidate) Synaptic transmission and gap junctions synchronize the bursting activity of olfactory bulb neurons. 2004-2005, 1- Univ. of Drexel, **Philadelphia**, 2- Univ. of Illinois, **Rockford**, 3- Univ. of Texas, **Galveston**, 4- Univ. of North Dakota, **Fargo**, 5- Univ. of Mississippi, **Jackson**, 6- Univ. of Arkansas for Medical Sciences, **Little Rock**.
7. **Hayar A**. (3/14/2011) Correlated Activity in Neuronal Networks: Olfactory Bulb vs. Cerebellum. Department of Cellular Biology and Anatomy, Louisiana State University Health Sciences Center, 1501 Kings Highway, Shreveport, LA 71103.

International seminars

- 07/01/1996: **Hayar A**. GABAergic and noradrenergic responses in the rat rostral ventrolateral medulla (RVL) *in vitro*: Relevance to cardiovascular regulation and vasomotor rhythmogenesis. International School for Advanced Studies ([SISSA](#)), 2-4, via Beirut, **Trieste, Italy**.
- 09/02/2010: **Hayar A**. Neuronal Interactions and Synchrony. Invited talk at the Basic Medical Science Departments and Biology Department, American University of Beirut, **Beirut, Lebanon**.

RESEARCH TECHNIQUES AND EXPERTISE

- Autoradiography in rat brain slices
- Intracellular pH measurement by micro-fluorimetry using the BCECF probe
- Intracellular dye labeling
- Immunocytochemical staining for biocytin and tyrosine hydroxylase
- *In situ* hybridization (GABA mRNA subunits)
- Intracellular, extracellular and field potential recordings in brain slices
- Patch-clamp technique: whole-cell, outside-out, and single channel recordings
- Analysis of the properties of evoked, spontaneous, and miniature postsynaptic currents

- Recordings from bulbospinal neurons identified with retrograde tracing of fluorescent dyes
- Simultaneous whole-cell recordings from pairs of neurons in olfactory bulb slices
- Auto- and cross-correlation analysis of spike trains and waveforms
- Calcium and voltage-sensitive dye imaging, confocal microscopy
- Ultraviolet light laser uncaging of glutamate in brain slices
- Laser Doppler measurement of cerebral blood flow
- High speed spinning disk confocal microscopy at 2000 frames/s

TEACHING

Despite the dedication of most of my effort to research, I have been involved in significant teaching and training in my Department as well as in other Departments. I have also organized Journal Club presentations (once or twice a week, with Drs. Al-Chaer, Garcia-Rill, Light, Pierce) that involve students, postdoctoral fellow, and faculty, during which we discuss recently-published articles in different areas of Neurophysiology.

Courses I am currently directing and teaching:

1- Cellular and Developmental Neuroscience (NBDS 5103). Course director and lecturer of more than half of the course (46 hours, 3 credit-hour course, 7-14 graduate students, 1/1/2011- until present).

For more information, see the course website which I have designed: <http://hayar.net/NBDS5103>

Course description: This course is required for all Neuroscience track graduate students. It consists of lectures, assigned readings and student presentations that cover the structure, function and development of cells of the nervous system, the basic principles of the physiology of excitable cells, and synaptic transmission.

Lectures: Neuronal Network Construction, Autonomic Nervous System, Central Control of the Cardiovascular System, Membrane Potential and Action Potential, Release of Neurotransmitters, Neurotransmitters, Neuroreceptors, Postsynaptic Potentials and Synaptic Integration, Synaptic Plasticity & Memory Formation, Cellular & Developmental Aspects of Olfaction, Alcohol-induced alterations in cerebellar circuits, Lab: Electrophysiology & Imaging, Neuroscience of Pain, Critical Discussion of a scientific article, students' article presentation.

2- Neuronal Signals (NBDS 5161). Course director and lecturer of the entire course (18 hours, 1 credit course, graduate students, 06/01/2010- until present)

For more information, see the course website which I have designed: <http://hayar.net/NBDS5161>

Course Description: This condensed one credit summer course consists of teaching the theoretical aspects of modern analytical methods to study neuronal activity. It focuses on the study of brain signals and describes several methods for recording and analyzing neuronal activity using modern techniques such as patch clamping and imaging neuronal networks using calcium- and voltage-sensitive dyes. The course is to be taught annually in June-July, during a 7-week period on Tuesdays and Thursdays. It consists of 12 sessions: 9 lectures (80 min each), 1 laboratory demonstration (80 min) and 2 article presentations (80 min each) by the instructor. The goal of the course is to help graduate and medical students pursuing a career in neuroscience or neurology to become familiar with the cutting edge techniques for monitoring brain activity. The students were allowed to use all the resources in my lab so that they can get practical experience in how research is performed, and how experimental data is analyzed and published in scientific journals.

Lectures: Design of an electrophysiology setup, Neural population recordings, Single cell recordings, Analyzing synaptic activity, Data acquisition and analysis, Analyzing and plotting data using OriginLab, Detecting electrophysiological events, Writing algorithms in OriginLab®, Imaging neuronal activity,

Laboratory demonstration of an electrophysiology and imaging experiment, Article presentation I: Electrophysiology, Article presentation II: Imaging, Exam and students' survey about the course.

3- Basic Neuroscience (NBDS 5033). (4 x 1.5 hrs lectures, graduate students, 1/1/2013- until present)

Course Description: This course consists of lectures that cover the structure, function and development of the central nervous system.

For more information, see the course website which I have designed: <http://hayar.net/NBDS5033>

Lectures: “Chemical Senses: Taste”, “Autonomous Nervous System”, “Central Control of Respiration”, and “Central Control of Digestive System”.

4- Grand Rounds/Neurology Residency Integrated Didactic Curriculum (4 x 1 hr lectures, ~12 neurology residents, 9/16/2013- until present).

Lectures: “Ion channels”, “The action potential”, “Synaptic Integration”, “Neurotransmitters”.

Previous teaching experience:

- 1992-1996: Experience in training graduate students for electrophysiological techniques at the Univ. Louis Pasteur, France.
- 2001-2003: Teaching in Medical Neuroscience courses at the Univ. of Maryland: The role of the RVL in hypertension, synaptic physiology, synaptic communications in glomerular circuits.
- 2004-2005: Teaching in Morphological Neuroanatomy: Limbic system, olfactory system (Univ. of TN).
- 08/18/2006: Neurosurgery Lecture Series/Grand Rounds, Olfactory System.
- 08/25/2006: Neurosurgery Lecture Series/Grand Rounds, Neuroreceptors.
- 08/28/2006 - 12/11/2006: Physiology Journal Club Series: supervise 8 student presentations
- 09/06/2006: Systems Neuroscience (NBDS 5153), Neurotransmitters I.
- 09/08/2006: Systems Neuroscience (NBDS 5153), Neurotransmitters II.
- 09/11/2006: Systems Neuroscience (NBDS 5153), Channels and Currents I.
- 09/13/2006: Systems Neuroscience (NBDS 5153), Channels and Currents II.
- 10/27/2006: Systems Neuroscience (NBDS 5153), Olfactory system.
- 01/12/2007: Medical Neuroscience, Neurotransmitters I, Neurotransmitters II.
- 04/03/2007: Cellular & Develop. Neurosci. (NBDS 5103), Membrane Potential and Action Potential.
- 04/12/2007: Cellular & Develop. Neurosci. (NBDS 5103), Postsynaptic Potentials and Synaptic Integration.
- 03/06/2008: Cellular & Develop. Neurosci. (NBDS 5103), Membrane Potential and Action Potential.
- 03/07/2008: Medical Neuroscience, Neurotransmitters I, Neurotransmitters II.
- 04/03/2008: Cellular & Develop. Neurosci. (NBDS 5103), Postsynaptic Potentials and Synaptic Integration.
- 03/05/2009: Medical Neuroscience, Neurotransmitters I.
- 03/06/2009: Medical Neuroscience, Neurotransmitters II.
- 03/30/2009: Cellular & Develop. Neurosci. (NBDS 5103), Postsynaptic Potentials and Synaptic Integration.
- 04/06/2009: Cellular & Develop. Neurosci. (NBDS 5103), Cellular and Developmental Aspects of Olfaction.
- 02/22/2010: Cellular & Develop. Neurosci. (NBDS 5103), Membrane Potential and Action Potential.

- 03/05/2010: Medical Neuroscience, Neurotransmitters I.
- 03/08/2010: Cellular & Develop. Neurosci. (NBDS 5103), Postsynaptic Potentials and Synaptic Integration.
- 03/09/2010: Medical Neuroscience, Neurotransmitters II.
- 04/09/2010: Cellular & Develop. Neurosci. (NBDS 5103), Cellular and Developmental Aspects of Olfaction.
- Medical Neuroscience NeuroAnatomy Lab: Lab1: 3/2/10 (Whole Brain), Lab2: 3/3/10 (Half Brain), Lab3: 3/8/10 (Gross Brain Stem), Lab4: 3/16/10 (Spinal Cord), Lab5: 3/30/10 (Internal Medulla), Lab6: 4/6/10 (Internal Pons and Midbrain), Lab7: 4/21/10 (Coronal Sections), Lab8: 4/27/10 (Neuroradiology), Lab9: 4/28/10 (Motor System), Lab10: 4/28/10 (Upper Brain Stem).
- Medical Neuroscience Clinical Conferences: CC1: 3/17/10 (Spinal Cord Diseases), CC2: 4/5/2010 (Brain Stem Diseases), CC3: 4/16/10 (Vision System), CC4: 4/30/10 (Motor Diseases), CC5: 5/7/10 (Higher Brain Diseases)

MENTORING AND TRAINING

- Thesis director of the following graduate Ph.D. students
 - Xiong Bin Lin (7/1/2011 – 12-31-2014, candidacy exam: 10/23/2013, graduated on 12/9/2014)
 - Martin Watts (co-director with Dr. Elie Al-Chaer, candidacy exam: 4/19/2010, graduated on 4/1/2014)

Mentoring and training for electrophysiological techniques the following:

- Graduate students:
 - David Heister (8/1/2006 – 4/15/2008) - My role: co-mentor
 - Meijun Ye (8/1/2006 – 4/21/2009) - My role: co-mentor
 - Nebojsa Kezunovic (8/1/2009 – present) - My role: co-mentor
 - Christen Simon (8/1/2009 – present) - My role: co-mentor
 - Samuel Carus (7/1/2010 – 9/1/2010) - My role: mentor (lab rotation)
 - Aminiel Awichi (1/1/2013- 4/21/2013) - My role: mentor (lab rotation)
- Research assistants:
 - Parul Soni (4/1/2006 – 3/1/2008)
 - Maria Burkovetskaya (11/1/2006 – 6/30/2008)
 - Madhvi Patel (5/10/2009 – 8/1/2009)
 - Julius Franz (8/1/2009 – 5/15/2010)
 - Krishnapraveen Yadlapalli (3/1/2008 – present)
 - Margarita Escovedo (5/10/2009 – 12/31/2011)
 - Stephanie Myal (8/2/2010 – 12/31/2011)
 - Nelson Piper (training in collaboration with Dr. Sung Rhee, 4/1/2011-present)
- Postdoctoral fellows:
 - Dr. Nikolay Karpuk (7/1/2006 – 6/30/2008)
 - Dr. Feras Jeradeh-Boursoulilian (5/1/2009 – 6/30/2010)
 - Dr. Nikhil Kamalnath Parelkar (training in collaboration with Dr. Sung Rhee, 12/1/2010-3/31/2011)
- Medical students:
 - James Scott Steele (5/17/2010 – 8/1/2010)

- High school students:
 - Brennon Luster (6/11/2007 – 6/22/2007)
 - Shaterrica Dawson (6/11/2007 – 6/22/2007)
 - Michael Smith (6/1/2010 – 8/6/2010)
 - Konstantin Gruenwald (6/1/2010 – 8/13/2010)

ADMINISTRATION AND SERVICE

Community service

- Jury Duty (Pulaski County Circuit Court): 5/1/2015 - 8/31/2015
- As a vice president of the Arkansas Chapter of the Society for Neuroscience, I continue to help the society' officers to organize our yearly scientific meeting to promote awareness about Neuroscience research. For example, each year in March, we organize the Brain Awareness Day at the Museum of Discovery. Our neuroscience exhibits attracted to the discovery museums additional visitors who were curious to learn more about the way the brain functions in animals and human being. This Brain Awareness Day event is of important value to the chapter vitality because it directly addresses the Society's outreach goal of promoting novel initiatives linked to neuroscience literacy, education or training. The Brain Awareness Day event at the Museum of Discovery has demonstrated to be a very effective method of introducing school-age children as well as adults to the world of neuroscience and the brain. I am also the webmaster of the Chapter' website: <http://www.ar-neuro.org>

Administrative & Academic Committees

- Member of the admissions committee for the new Graduate Program in Biomedical Sciences (GPIBS) and Neuroscience Track representative (11/2/2015-present)
- Member of the Exit Survey Committee of the UAMS Faculty Senate (10/17/2015)
- President of the Arkansas Chapter of the Society for Neuroscience (11/8/2011-12/31/2012)
- President-elect of the Arkansas Chapter of the Society for Neuroscience (11/10/2010-11/8/2011)
- Member of the Institutional Animal Care and Use Committee (7/1/2010-present): Obtained IACUC101 and IACUC201PLUS certificates on 9/19/2012 -9/20/2012
- Member of the Dept. of Neurobiology & Developmental Sciences Graduate Advisory Committee (9/1/2009 – present)
- Member of the Academic Senate Communications Committee (12/1/2010-present)
- Member of the Strategic Planning Committee (Chair of Research Subcommittee) of the Dept. of Neurobiology & Developmental Sciences (8/20/2008 – 12/31/2008)
- Member of the Recruitment Committee of the Dept. of Neurobiology & Developmental Sciences (5/7/2009 – 2010)
- Member of ResNet proposal Committee (4/1/2011-6/30/2012)

Graduate student thesis committees

Member of the thesis committees of the following graduate students:

1. David Heister (Dr. Edgar Garcia-Rill's Lab, candidacy exam: 4/12/2007, graduated on 4/15/2008)
2. Meijun Ye (Dr. Edgar Garcia-Rill's Lab, candidacy exam: 10/2/2007, graduated on 4/21/2009)
3. Kyongmin Kim (Dr. Z. Jimmy Zhou's Lab, candidacy exam: 9/10/2007, did not graduate)
4. Hamdan Hamdan (Dr. Patricia Wight's Lab, candidacy exam: 4/11/2008, graduated on 5/7/2012)
5. Jennifer Watts (Dr. Elie Al-Chaer's Lab, candidacy exam: 5/26/2009, graduated on 6/28/2011)
6. Christen Simon (Dr. Edgar Garcia-Rill's Lab, candidacy exam: 5/18/2010, graduated on 10/28/2011)
7. Nebojsa Kezunovic (Dr. Edgar Garcia-Rill's Lab, candidacy exam: 11/30/2010, graduated on 3/6/2012)

8. James Hyde (Dr. Edgar Garcia-Rill's Lab, candidacy exam: 4/11/2012, graduated on 4/26/2013)
9. Paige Beck (Dr. Edgar Garcia-Rill's Lab, candidacy exam: 4/18/2012, graduated on 4/30/2013)
10. Naveen Babu Kandavalli (Dr. Steve Barger's Lab, did not graduate)
11. Martin Watts (Dr. Elie Al-Chaer's Lab, candidacy exam: 4/19/2010, graduated on 4/1/2014)
12. Gwendolyn Carter (Dr. Mark Mennemeier's Lab, candidacy exam: 5/1/2012, graduated on 4/28/2015)
13. Tonisha Kearneyramos (Dr. James G. Andrews' Lab, candidacy exam: 8/23/2013, graduated on 5/22/2015)
14. Xiong Bin Lin (Dr. Hayar's Lab, candidacy exam: 10/23/2013, graduated on 12/9/2014)
15. Brennon Luster (Dr. Edgar Garcia-Rill's Lab, candidacy exam: 11/19/2013)
16. Stasia D'Onofrio (Dr. Edgar Garcia-Rill's Lab, candidacy exam: 11/26/2013)
17. Helen Hayes ((Dr. Mark Mennemeier's Lab)

Grant review and study sections

- **2010: NIH Study Section:** Ad hoc reviewer for the NTRC "Neurotransporters, Receptors, Channels and Calcium Signaling Study Section" at the NIH
- **2010: NIH Study Section:** Ad hoc reviewer for R03 Chemical Senses review meeting, National Institute on Deafness and Other Communication Disorders Special Emphasis Panel (ZDC1 SRB-R (37))
- **2012:** UAMS Translational Research Institute: TRI Pilot Grant Study Section Meeting (8/20/2012)
- **2013:** External reviewer for The University of Alaska's IDeA Network of Biomedical Research Excellence (INBRE) internal Seed Grant Competition (11/13/2013).

I revised, made suggestions and/or helped in providing preliminary data for the following grants at the University of Arkansas for Medical Sciences:

- Dr. Z. Jimmy Zhou: R01 EY010894-11, Title: "Physiology of the vertebrate retina". Funded on 8/1/2007
- Dr. Elie Al-Chaer: R01 DK077733-01, Title: "Sex Hormones and Visceral Hypersensitivity". Funded on 4/1/2008
- Dr. Jeffrey Kaiser: 5R01NS060674, Title: "Physiological Disturbances Associated with Neonatal Intraventricular Hemorrhage". Funded on 6/1/2008
- Dr. Edgar Garcia-Rill: R01 NS020246-22, Title: "Central modulation of rhythms". Funded on 12/1/2008
- Dr. Nancy Rusch: R01HL093526-01A1, Title: "Long-term Antihypertensive Therapy by Delivery of the BK Channel Gene to VSMCs". Funded on 5/5/2009

at the Univ. of Tennessee:

- Dr. Fu-Ming Zhou: R01 DA021194-01A2, Title: "Non-transporter cocaine mechanisms in dopamine system". Funded on 9/31/2007
- Dr. Hongwei Dong: R03 DC009049-01, Title: "Acitivity-Dependent Plasticity of Sensory Synapses in the Olfactory Bulb". Funded on 7/1/2007
- Dr. Matthew Ennis: R01DC003195-11, Title: "Metabotropic Glutamate Receptors in the Olfactory Bulb". Funded on 1/1/2007

Requested reviewer for the following journals:

- Journal of Neuroscience
- Journal of Neurophysiology
- British Journal of Pharmacology
- Molecular and Cellular Neuroscience
- Journal of Neuroscience Methods

- Neuroscience Letters
- Public Library of Science (plos.org)
- Canadian Journal of Neurological Sciences
- Journal of Visualized Experiments

Editorial board

Advances in Neuroscience, Hindawi Publishing Corporation (since 2013)

WEB DESIGN AND WEBMASTER EXPERIENCE

- I advertise for my teaching, research and collaborations on a website that I personally design (<http://hayar.net>). I frequently update this website to demonstrate that, at UAMS, we have highly competitive teachers and scientists who lead the field of electrophysiological research in the brain. In addition, I constantly encourage my colleagues to advertise their research online, and help them in my role as webmaster responsible for maintaining and updating the websites for the Dept. of Neurobiology & Developmental Neurosciences, the Center of Translational Neurosciences (CTN), and the Arkansas Chapter of the Society for Neuroscience.

- Since July 2006, I am the webmaster and responsible for updating the following websites:

- 1- Dept. of Neurobiology & Developmental Sciences: <http://neurobiology.uams.edu>
- 2- Center of Translational Neurosciences: <http://www.uams.edu/ctn>
- 3- Arkansas Chapter of the Society for Neuroscience: <http://www.ar-neuro.org>

- Since August 2007, I am responsible for organizing and scheduling the Center of Translational Neurosciences and the Dept. of Neurobiology & Developmental Sciences seminars:

<http://neurobiology.uams.edu/seminars>

- Since September 2010, I volunteered to become administrator of a SharePoint blog site for the “Neuroscience Magnet Group” established by the Dean of Medical School to enhance collaborative research:

<http://sharepoint.uams.edu/Divisions/neuromagnet>

- Since April 2011, I am responsible of administering the UAMS Academic Senate’s website:

<http://academicsenate.uams.edu>

- Since February 2015, I am responsible for updating the Institutional Animal Care and Use Committee’s website: <http://inside.uams.edu/iacuc>

-Neurobiology courses’ webpages:

- 1-Cellular & Developmental Neurobiology: <http://hayar.net/NBDS5103>,
- 2-Neuronal Signals: <http://hayar.net/NBDS5161>,
- 3-Basic Neuroscience: <http://hayar.net/NBDS5033>

EXPERIENCE IN COMPUTER HARDWARE AND SOFTWARE

- Custom building high-end computers for research and troubleshooting PC hardware and software at the Center for Translational Neurosciences
- **Operating Systems:** MS-DOS, Windows, Macintosh

- **Application programs:** Microsoft Office, Canvas, Corel Draw, Photoshop, Adobe Acrobat, pClamp, Spike2, Origin, MiniAnalysis, Neuroplex, SAP, ARIA, Micromanager, ImageJ, Windows Movie Maker, Windows Media Encoder, Photoscape, Any Video Converter
- **Programming Languages:** Visual Basic, Visual C++, Origin C and Labtalk Script language, OriginLab, MatLab
- **Internet:** Webpage design (see my website <http://hayar.net>), Personal Web Server, FTP Server, Frontpage, Microsoft Expression Web, Wordpress.
- SAP user since 11/16/2006.
- Online grant submission (Grants.gov) and routing (ARIA, TRACKS)

PRESS RELEASE AND PUBLICITY

UAMS News Bureau: Office of Communications & Marketing, 4301 W. Markham # 890, Little Rock, AR 72205

- 1- UAMS Faculty Member Receives Award for Smell Research. June 16, 2006.
<http://www.uamshealth.com/?id=1655&sid=1>
- 2- UAMS Researchers Identify Sleep-Wake Controls with Implications for Coma Patients and Those Under Anesthesia. July 20, 2007.
<http://www.uamshealth.com/?id=2849&sid=1>
- 3- Brain Mechanism Could Be Key to New Stimulants, Anesthetics. June 2, 2010
<http://www.uamshealth.com/News/Default.aspx?id=5349&sid=1&nid=8818>

NATIONAL AWARD AND RECOGNITION

I was awarded in 2006 the “AChemS Young Investigator Award for Research in Olfaction” by the Association for Chemoreception Sciences (AChemS), an international association that advances understanding of the senses of taste and smell. The award is given annually to an outstanding junior scientist who is an emerging leader in the field of olfaction, and whose research record provides evidence of excellence and contributions that have had or are likely to have a major impact on research in the field of olfaction. I was given this award (\$2000) because I have played an important role in promoting chemosensory research by advancing our knowledge of olfactory bulb neurophysiology. My research project constitutes an essential step to our understanding of olfactory input processing at the level of the glomeruli and it helps us to unravel the fundamental network mechanisms responsible for encoding and processing sensory information. In 2010, I was a nominee for the “Secretary” position at the Association for Chemoreception Sciences (AChemS).

ESTABLISHING STATE-OF -THE-ART TECHNIQUES FOR EXPLORING THE BRAIN

1- Ultra fast imaging of neuronal activity

Optical imaging techniques, nowadays, have become powerful tools for investigating cellular and network physiology. We have purchased a state-of-the art fast imaging system (NeuroCCD-SMQ, RedShirtImaging, CT) with a very high temporal resolution camera, capable of acquiring up to 5000 frames/sec. At this frame rate it is possible to image calcium and voltage signals at sub-ms temporal resolution. This acquisition rate will allow us to detect fast voltage or calcium signal transients in a single neuron or across a population of neurons. I have obtained interesting preliminary data and submitted them as part of new grant applications. Because this is a break-through technique and it is the first of its kind at UAMS, I have helped many colleagues to generate imaging data related to their project. For example, we

have performed imaging experiments on the retina and the preliminary data has helped Dr. Z. Jimmy Zhou get funded by an NIH grant (R01 EY010894-11, entitled “Physiology of the vertebrate retina”). I have performed calcium imaging experiments on the intact dorsal root ganglion in collaboration with Dr. Elie Al-Chaer (Hayar et al., 2008). The purpose of the ongoing experiments is to elucidate the mechanisms of sensory hyper-excitability that lead to chronic pain and we are planning to submit soon an NIH grant on this project.

2- Live confocal live imaging

We have installed on top of an Olympus microscope a CSU-X1 spinning disk confocal (Yokogawa Electric Corp, Japan). This system has the world's fastest scanning speed (up to 2000 frames/s) and integrates well with our RedShirtImaging camera which is also capable of acquiring 2000 fps. It consists of a Nipkow spinning disk that rotates at 10,000 rpm and contains about 20,000 pinholes and a second spinning disk containing the same number of micro-lenses to focus excitation laser light into each corresponding pinhole. It can very rapidly raster scan the field of view with about 1,000 laser beams. Multi-beam scanning not only increases scanning speed, but also results in significantly lower photobleaching and phototoxicity. The addition of this relatively low-cost (\$150,000) confocal system is expected to enhance our fast live imaging technology by allowing us to image deeper in the tissue with much better signal-to-noise ratio and less light scattering.

3- Ultraviolet laser technology to stimulate and image the brain

We have purchased an ultraviolet laser uncaging system. This equipment generates a high energy ultraviolet laser beam which is linked to the microscope illuminator port via a 50 μm diameter quartz optical fiber guide. Using this system, it is possible to perform spot illumination of areas as small as 5 μm diameter to uncage compounds such as glutamate or calcium in a small region of a brain slice such as single dendrites. This technique can be combined with calcium-sensitive dye imaging. The ultraviolet laser light can also be used to evoke small brain lesions or to evoke a clot in a single capillary or blood vessel in the brain in vivo to mimic the effect of stroke and study the mechanism of local ischemia.

4- Infrared laser technology to quantify local cerebral blood flow

We have also purchased an infrared laser equipment (Advance Laser Blood Flowmeter ALF 21) for monitoring cerebral blood flow via Doppler effect. A semiconductor laser beam is stabilized and guided through a quartz optical fiber with an open angle of approximately 28 degrees and then reflected by the organic tissues, get scattered, reflected, and so forth to diffuse. Light reflected by the moving blood changes its frequency by Doppler Shifts, in accordance with the speed of blood flow. The equipment can measure simultaneously blood flow velocity and mass. We are planning to use this equipment to measure the effect of hypoventilation and hypercapnia on blood flow in premature animals. This equipment will be used to generate preliminary results to apply for competitive multi-investigator NIH grants in collaboration with Dr. Jeffrey Kaiser, a neonatologist recently recruited at the Center of Translation Neurosciences.

COLLABORATIONS

I am a team player and I have been involved in several collaborative projects with researchers in my Department, at the University of Arkansas and with collaborators in other Universities especially members of the Association for Chemical Senses. I continuously seek to help members of my neuroscience community to initiate new research or to refine ongoing work. My working philosophy is that real success can only be achieved when your colleagues are also successful. I am an excellent team player because my colleagues can rely on me to troubleshoot and solve their scientific problems. I share openly and willingly any scientific information, knowledge and experience. I have an international background and I communicate

constructively and listen actively to colleagues with different ideas and points of view and I treat them in a respectful and supportive manner.

My ultimate goal is to understand the alterations in neuronal networks in pathological conditions, such as neurodegenerative diseases, functional pain, hypertension, and when the brain becomes addictive to alcohol and drugs of abuse. Since my recruitment at the Dept. of Neurobiology & Developmental Sciences on January 2006, I have built 6 patch-clamp electrophysiology setups: 3 in my lab and 3 others in my colleagues' labs (Dr. Elie Al-Chaer and Dr. Garcia-Rill at the Center for Translational Neurosciences). I have trained and co-mentored 6 graduate students, 8 research assistants, 3 postdoctoral fellows, 1 medical student, and 4 high-school students in several techniques such as patch-clamp recordings in different brain structures involved in olfaction, vision, sleep and pain.

List of ongoing and previous collaborations since recruitment at UAMS in 2006:

1. Collaboration with Dr. Peter Crooks (Dept. of Pharmaceutical Sciences, UAMS) to test an antagonist of the nicotinic receptors $\alpha 9\alpha 10$ using electrophysiological and imaging techniques. Dr. Crooks is internationally recognized for his research in anticancer drug discovery and he is interested in developing new pain medication to treat acute and chronic pain.
2. Collaboration with Dr. Maxim Dobretsov (Dept. of Anesthesiology, UAMS) to investigate the role of the alpha3 isoform of neuronal sodium-potassium ATPase in controlling the activity of Purkinje cells. An R03 grant has been submitted on this research project on 10/15/2015 and a CTN pilot study grant has been submitted on 10/23/2015. This research project will provide insight into the fundamental mechanisms leading to dystonia and it will help us develop strategies to cure or more effectively treat people who are affected by this neurological disorder.
3. Collaboration with Dr. Antino Allen (Dept. of Pharmaceutical Sciences, UAMS). I have helped Dr. Allen, a new faculty, to prepare and submit a NASA grant in which I am co-I. The grant was discussed at a study section but was not ranked high enough to receive funding. It will be revised and submitted later. I am also collaborating with Dr. Allen on a behavioral test (licking) to investigate motor functions in irradiated mice. I have also trained him to perform electrophysiological experiments that consist of recording field potentials in hippocampal slices to investigate the effects of irradiation on synaptic plasticity in irradiated mice. This is a model of space radiation that astronauts encounter while traveling long journeys into space.
4. Collaboration with Dr. Edgar Garcia Rill (Dept. of Neurobiology and Developmental Sciences, UAMS) to investigate electrical coupling in the reticular activation system which is involved in the regulation of rapid eye movement sleep. We had a funded 5-year collaborative grant that started on 8/1/2009. We have published so far 10 articles and 8 abstracts in collaboration.
5. Collaboration with Dr. Elie Al-Chaer (Dept. of Pediatrics, UAMS) to investigate the effect of visceral hypersensitivity on the electrophysiological properties and calcium signaling in dorsal root ganglion neurons using the whole-cell patch clamp technique in the intact ganglion. We have published so far 1 article and 2 abstracts in collaboration. We have another manuscript in preparation on the effects of purinergic receptor activation in spinal cord slice.
6. Collaboration with Drs. Kim Light and Dwight Pierce (Dept. of Pharmaceutical Sciences) to investigate the alterations in cerebellar neuronal circuit interactions in a rat model of Fetal Alcohol Spectrum Disorders. We have published so far 4 articles and 4 abstracts in collaboration.
7. Collaboration with Dr. Sung Rhee (Dept. of Pharmacology and Toxicology) to investigate a novel scaffolding molecule in the muscle cells of small cerebral arteries that may ensure that potassium channels are expressed in adequate numbers and in the right location in the muscle cells of cerebral

arteries to optimize blood flow to the brain. We had a funded 5-year collaborative grant that started on 4/1/2010.

8. Collaboration with Dr. Nancy Rusch (Dept. of Pharmacology and Toxicology, UAMS) to perform *in vivo* experiments using an infrared laser equipment (Advance Laser Blood Flowmeter ALF 21) for monitoring cerebral blood flow via Doppler effect. The goal of the collaboration was to bring together a team of researchers with various expertises in order to strengthen research in the cardiovascular field. Preliminary data were obtained and I provided a consultant letter that was used in a grant application on antihypertensive gene therapy, which was subsequently funded on 5/5/2009.
9. Collaboration with Dr. Kathryn Hamilton (Louisiana State University) to characterize the cell types of the olfactory bulb external plexiform layer and to understand the contributions of these cells in this layer to olfactory discrimination. We have published so far 8 papers and 7 abstracts in collaboration. We had a funded 3-year collaborative grant that started on 4/1/2009.
10. Collaboration with Dr. Mahmoud Kiaei (Dept. of Neurobiology and Developmental Sciences, UAMS) to investigate the licking pattern in a mouse model of amyotrophic lateral sclerosis (ALS). We generated interesting preliminary data showing that a disruption in motor behavior can be detected at early age before any ALS symptom becomes obvious and these data could be used to support future grant applications.
11. Collaboration with Dr. Jeffrey Kaiser (Dept. of pediatrics, UAMS) to develop an animal model of intraventricular hemorrhage and to test the effect of hypercapnia and hypertension on cerebral blood flow and other respiratory and cardiovascular parameters. New techniques have been developed in my lab to investigate brain hemorrhage by ultra-fast imaging of small blood vessels. A recent R03 grant on this topic has been submitted on 10/15/2015.
12. Collaboration with Dr. Jimmy Zhou (Dept. of Physiology and Biophysics, UAMS, and Yale Univ.) to investigate retinal waves using imaging of calcium and voltage-sensitive dyes. Dr. Zhou got funded by a second R01 grant application on the synaptic function and organization of the mammalian retina. Then, he moved to Yale Univ. where he became Vice Chairman and Director of Research at the Dept. of Ophthalmology and Visual Science.
13. Collaboration with Dr. Tammy Kielian (Dept. of Neurobiology and Developmental Sciences, UAMS) to investigate the effects of brain infection on electrical coupling in glial cells labeled by GFAP in transgenic mice. Dr. Kielian has moved her laboratory to the University of Nebraska Medical Center in Omaha, NE. One of my postdoctoral fellows, Dr. Nikolay Karpuk has moved with her to continue working on this project.
14. Collaboration with Dr. Naim Haddad (Dept. of Neurology, UAMS) to establish a method of EEG dipole source mapping in epilepsy and neurodegenerative diseases. We have applied for a "Pilot study Center for Translational Neuroscience Award" and setup EEG equipment to start this pilot study. Dr. Haddad moved subsequently to another position at Weill Cornell Medical College in Qatar.
15. Collaboration with Dr. Atom Sarkar (Dept. of Neurosurgery, UAMS) to help set up a Human Electrophysiology Core for recording from human brain tissue from surgeries performed in epileptic or cancer patients.
16. Collaboration with Dr. Roger Buchanan (Arkansas State University) to determine how repetitive transcranial magnetic stimulation (rTMS) alters the effects of chronic exposure to cigarette smoke on the rat P13 potential. We obtained a funded collaborative grant from the Arkansas Bioscience Institute.
17. Collaboration with Dr. Jason Chang (Dept. of Neurobiology and Developmental Sciences, UAMS) to investigate the mechanisms of neurotoxicity of methyl mercury in glial cells and neurons.

18. Collaboration with Dr. Xiong Liu (Mesolight, LLC) to develop a novel fluorescence contrast agent for near-infra-red deep tissue imaging based on up-converting nanoparticles (UCNPs). A collaborative grant was submitted on 08/05/2010.
19. Collaboration with Dr. Matthew Ennis (Univ. of Tennessee Health Science Center) on a research project to study metabotropic glutamate receptors (mGluR) in the olfactory bulb. I provided preliminary showing how mGluR activation enhances External Tufted cell rhythmic bursting and synchronize the glomerular network. Dr. Ennis' grant renewal was approved for funding in 2007. I have subsequently published with Dr. Ennis 5 articles.