September 2018 **CURRICULUM VITAE**

A. *PERSONAL DATA*

Full Name: George Davis Bittner

Place and Date of Birth: August 17, 1941; New York, NY

Social Security Number: 561‑68‑4993

Marital Status: Married (Dr. Cathy Yang, MD, PhD, COO

 CertiChem

Children: Jack, Lucie

Current Home Address: 2812 Pearce Road, Austin, Texas 78730

 (512) 346‑4392

Current Office Address: Patterson Laboratories, Room 321

 Department of Neuroscience

 University of Texas

 Austin, TX 78712-1064

 (512) 923-3735 (cell). preferred # to call

 (512) 471-6971 (Lab)

 email: bittner@austin.utexas.edu

B. *EDUCATION*

9/59 ‑ 6/62 Duke University, Durham, NC; A.B., Chemistry, 9/62

9/62 ‑ 12/66 Stanford Medical School, Palo Alto, CA; 5 year MD/PhD program. Withdrew in good standing (sixth in class) 12/66 via leave of absence in December of fifth year to devote full time to research, 6/64 ‑ 8/67

Stanford University; Ph.D., Neurological Sciences, 1967; Supervising Professor: Dr. Donald Kennedy, Chairman, Biological Sciences

11/67 ‑ 6/69 NIH Postdoctoral fellowship with Dr. Jose Segundo, Department of Anatomy/Cell Biology, UCLA, Los Angeles, CA

C. *PROFESSIONAL EXPERIENCE*

CEO CertiChem 5/00 – present, CEO PlastiPure 5/00 – 6/08, CSO PlastiPure 7/08 – present

Professor, Department of Neuroscience, 9/2013 - present

Professor, Neurobiology Section, School of Biology, 9/98 – 8/2013

Professor, Dept. of Zoology, University of Texas, Austin, TX, 9/82 – 8/98

Adjunct Professor, College of Pharmacy, University of Texas, Austin, TX, 9/87 – 5/05

Associate Professor, Department of Zoology, University of Texas, 9/74 ‑ 8/82

Assistant Professor, Department of Zoology, University of Texas, 9/69 ‑ 8/74

Adjunct Professor, Dept. of Physiology and Biophysics, University of Texas Medical Branch,

 Galveston, TX, 3/96 - present

Visiting Associate Professor, Department of Physiology, University of Texas Medical School, San Antonio, TX, 9/77 ‑ 8/78

Visiting Associate Professor, Department of Anatomy, Case‑Western Reserve University Medical School, Cleveland, OH, 8/75 ‑ 1/76

NIH Postdoctoral Fellow, Dr. Jose Segundo, Department of Anatomy, UCLA, 11/67 ‑ 6/69

NIH Predoctoral Fellow, Dr. Donald Kennedy, Biological Sciences, Stanford University, 1965 ‑ 67

Research Assistant, Dr. Keith Killam, Department of Pharmacology, Stanford University, 1962 ‑ 63

D. *UNIVERSITY ADMINISTRATIVE RESPONSIBILITIES (since 1985)*

Biology Graduate Advisor, 1982 - 1990

Program Director, Neurobiology Training Grant, 1985 - 1991

Program Director, Electron Microscope Applications to NIH, NSF, 1985 - 1986

Organizing Director, Institute for Neuroscience, 1985 - 1986

Member, Executive Committee, Institute for Neuroscience, 1986 - 1994

Member, Executive Committee, Institute for Biotechnology, 1988 - 1995

Natural Science Promotion Committee (2002-2004; Chair, 2003-2004)

Natural Sciences Courses and Curricula committee (2003-2005)

CNS Scholarship Committee (2002-present)

University of Texas Libraries Committee (8/2014-present); Chair 2017-2018

Student Conduct Hearing Officer (9/2016-present)

E. *PROFESSIONAL SOCIETIES* Past and present\*

Society for Neuroscience\* Neurotrauma Society

A.A.A.S. (Elected Fellow)\* Society for Cell Biology

Society for Neurochemistry Society for Developmental Neurobiology

American Chemical Society\* Endocrine Society\*

F. *PROFESSIONAL AND PUBLIC SERVICE (Since 1985)*

Member, NINCDS Review Committee for Program Project Grants, 1986 - 1987

Member, Advisory Committee for Basic Neuroscience Research, Air Force Office of Sponsored Research, 1987 - 1988

Vice President, Central Texas Biotechnology Consortium, 1986 - 1989

Member, Neuroscience Review Committee for Veteran Administration Grants, 1990

Treasurer, Society for Neuroscience (Austin Chapter), 1985 - 1996

Member, Biotechnology Committee, Austin Chamber of Commerce, 1987 - 1994

Member, NSF and Howard Hughes Panels for Predoctoral Fellowships in Neurobiology, 1993 - 1995

Chair, Neuroscience Panel for Howard Hughes and NSF Predoctoral Fellowships, 1996Editorial Review Board, Neural Regeneration Research since June 2015

Review 8-15 Manuscripts/year total for *Journal of Neurophysiology*, *Journal of Comparative Physiology*, *Science*, *Journal of Neurobiology*, *Brain Research*, *Journal of Neuroscience*, *Toxicology in Vitro*, *Toxicological Sciences*, *Environmental Health Perspectives, Environmental Health, Neural Regeneration Research*

Ad Hoc Reviewer, NIH, NSF Neurobiology Grant Applications in Synaptic Plasticity, Nerve Regeneration, or Glial Function, 1985 – present

Member NIH BNVT panel study section, panel to review/score R-01, R-21, U-01, U-03 etc grant applications. 8/2014-present

G. *INVITED SEMINARS/PRESENTATIONS (2005-2015)*

 Robert Wood Johnson Medical School, Piscataway, NJ (April, 2005)

 NIEHS Campus, Research Triangle Park, NC (April, 2005; August, 2006)

 Lone Star Paralysis Foundation, Austin, May 2006

 Brain, Spine Center, Brackenridge Hospital, Nov 2006

 Department of Biology, North Carolina State University, Raleigh NC (March 2007)

 Breast Cancer Foundation/Fund San Francisco, Ca. Detection of estrogenic activity in plastics

 (Jan, 2008)

 Lone Star Paralysis Foundation, Axonal repair using polyethylene glycol (April, 2008)

 NIH/NIEHS Campus Raleigh, NC detection of estrogenic activity. (March, 2009).

 A Robotic MCF-7 Cell Proliferation Assay to Detect Estrogen Receptor Agonists and Antagonists 2010. C.Z. Yang, N. Bodon and G.D. Bittner, Society of Toxicology., March 2010, Salt Lake City

 Almost all plastics release chemicals having estrogenic activity: a health problem that can be solved. NIEHS research campus, NC. 1.14.11.

Rapid Repair of Severed Nerve Axons. Harvard Medical School, Dept of Orthopedic Surgery . Dec. 2011

Rapid Repair of Severed Nerve Axons. Concordia University, Dept of Biology, Feb, 2012

Rapid Repair of Severed Nerve Axons. University of Texas, Psychology Dept, Feb 2012

Rapid Repair of Severed Nerve Axons. Wayne State Medical School, Anatomy/Cell Biology, Feb 2012

Rapid Repair of Severed Nerve Axons. U. Miami Medical School, Dept. of Orthopedic Surgery, March 2012

Rapid Repair of Severed Nerve Axons. Department of Biology, North Carolina State University, April, 2013

Rapid Repair of Severed Nerve Axons. Department of Biomedical Engineering, NC State University, April, 2013

Rapid Repair of Severed Nerve Axons. Department of Neurosurgery, Duke University Medical School, April, 2013

Rapid Repair of Severed Nerve Axons. Department of Orthopedics and Plastic Surgery and Neuroscience Program, Wake Forrest Medical School, April, 2013.

Plastics and Chemicals in the Environment. Sierra Club. Austin, TX September 2013.

Bioengineered repair of severed limb nerves. UT Quest. March 2014.

Rapid restoration of behaviors lost after completely severing peripheral limb nerves:
 It’s not just for Luke Skywalker and (Mr.) Crabs anymore U. Virginia, Biology Dept. Oct 2014.

Rapid restoration of behaviors lost after completely severing peripheral limb nerves:
 It’s not just for Luke Skywalker. University of Indiana Medical School. March, 2015.

Biotech Advances in Hormone Free products. UT Quest. March, 2015.

A battery of in vitro assays to detect estrogenic activity. ICCVAM Conference, NIH, May, 2016

H. *AWARDS AND HONORARY SOCIETIES*

First Prize, Florida State Science Fairs, 1958, 1959

Phi Eta Sigma, Freshman Honorary, Duke University, 1959 - 1960

Phi Beta Kappa, Phi Eta Sigma, Duke University, 1962

A.B., Magna Cum Laude, Duke University, 1962

NIH, NSF predoctoral fellowships, Stanford University, 1965 - 1966

NIH postdoctoral fellowship, UCLA, 1967 - 1969

Fellow, Neurosciences Study Program, Boulder, CO, Summer 1969

NIH Career Development Award, 1975-1980

Elected Fellow, American Association for the Advancement of Science, Spring, 1994

I. *UNIVERSITY AND DEPARTMENTAL COMMITTEES (Since 1985)*

Zoology, Long Range Planning Committee, 1984 - 1986

Zoology, Chairman Recruitment Committee, 1985 - 1986

Faculty Advisor Graduate Fellows Program, 1985 - 1986

Selection Committee, Churchill Scholar Program, 1985 - 1987

Plan II Advisory Committee, 1986 - 1990

Zoology Computer Committee, 1987 - 1990

Zoology, Admissions Committee, 1989 - 1990

Dean's Committee to Revise Plan II Curriculum, 1986 - 1992

Zoology, Cell Biology Search Committee (Chair), 1991 - 1992

Zoology, Departmental Visiting Committee, 1988 - 1993

Dean of Natural Science, Industrial Associates Committee, 1988 - 1994

Zoology Electron Microscope Committee, 1985 - 1998

Zoology, Industrial Liaison, 1988 - 1996

Zoology, Fellowship Committee, 1990 – 1998

Biology Fellowship Committee (1999-present)

Natural Sciences Courses and Curricula committee (2003-2005)

CNS Scholarship Committee (2002-present)

University of Texas Libraries Committee (8/2014-present)

Student Conduct Hearing Officer (9/2016-present)

J. *COURSES TAUGHT*

 **1. Undergraduate Courses**

 Mammalian Physiology (Zoology 465M)

 Vertebrate Physiology (Zoology 365L, Biology 365R, NEU 365R)

 Vertebrate Physiology Laboratory (Zoology 165P)

 Human Physiology (Zoology 316K)

 Structure and Function of the Mammalian Central Nervous System (Zoology 371L)

 Physiology of Organismic Adaptations (Zoology 363L, 363M)

 Adaptive Physiology Laboratory (Zoology 263P)

 Current Limits of Scientific Knowledge (TC 659: Plan II Honors Section)

 The Neuronal Basis of Brain and Behavior (Zoology 371L, Biology 371M)

 Comparative Physiology (Biology 361T)

 Nerve Regeneration in Invertebrates and Vertebrates. Writing component course (NEU 337)

 **2. Graduate Courses**

 Advanced Cell Biology (Zoology 388M)

 Principals of Neuroscience (Zoology 688QA, B;NEU 382T; NEU 383T, BIO 437; NEU 482T)

 Developmental Neurobiology (Zoology 390K; Biology 390K)

 Adaptive Physiology of Marine Organisms (MNS 382.12 at The University of Texas Marine Station at Port Aransas)

 Cellular Neurobiology (Anatomy 449 at Case Western Reserve University)

 Basic Properties of Nerve Cells: Axonal Conduction and Synaptic Transmission (Zoology 385L.13a; Biology 381K))

 Basic Properties of Nerve Cells: Trophic Interactions and Regeneration (Zoology 385L.13b; Biology 381K)

 Current Concepts in Cellular/Molecular Neuroscience (Zoology 385L.15; Biology 381K))

 Neurophysiology of Nerve and Muscle, (UTSA Department of Physiology)

 Environmental Physiology (Marine Science 354 at The University of Texas Marine Science Institute, Port Aransas, TX)

 Basic Properties of Nerve Cells: Metabolic, Glial-Neuronal, and Regeneration. (BIO. 381K.10/NEU 385L.1).

 Nerve Regeneration in Invertebrates and Vertebrates (NEU 381N.1)

K. *INDIVIDUAL INSTRUCTION*

*Supervision of Undergraduate Students*

I perform a significant amount of individual research instruction with undergraduates who often register for BIO research courses, Biology Honors, or Plan II thesis courses. Whether they officially register or not, each student makes a commitment to work 10-20 hours per week for at least 18 months and to take a series of courses in cell, molecular, and/or neurobiology to give them an appropriate conceptual and factual basis for their research. By the time they graduate, most such students are a co-author in at least one peer-reviewed publication and participate in weekly lab journal club/data presentation meeting. Those undergraduate students in my lab doing such meeting such criteria in the past five years were as follows:

Student In Lab

 Cameron Ghergherehchi 2011-2015

 Christopher Driscoll 2012-2014

 Robert Hastings 2012-2014

 \*Chris McGill ` 2012-2018

 Colton Riley 2012-2014

 Ti Ha 2013-2015

 Nicholas Munoz 2013-2015

 \*Andrew Poon 2014-2018

 Monika Pyarali 2013-2016

 Michael Bounajem 2014-2016

 Alex Mazal 2014-2016

 Aakarshita Bansal 2015-2016

 Patrick Dunne 2015-2017

 Maui Guitterrez 2014-2017

 Nicole Wong 2015-2017

 \*Amir Ali 2015-2018

 Zach Burgess 2016-2017

 Adrian Gorszawski 2016-2017

 \*Sarah Nguyen 2016-present

 Matthew Hooper 2016-2018

 Karthik Jagannath 2016-2018

 \*Edward Kang 2017-present

 \*Milki Negeri 2018-present

 \*Meghana Gogineni 2018-present

 \*Kenneth Pham 2018-present

 \*Ted Zhao 2018-present

 \*Bryan Nyakiti 2018-present

 \*Shruti Kumar 2018-present

\*currently active. Chris McGill and Andrew Poon were full time research scientists 2016-2018

Many undergraduates in my laboratory (Aesher, Baskind, Cummings, Farnam, Garcia, Hsu, Lichstein, Loftin, Lusco, Nguyen, Storm, Thomas, Truchard, and Weiner) have been awarded NIH or Howard Hughes Fellowships for the summer, four (Bobb, Eddleman, Sterkenburg, and Todora) have been awarded fellowships at Woods Hole, and five (Bobb, Brown, Loftin, Sunio, and Wade) have been awarded ATP Minority Fellowships. Almost all students who had worked in my laboratory have been admitted to excellent medical or graduate schools (Cummings - Cell and Molecular Biology, UCSF; Cobb - Biology, UC Berkeley; Storm - Cell and Molecular Biology, Stanford; Truchard - Biology, UC Berkeley; Todora - Neurobiology, Harvard; Weiner - Cell and Molecular Biology, UCSF; Hristov – Johns Hopkins Medical School; Marzullo – Neuroscience, Univ. of Michigan: Truong –University of Texas Medical School at Houston; Rossano, Driscoll: UT Medical School San Antonio; Covington/Figard – Rice University; Boydston, Ha-Southwestern Medical School, Hastings: Neuroscience, Texas A&M, Riley: Georgetown Medical School. Mazal-Southwestern Medical School: Pyarali-Baylor Medical School; Many have won Research Grants or other honors at UT (Cummins, Hsu, Truchard, Todora, Weiner, Rossano, Robinson, Jang, Covington, Boydston, Ha, Pyarali, Mazal)

Publications since 1996 of former undergraduates (asterisked\*):

T.D. Raabe, T. Nguyen,\* and G.D. Bittner. 1996. Calcium activated proteolysis of neurofilament proteins in goldfish Mauthner axons. J. Neurobiol. 6:253-261.

T.D. Raabe, T. Nguyen,\* C. Archer,\* G.D. Bittner. 1996. Mechanisms for the maintenance and eventual degradation of neurofilament proteins in the distal segments of sered goldfish Mauthner axons. J. Neurosci. 16:1605-1613.

O. Weiner,\* A.M. Zorn, P.A. Krieg, and G.D. Bittner. 1996. Medium weight neurofilament mRNA in goldfish Mauthner axoplasm. Neurosci. Lett. 213:83-86.

Sunio\* and G.D. Bittner. 1997. Cyclosporin retards the Wallerian degeneration of peripheral mammalian axons. Exp. Neurol. 146:46-56.

C.S. Eddleman,\* M.L. Ballinger, M.E. Smyers, C.M. Godell,\*H.M. Fishman, and G.D. Bittner. 1997. Repair of plasmalemmal lesions by vesicles. PNAS 94:4745-4750.

C.M. Godell,\* M.L. Ballinger, C.S. Eddleman,\* M.E. Smyers, H.M. Fishman, and G.D. Bittner. 1997. Calpain promotes the sealing of severed giant axons. PNAS 94:4751-4756.

M.L. Ballinger, A.R. Blanchette, T.L. Krause,\* M.E. Smyers, H.M. Fishman, and G.D. Bittner. 1997. Delaminating myelin membranes help seal the cut ends of severed earthworm giant axons. J. Neurobiol. 33:945-960.

C.S. Eddleman,\* M.L. Ballinger, M.E. Smyers, H.M. Fishman, and G.D. Bittner. 1998. Endocytotic Formations of vesicles and other membranous structures induced by Ca2+ and axoplasmic injury. J. Neurosci. 18:4029-4041.

C.S. Eddleman,\* M.E. Smyers, A. Lore,\* H.M. Fishman, and G.D. Bittner. 1998. Anomalies associated with dye exclusion as a measure of axolemmal repair. Neurosci. Lett. 256:13-126.

A.B. Lore,\* J.A. Hubbell, D.S. Bobb Jr., M.L. Ballinger, K.L. Loftin,\* J.W. Smith,\* M.E. Smyers, H.D. Garcia,\* and G.D. Bittner. 1999. Rapid induction of functional and morphological continuity between severed ends of mammalian or earthworm myelinated axons. J. Neurosci. 19:2442-2454.

J.W. Lichstein,\* M.L. Ballinger, A.R. Blanchette, H.M. Fishman, and G.D. Bittner. 1999. Structural changes at the cut ends of earthworm giant axons in the interval between dye barrier formation and Neuritic outgrowth. J. Comp. Neurol. 416:143-157.

C.S. Eddleman,\* G.D. Bittner and H.M. Fishman. 2000. Barrier permeability at cut axonal ends progressively decreased until an axonal seal is formed. Biophys. J., 79:1883-1890.

E. Detrait, C.S. Eddleman, S. Yoo, M. Fukuda, G.D. Bittner and H.M. Fishman. 2000. Axolemmal repair requires proteins that mediate synaptic vesicle fusion. 2000 J. Neurobiol. 44:382-391.

E. Detrait, S. Yoo, T. Nguyen,\* C.S. Eddleman, M. Fukuda, G.D. Bittner, and H.M. Fishman. 2000. Repair of severed neurites of PC 12 cells requires divalent cations and a concerved region of synaptotagmin. J. Neuroscience Research. 62:566-573

T. C. Marzullo\*, J.S. Britt\*, R. Stavisky and G.D. Bittner. 2002. Cooling enhances in vitro survival and fusion-repair of severed axons taken from the peripheral and central nervous system of rats. Neuroscience Letters. 327:9–12.

C.S. Eddleman\*, G.D. Bittner, and H.M. Fishman. 2003. SEM comparison of severed ends of giant axons isolated from squid (*Loligo pealei*) and crayfish (*Procambarus clarkii*). Biol Bull. 203: 219 – 220.

S. Yoo, M. P. Nguyen\*, M. Fukuda, G. D. Bittner, and H. M. Fishman. 2003. Plasmalemmal sealing of transected mammalian neurites is a gradual process mediated by Ca-regulated proteins. J. Neurosci. Res. 74:541-551.

R. C. Stavisky, J. M. Britt,\* T. Pham\*, T. C. Marzullo\* and G. D. Bittner. 2003. Wallerian Degeneration of mammalian PNS and CNS axons is accelerated by incubation with protein synthesis inhibitors. Neuroscience Res. 47: 445 – 449.

R.C. Stavisky, J.M. Britt\*, A. Zuzek\*, E. Truong\* and G.D. Bittner. 2005. Melatonin enhances the in vitro and in vivo repair of severed rat sciatic axons. Neurosci. Letters, 98-101.

M. G. Nguyen\*,G.D. Bittner, and H.M. Fishman, H.M. 2007. Critical interval of sodium calcium transient after neurite transaction determines B104 cell survival. J. Neurosci. Res., 805-816.

J. M. Britt\*, J.R. Kane, C.S. Spaeth, A. Zuzek\*, G.L.Robinson\*, M.Y. Gbanaglo, C.J. Estler\*, E.A. Boydston\*, T. Schallert, T and G.D. Bittner. (2010). Polyethylene glycol rapidly restores axonal integrity and improves the rate of motor behavior recovery after sciatic nerve crush injury. J Neurophysiol., 104: 695-703

C. S. Spaeth, E.A. Boydston\*, L.A. Figard\*, A. Zuzek\* and G.D. Bittner (2010). A model for sealing plasmalemmal damage in neurons and other eukaryotic cells. J. Neurosci. 30: 15790-15800.

Spaeth CS, Fan, GD\*, Spaeth EB, Robison T\*, Wilcott RW\*, Bittner GD (2012) Neurite transection produces cytosolic oxidation which enhances plasmalemmal repair. *J Neurosci Res*.90:945-954

Spaeth CS, Robison TR, Fan, JD, Bittner GD (2012) Cellular mechanisms of plasmalemmal sealing and axonal repair by polyethylene glycol and methylene blue. *J. Neurosci. Res.* 90:955-966.

Bittner, GD C.P. Keating, J. R. Kane, J.M. Britt\*, C. S. Spaeth, J. D. Fan\*, A. Zuzek,\* R. W. Wilcott\*, W. P. Thayer, J.M. Winograd, F. Gonzalez-Lima and T. Schallert. (2012)Rapid, effective and long-lasting behavioral recovery produced by microsutures, methylene blue

 and polyethylene glycol after complete cut of rat sciatic nerves*. J Neurosci Res*. 90:967-980.

Spaeth CS, Boydston EA\*, Wilcott RW\*, Fan JD\*, Robison T\*, Bittner,GD (2012) Pathways for plasmalemmal repair mediated by PKA, Epac and cytosolic oxidation in rat B104 cells *in vitro* and rat sciatic axons *ex vivo*. *Devel Neurol.*, 72: 1399-1414.

 Zuzek A\*, Fan JD\*, Spaeth CS, Bittner GD. 2013. Sealing of transected neurites of rat B104 cells requires a diacylglycerol PKC-dependent pathway and a PKA-dependent pathway. Cell Molec Neurosci. 33: 31-46.

Rodriguez-Feo CL, K.W. Sexton,R. B. Boyer, A. C. Pollins,N. L. Cardwell, L. B. Nanney,R. B. Shack, M. A. Mikesh,C. H. McGill\*, C. W. Driscoll\*, G. D. Bittner, W. P. Thayer. 2013. Blocking the P2X7 Receptor Improves Outcomes After Axonal Fusion. J. Surgical Research. . 184(1):705-13. doi: 10.1016/j.jss.2013.04.082.

D.C. Riley\*, G.D. Bittner, M.A. Mikesh, N.L. Cardwell, A.C. Pollins, C.L. Ghergherehchi\*, S.R. Bhupanapadu Sunkesula, T.N. Ha,\* B.T.D. Hall\*, A.D. Poon\*, M. Pyarali\*, R.B. Boyer, A.T. Mazal\*, N. Munoz\*, R.C. Trevino, T.Schallert, W.P. Thayer. (2014) PEG-fused allografts produce rapid behavioral recovery after ablating sciatic nerve segments. J. Neurosci. Res. Apr;93(4):572-83. doi: 10.1002/jnr.23514. PubMed PMID: 25425242; PubMed Central PMCID: PMCPMC4329031.

G.D. Bittner, D.R. Sengelaub, R.C. Trevino, J.D. Peduzzi, M. Mikesh, C.L. Ghergherehchi\*, T.Schallert, W.P. Thayer. 2015. The curious ability of PEG-fusion technologies to restore lost behaviors after nerve severance. J Neurosci Res. J Neurosci Res. 94: 207-230. online 3 Nov.2015. doi. 1002/jnr 23685

C. L. Ghergherehchi\*, G. D. Bittner, R. L. Hastings\*, M. Mikesh, D. C. Riley\*, R. C. Trevino, T. Schallert, W. P. Thayer, S. Raju Bhupanapadu Sunkesula,, T-A. N. Ha\*\, N. Muno\*, M. Pyarali\*, A. Bansal\*, A. D. Poon\*, A. T. Mazal\*, T. A. Smith, N. S. Wong\*, P. J. Dunne\*. 2015. Effects of extracellular calcium and surgical techniques on restoration of axonal continuity by PEG-fusion following complete cut- or crush-severance of rat sciatic nerves. J Neurosci Res. 94:231-235. Doi. 10.1002/jnr23704 . Epub Jan 5, 2016

G.D. Bittner, M. Mikesh, C. L. Ghergherehchi\*. 2016. PEG-fusion retards Wallerian degeneration and rapidly restores behaviors lost after nerve severance. Neural Regen. Res. 11:217-219. Doi 10.4103/1673-5374.177716

C.H. McGill\*, S. R. Bhupanapadu Sunkesula, A.D. Poon\*,M. Mikesh, G. D. Bittner. 2016. Sealing Frequency of B104 Cells Declines Exponentially with Decreasing Transection Distance from the Axon Hillock. Exp. Neurol. 279:149-158. doi:10.1016/j.expneurol.2016.02.001

G.D. Bittner, D.R. Sengelaub, R.C. Trevino, C.L. Ghergherehchi\*, M. Mikesh. 2016.Robinson and Madison have published no data on whether polyethylene glycol fusion repair prevents reinnervation accuracy in rat peripheral nerve. J Neurosci Res. In Press.

George D. Bittner, Christopher S. Spaeth, Andrew D. Poon\*, Zachary S. Burgess\*, Christopher H. McGill\*. 2016. Repair of traumatic plasmalemmal damage to neurons and other eukaryotic cells. Neu. Regen. Res. Exp. Neurol. 279:149-158. doi:10.1016/j.expneurol.2016.02.001

G.D. Bittner, M. Mikesh, C. L. Ghergherehchi. 2016. PEG-fusion retards Wallerian degeneration and rapidly restores behaviors lost after nerve severance. Neural Regen. Res. 11:217-219. Doi 10.4103/1673-5374.177716

GD Bittner, DL Sengelaub, CL Ghergherehchi\*. 2018. Conundrums and confusions regarding how PEG-fusion produces excellent behavioral recovery after peripheral nerve injuries. Neural Regeneration Research. 13: 53-57..

Andrew D. Poon\*, Sarah H. McGill\*, Solomon Raju Bhupanapadu Sunkesula, Zachary S. Burgess\*, Patrick J. Dunne\*, Edward E. Kang\* and George D Bittner. 2018.CaMKII and DMSO affect the sealing frequencies of transected hippocampal neurons. J. Neurosci. Res. 96:1208-1222.

Mikesh M, Ghergherehchi CL\*, Hastings RL\*, Ali A, Rahesh S\*, Jagannath K\*, Sengelaub DR, Trevino RC, Jackson DM, Bittner GD. 2018. Polyethylene glycol solutions rapidly restore and maintain axonal continuity, neuromuscular structures and behaviors lost after sciatic nerve transections in female rats. J. Neurosci. Res. 96: 1223-1242.

Mikesh M, Ghergherehchi CL\*, Rahesh \*, Jagannath K\*, Ali A\*, Sengelaub DR, Trevino RC, Jackson DM, Tucker HO, Bittner GD. 2018. Polyethylene glycol treated allografts not tissue matched nor immunosuppressed rapidly repair sciatic nerve gaps, maintain neuromuscular functions, and restore voluntary behaviors in female rats. J. Neurosci. Res. 96:1243- 1264.

Ghergherehchi CL\*, Mikesh M, Sengelaub DR, Jackson DM, Smith T, Shores JT, Bittner GD. (2018) Polyethylene glycol (PEG) and other bioactive solutions with neurorrhaphy for rapid and dramatic repair of peripheral nerve lesions by PEG-fusion. J Neurosci Methods. Submitted.

L. *GRADUATE STUDENT SUPERVISION*

1. *M.A. Degrees:*

*Completed*

R.T. Kopanda. 1973. Trophic interactions in the crayfish, *Procambarus clarkii*. Currently Deputy Director of ADAMHA.

L. Boone. 1973. Trophic dependencies in a crustacean muscle. Currently a practicing M.D.

M. Nitzberg. 1973. Ultrastructural changes in transplanted segments of crustacean peripheral nerves. Currently a science advisor to a computer firm.

Obichere Nwabuko. 1976. The roles of calcium in vertebrate muscle contraction. Current position unknown.

M.S. Bouton. 1980. Mechanisms of axonal regeneration in crayfish motor axons. Currently a practicing M.D..

Todd Miller. 1990. Role of synapsin in neurotransmitter release. Currently in law school.

Melva Avalos. 1990. The effect of pentobarbital on pre- and postsynaptic channels at crayfish neuromuscular junctions. Current Position Unknown.

Guillermo Espinoza. 1992. Morphological correlates of longterm potentiation at hippocampal synapses. (Co-directed with Dr. Abraham Amsel of Psychology).

Tonya Thompson. 1992. Neurochemistry of monoamine oxidase enzymes and neurotoxins. (Co-directed with Dr. Creed Abell, Department of Pharmacology). Currently a practicing MD..

Qi-Quan Huang. 1993. Molecular biology of muscle development. (Co-directed with Kuan Wang of Biochemistry). Currently a research associate in Canada.

Tia Sea. 1993. Effect of temperature on survival of severed distal stumps of mammalian axons. Currently a practicing nurse..

Cecilia Smith. 1994. Neurite outgrowth in organ culture. Address Unknown

Chris Godell. 1995. Calpain-induced sealing of severed nerve axons. Currently a practicing MD..

Arisa Sunio. 1995. The immunosuppressant cyclosporin A retads the degeneration of distal segments of mammalian axons. Currently a Research Associate, Southwestern Medical School, Dallas, TX.

Adam Blanchette. 1998. Changes in configuration and location of membranous structures that seal the cut ends of earthworm giant axons. Currently a Research Associate at UT Medical School, San Antonio, TX

*2. Ph.D. Degrees:*

*Completed*

Milton P. Charlton. 1975. Parameters of transmitter release in squid synapses. Currently a Professor of Physiology at Toronto University.

Lawrence W. Powers. 1975. Physiological and ecological correlates of burrowing behavior in fiddler crabs. Currently Professor and Chairman, Department of Medical Technology, University of South Alabama, Mobile, AL.

Mark E. Meyer. 1977. Histological and biochemical studies of trophic dependencies in crayfish giant axons. Currently a Professor of Biology at University of Washington (Seattle).

Stewart C. Birse. 1979. Mechanism and specificity of giant axon regeneration in the earthworm central nervous system. Currently a practicing M.D.

Claire E. Hulsebosch. 1979. Regeneration of axons and cell bodies in the central nervous system of annelids: a test of the neuron addition hypothesis. Currently a Professor of Anatomy at U.T. Medical School, Galveston, TX.

Douglas A. Baxter. 1981. Mechanism of pre‑synaptic inhibition of transmitter release in crayfish axons. Currently a Senior Staff Scientist at Sensory Sciences Center, Baylor Medical School.

Rebecca Sheller. 1989. Molecular mechanisms for long term survival of severed crayfish nerve axons. Currently a Professor, Southwestern University, Georgetown, TX.

Shobhana Sivaramakrishnan. 1989. Biophysical mechanisms of calcium and membrane depolarization in synaptic facilitation. Currently a Research Scientist, University of Connecticut.

Alvin Lyckman. 1990. Mechanisms of neuritic outgrowth, neuritic guidance, and specific functional reconnection of severed giant axons in earthworms. Current address unknown.

Stephen Massia. 1992. Surface modifications of synthetic materials for the promotion of cell adhesion. Co-directed with Dr. Jeffrey Hubbel of Chemical Engineering. Currently a Research Scientist in a private biotechnology firm.

Jeffery Moehlenbruck. 1993. Biochemical mechanisms for long term survival of severed goldfish axons. Currently a Professor, St. Edwards Univeristy, Austin, TX.

Todd Krause. 1993. Cellular mechanisms for rapid repair of severed giant axons. Currently a patent attorney, Boston, MA .

Sandy Tanner. 1994. Protein transport and turnover in crayfish medial gaint axons. Research Director, Nymox Corporation (retired)..

Sterling Wright. 1995. Biophysical/electrophysiological mechanisms of synaptic plasticities at crayfish neuromuscular junctions. Currently a Professor, Murray State University, Ky.

Tim Raabe. 1995. Mechanisms which determine protein turnover in intact and anucleate axons in vertebrates. Currently an Associate Professor, St. Mary’s University, San Antonio, TX.

Curtis Herbert. 1996. Effect of inhibitors of fibrinogen proteolysis on neuritic outgrowth from dorsal root ganglia. Co-directed with Dr. Jeffrey Hubble of Chemical Engineering. Currently an Associate Professor, University of Minnesota, Minneapolis, Minn.

Chris Eddleman. 1999 Biophysics and molecular biology of plasmalemmal sealing. Co-directed with Dr. Harvey Fishman, UTMB Galveston. Currently a practicing MD

 Soonmoon Yoon. 2003 Molecular mechanisms of axonal sealing. Co-directed with Dr. Harvey Fishman. Currently a postdoctoral fellow with Dr. Barbara Bregman, Georgetown University Medical School

 Michael Nguyen. 2006. Role of calcium in neurite sealing and cell degeneration. Co-directed with Dr. Harvey Fishman. Currently a practicing MD.

 Chris Spaeth. 2011. Molecular mechanisms of plasmalemmal sealing. Postdoctoral fellow with Dr. John Terman. Southwestern Medical School

 Aleksej Zuzek. 2012. Biochemical pathways of plasmalemmal sealing. Postdoctoral Fellow at Texas A&M Medical School (Temple, TX)

*Current*

Cameron Ghergherehchi. Fourth year CMB student. Lone Star Paralysis Foundation Fellowship

Tyler Smith. Fourth year CMB student. NIH Predoctoral Fellowship

3. *Postdoctoral Fellows.*

*Completed*

Dr. Thomas Hamilton, 1973 ‑ 1974. Currently a CIA biomedical scientist and Professor of Biology, University of Virginia, Falls Church.

Dr. Larry Sewell, 1973 ‑ 1974. Currently a patent attorney and biomedical consultant, University of Texas Medical School, Dallas.

Dr. Samuel Velez, 1975 ‑ 1976. Currently a Professor of Biology, Dartmouth.

Dr. Bonnie Templeton, 1975 ‑ 1976. Currently a Research Associate, Washington University, Department of Biology, St. Louis, MO.

Dr. Thomas Anderson, 1977 ‑ 1979. Currently the Director of the CNS Trauma Research Center, General Motors Corp.

Dr. David Falk, 1978. Current position unknown.

Dr. Robert Grossfeld, 1976 ‑ 1979. Currently a Professor of Zoology, North Carolina State University, Raleigh.

Dr. Douglas Baxter, 1981. Mechanism of pre-synaptic inhibition of transmitter release in crayfish axons. Currently a Senior Staff Scientist at Sensory Sciences Center, Baylor Medical School.

Dr. Terry A. Viancour, 1982 ‑ 1984. Currently an Associate Professor of Zoology, University of Maryland, Baltimore.

Dr. Richard A. Friedman, 1983 ‑ 1985. Currently an Associate Professor of Biophysics and Physiology, Vanderbilt University.

Dr. Kalpathi Seshan, 1982 ‑ 1986. Currently Research Associate, University of Texas, Austin.

Dr. Steven Halls, 1986 - 1987. Current position unknown.

Dr. Bruce Winegar, 1986 ‑ 1988. Currently Research Associate, Department of Pharmacology, University of California Medical School, San Francisco, CA.

Dr. Scott Poehlman, 1988 - 1989. Currently an MD. Neurology, University of Wisconsin, Madison.

Dr. Alvin Lyckman, 1991 - 1992. NIAAA postdoctoral fellowship. Currently a Research Associate. NIH.

Dr. Jay Blundon, 1987 ‑ 1993. NIH, NIAAA postdoctoral fellowships. Currently an Associate Professor, Department of Biology, Rhodes College, Memphis, TN.

Dr. Rebecca Sheller, 1990 - 1994. NIAAA postdoctoral fellowship. Currently an Associate Professor at Southwestern University, Georgetown, TX.

Dr. Todd Krause, 1993 - 1994. NIAAA fellowship. Co-directed with Dr. Harvey Fishman (UTMB, Galveston) Dept of Biophysics. Currently a patent attorney. Boston, MA..

Dr. Eric Detrait. 1998-2000. Molecular mechamims of plasmalemmal sealing. Co –directed with Dr. Fishman. Currently a Research Scientist at University of Rochester Medical School.

Dr. Ronda Stavisky. 2002-2005. Role of PEG in axonal repair. Currently a Lecturer, University of Texas at Austin.

Dr. Van Herd. 2010-2013. Currently on leave for family health emergency.

Dr.Solomon Raju Bhupanapadu Sunkesula. 5/2013 – 12/2015. Role of PEG in axonal repair; Biochemical pathways of membrane sealing. Current: Research Scientist, MD Anderson

1. *RESEARCH SUPPORT:* G. Bittner = sole P.I. unless otherwise noted; direct costs

Neuraptive Sponsored Research Agreement.

 5/1/2017- 1/1/2018. $56,299

Pilot study of glucocorticoids (GCs) in rat sciatic nerve PEG-fusion model $25,000

Pilot Study of Neuraptive Device Effectiveness in Rat and Rabbit Sciatic Nerve PEG-Fusion Model $31,299

Neuraptive Resesrch Gift for Equipment 5/5017 $15,000

Neuraptive Resesrch Gift for PEG-fusion Research 10/2017 $50,000

Neuraptive Resesrch Gift for PEG-fusion Research 5/2018 $20,000

NIH 1 R01 NS081063-01   A novel bioengineered technique to rapidly and permanently repair cut PNS nerves

 9/15/12—6/30/18 $1,860,200 Total direct + indirect costs originally awarded... Total award after across the board cut of 17.5% for all NIH R-01 non-modular grants in negotiation. $337,869 agreed-upon sum for first year.

 7/15/15 - 6/30/18. $153,000 supplement

Lone Star Paralysis Foundation Nerve Regeneration Research

6/11-12/12 $50,000

2/12- 12/13 $40,000-45,000 (eqpt and student training)

5/12-12/14 $60,000

5/14-12/15 $40,000 + eqpt

1/16-12/16 ~$60,000 + eqpt

1/16- 7/16 $20,000 Dr. Richard Trevino (PI) at WellSpan York Hospital and G Bittner (Basic science advisor) to U Pennsylvania Pharmaceutical lab for FDA IND of sterile PEG solution for York IRB

1/17-12/17 $60,000

 1/18- 8/30/18 30K (3/7 )+35K(5/22) +10K(8/6) +90K 8/30) = $165,000

Lone Star Paralysis Foundation. Enhanced regeneration of Severed Spinal and Sciatic Axons

10/1/09 - 12/31/10 $ 30,000

Lone Star Paralysis Research Grant *In vivo* PEG repair of severed sciatic axons

 1/1/07 – 9/31/1/08 $40,000

Lone Star Paralysis Research Grant *In vivo* PEG repair of severed sciatic axons

 1/1/06 – 8/30/06 $10,000

CertiChem Research Grant *In vivo* PEG repair of severed spinal axons

 1/1/06 – 12/31/06 $10,000

NIH Research Grant NS 31256. Cellular Mechanisms of Axonal Repair and Degeneration

 1/1/01 - 12/31/06 $1,640,683 PI = H.M. Fishman (UTMB Galveston),

 G. Bittner functions as Co-PI

ATP Research Grant 003658-0193. Rapid Repair of chronically severed spinal and sciatic axons in mammals

 1/1/00 - 12/31/01 $216,000 PI = George Bittner, Co-PI = Tim Schallert

NIAAA Training Grant AA 07471. Neurochemical and behavorial correlates of EtOH effects.

 9/30/87 - 6/30/02 $559,624 PI = Steve Leslie with 5 other faculty including myself

NIH Research Grant NS 31256. Cellular Mechanisms of Axonal Repair and Degeneration

 12/1/97 - 12/31/00 $1,413,281 PI = H.M. Fishman (UTMB Galveston),

 G. Bittner functions as Co-PI

ATP Research Grant 003658-446. Repair of severed mammalian axons by biopolymers and agents that induce axonal sealing.

 12/1/95 - 8/31/98 $192,600 PI = G. Bittner; Co-PI = Kathy Wiley (Huston-Tillotson College), Co-PI = Harvey Fishman (UTMB Galveston)

NIH Training Grant GM 08474. Biotechnology of molecular recognition.

 7/1/94 - 6/30/01 $601,188 PI = George Georgiou with 8 other faculty, including myself

NIH Research Grant HD 31484. Enhanced regeneration of nerve axons by biopolymers.

 4/1/94 - 3/31/97 $138,208

NIH Research Grant NS 28482. Presynaptic mechanisms of some neuronal plasticities.

 12/92 - 11/97 $674,191 PI = G. Bittner, Co-PI = M.S.Brodwick (UTMB Galveston)

ATP Research Grant 003658-296. Functional repair of severed mammalian axons using biopolymers.

 12/93 - 8/96 $171,895 PI = G. Bittner, Co-PI = Kathy Wiley (Huston-Tillotson College)

NIH Research Grant NS 31256. Cellular Mechanisms of Axonal Repair and Degeneration

 12/92 - 11/96 $1,581,642 PI = H.M. Fishman (UTMB Galveston),

 Co-PI = G. Bittner

ATP Research Grant 00145. Rapid *in vivo* repair of severed mammalian axons.

 12/1/91 - 8/30/94 $180,073

TATP Research Grant 003658-194. Rapid reconnection of severed mammalian myelinated axons.

 11/1/89 - 10/30/91 $160,750

NSF Research Grant ECS 8915178. Membrane fusion and chemotropic approaches to nerve regeneration.

 9/1/89 - 8/30/92 $579,465 PI = G. Bittner, Co-PI = J.A. Hubbell (Chemical Engineering)

NIAAA Research Grant AA07746. Effect of alcohol on mechanisms on synaptic plasticity.

4/1/88 - 3/31/91 $259,806

TATP Research Grant 14-2202. Rapid repair of severed nerve axons.

 6/1/88 - 8/31/89 $178,473

URI Research Grant #26-1694-4292, BRSG. Effect of alcohol and pentobarbitol on mechanisms of synaptic plasticity.

 12/4/87 - 8/31/88 $6,000

NIAAA Training Grant AA 07471. Neurochemical and behavioral correlates of EtOH effects.

 9/87 - 6/92 $450,128 PI = S.W. Leslie with 6 other faculty, including myself

TARP Research Grant 14‑9700. Rapid repair of severed nerve axons.

 1/1/86 ‑ 8/31/87 $275,000

NIH Training Grant NS 07281. Sensory motor processing and developmental neurobiology.

 7/1/85 ‑ 6/30/91 $235,852 PI = G. Bittner with 4 other faculty

NIH Research Grant NS 19764. Intercellular exchange of proteins by crayfish axons.

 7/11/83 ‑ 6/31/87 $251,852

NIH Research Grant AG 02881. Effect of ageing on regeneration of ablated neurons.

 4/1/81 ‑ 3/31/83 $56,991

NIH Research Grant NS 17275. Mechanisms of neuronal regeneration.

 4/1/81 ‑ 3/31/84 $101,122

NSF Research Grant BNS 80‑22248. Mechanisms of neuronal regeneration.

 1/1/81 ‑ 5/31/83 $70,000

NSF Research Grant BNS 77‑27678. Degeneration‑regeneration of neuronal connections.

 7/78 ‑ 12/80 $66,000

NIH Research Grant NS 14412. Trophic interactions of axons, glia, and other neurons.

 4/78 ‑ 6/81 $69,352

NIH Career Development Award NS 00070. Mechanisms of neuronal regeneration.

 9/75 ‑ 6/81 $140,000

NSF Research Grant GB‑36949. Mechanisms of neurosecretion.

 1/74 ‑ 6/76 $65,000

NIH Training Grant GM-00836. Physiology and Biophysics.

 6/69 - 8/74 $451,745 PI = A.R. Schrank with 8 other faculty, including myself

NIH Research Grant NS11861. Degeneration‑regeneration of neuronal connections.

 9/74 ‑ 8/77 $149,160

NSF Research Grant GB‑30199. Trophic interactions of invertebrate neurons.

 9/71 ‑ 8/73 $35,700

Biomedical Sciences Support Funds 26‑1693‑9950.

 3/71 ‑ 6/71 $2,500

NSF Graduate Support Funds 26‑1140‑0550.

 9/68 ‑ 9/69 $20,000

NIH Research Grant NS‑08609. Cellular correlates of behavior in crustacean limbs.

 6/69 - 5/73 $113,303

NIH Postdoctoral Fellowship.

 11/67 ‑ 6/69 $6,500/yr

NIH Predoctoral Fellowship 26‑1698‑0950.

 6/65 ‑ 11/66 $2,800/yr

N. *PUBLICATIONS AND CONTRIBUTIONS*

I regularly receive notices from Research Gate or similar entities that my peer-reviewed papers are the most highly cited or downloaded than anyone else in my current department for the previous week or month.

*Articles*

J. Chen, K.F. Killam, and G.D. Bittner. 1964. Comparison of chlorpromazine, trifluoperazine and pentobarbital on conditioned arousal to reticular stimulation in cats. Fed. Proc. 23:264‑268.

G.D. Bittner. 1967. Excitation‑contraction coupling in crustacean neuromuscular systems. Ph.D. Thesis. Stanford University.

R.R. Hoy, G.D. Bittner, and D. Kennedy. 1967. Regeneration in crustacean motoneurons: evidence for axonal fusion. Science 156:251‑252.

G.D. Bittner. 1968. The differentiation of crayfish muscle fibers during development. J. Exp. Zool. 167:439‑456.

G.D. Bittner. 1968. Differentiation of nerve terminals in the crayfish opener muscle and its functional significance. J. Gen. Physiol. 51:731‑758.

G.D. Bittner and D. Kennedy. 1970. Quantitative aspects of transmitter release. J. Cell. Biol. 47:585‑590.

G.D. Bittner and J. Harrison. 1970. A reconsideration of the Poisson Hypothesis for transmitter release at the crayfish neuromuscular junction. J. Physiol. 206:1‑23.

H.L. Atwood and G.D. Bittner. 1971. Matching of excitatory and inhibitory inputs to crustacean muscle fibers. J. Neurophysiol. 34:157‑170.

H.L. Atwood, C.K. Govind, and G.D. Bittner. 1973. Ultrastructure of nerve terminals and muscle fibers in denervated crayfish muscle. Zeit. Zellforsch. 146:155‑166.

G.D. Bittner and R. Kopanda. 1973. Factors influencing molting in the crayfish *Procambarus clarkii*. J. Exp. Zool. 186:7‑17.

G.D. Bittner. 1973. Trophic dependence of fiber diameter in a crustacean muscle. Exp. Neurol. 41:38‑53.

G.D. Bittner. 1973. Degeneration and regeneration in crustacean neuromuscular systems. Amer. Zool. 13:379‑408.

G.D. Bittner and A. Johnson. 1974. Degeneration and regeneration in crustacean peripheral nerves. J. Comp. Physiol. 89:1‑21.

L.P. Boone and G.D. Bittner. 1974. Morphological and physiological measures of trophic dependence in a crustacean muscle. J. Comp. Physiol. 89:123‑144.

G.D. Bittner, M. Ballinger, and J.L. Larimer. 1974. Crayfish CNS: minimal degenerative‑regenerative changes after lesioning. J. Exp. Zool. 189:13‑36.

M.P. Charlton and G.D. Bittner. 1974. Facilitation of transmitter release at the squid giant synapse. Biol. Bull. 147:471‑472.

D. Kennedy and G.D. Bittner. 1974. Ultrastructural correlates of motor nerve regeneration in the crayfish. Cell Tiss. Res. 148:97‑110.

G.D. Bittner and M. Nitzberg. 1975. Degeneration of sensory and motor axons in transplanted segments of a crustacean peripheral nerve. J. Neurocytol. 4:7‑21.

G.D. Bittner and D.W. Mann. 1976. Differential survival of isolated portions of crayfish axons. Cell and Tiss. Res. 169:301‑311.

S.C. Birse and G.D. Bittner. 1976. Regeneration of giant axons in earthworms. Brain Res. 113:575‑581.

G.D. Bittner and L. Sewell. 1976. Facilitation at crayfish neuromuscular junctions. J. Comp. Physiol. 109:287‑308.

G.D. Bittner. 1977. Trophic interactions of crustacean neurons. In: Identified Neurons and Behavior, Ed. by G. Hoyle in honor of Professor C.A.G. Wiersma. pp. 507‑532.

M.L. Ballinger and G.D. Bittner. 1978. Developmental abnormalities of identifiable neurons in the crayfish *Procambarus simulans*. J. Neurobiol. 9:301‑307.

G.D. Bittner and D.L. Traut. 1978. Growth of crustacean muscles: constancy of fiber number and sarcomere number. J. Comp. Physiol. 124:277‑285.

M.P. Charlton and G.D. Bittner. 1978. Effect of changes in presynaptic potentials on facilitation in squid synapses. J. Gen. Physiol. 72:487‑511.

M.P. Charlton and G.D. Bittner. 1978. Facilitation of transmitter release at squid synapses. J. Gen. Physiol. 72:471‑486.

M.R. Meyer and G.D. Bittner. 1978. Histological studies of trophic interactions in crayfish giant axons. Brain Res. 143:195‑211.

M.R. Meyer and G.D. Bittner. 1978. Biochemical studies of trophic interactions in crayfish giant axons. Brain Res. 143:212‑232.

M.L. Ballinger and G.D. Bittner. 1980. Ultrastructural studies of severed medial giant and other CNS axons in crayfish. Cell and Tiss. Res. 208:123‑133.

G.D. Bittner and M.L. Ballinger. 1980. Ultrastructural changes at gap junctions between lesioned crayfish axons. Cell and Tiss. Res. 207:143‑153.

D.A. Baxter and G.D. Bittner. 1980. The normal accumulation of facilitation during presynaptic inhibition. Brain Res. 189:535‑539.

T.E. Anderson and G.D. Bittner. 1980. Long‑term alteration of electrotonic synapses. Brain Res. 184:224‑228.

C.E. Hulsebosch and G.D. Bittner. 1980. Evolution of abilities to regenerate CNS neurons. Am. Naturalist 115:276‑284.

T.A. Viancour, G.D. Bittner and M.L. Ballinger, 1981. Selective transfer of Lucifer Yellow CH from axoplasm to adaxonal glia. Nature. 293:65‑67.

M.S. Bouton and G.D. Bittner. 1981. Regeneration of motor axons in crayfish limbs: distal stump activation followed by synaptic reformation. Cell and Tiss. Res. 219:379‑392.

G.D. Bittner and M.R. Brown. 1981. Long term survival of enucleated glial cytoplasm in the leech *Macrobdella decora*. Brain Res. 218:357‑364.

C.E. Hulsebosch and G.D. Bittner. 1981. Regeneration of nerve cell bodies in annelids: a test of the neuronal addition hypothesis. J. Comp. Neurol. 198:77‑88.

C.E. Hulsebosch and G.D. Bittner. 1981. Morphology and number of neurons in two species of polychaetes. J. Comp. Neurol. 198:65‑76.

S. Velez, G.D. Bittner, G.K. Govind and H.L. Atwood. 1981. Trophic reactions of crayfish muscle fibers and nerve synapses following denervation, tenotomy, and immobilization. Exp. Neurol. 71:307‑325.

S.C. Birse and G.D. Bittner. 1981. Regeneration of earthworm giant axons following transection or ablation. J. Neurophysiol. 45:724‑742.

G.D. Bittner and R.A. Schatz. 1981. An examination of the residual calcium hypothesis for transmitter release. Brain Res. 210:431‑436.

G.D. Bittner. 1981. Trophic interactions of crustacean giant axons. Comp. Biochem. Physiol. 68A:299‑306.

R.M. Grossfeld, G.D. Bittner, and M.A. Raymond. 1982. Inter‑ and intra‑axonal variations in morphology and metabolic activity of the crayfish medial giant axon. J. Neurobiol. 13:191‑197.

D.A. Baxter and G.D. Bittner. 1982. Intracellular recordings from crustacean motor axons during presynaptic inhibition. Brain Res. 223:422‑428.

G.D. Bittner. 1983. Muscles and their neural control. Science 222:611‑613.

D.A. Baxter, G.D. Bittner, and T.H. Brown. 1985. Quantal mechanisms of long‑term synaptic potentiation. PNAS 82:5978‑5982.

G.D. Bittner, and J.P. Segundo. 1986. Facilitation. In Encyclopedia of Neuroscience. Ed. G. Adelman. Birkhauser. p. 428-430.

G.D. Bittner, M.L. Ballinger, and M.A. Raymond. 1986. Reconnection of severed nerve axons with polyethylene glycol. Brain Res. 367:351‑365.

K.R. Seshan and G.D. Bittner. 1987. Developmental and other factors affecting regeneration of crayfish CNS axons. J. Comp. Neurol. 262:535-545.

T.A. Viancour, K.R. Seshan, G.D. Bittner, and R.A. Sheller. 1987. Organization of axoplasm in crayfish giant axons. J. Neurocytol. 16:557-566.

R.N. Friedman, G.D. Bittner, and J.A. Blundon. 1988. Electrophysiological and behavioral effects of ethanol on crayfish. J. Exp. Pharm. & Therap. 246:125-131.

G.D. Bittner. 1988. Long term survival of severed distal axonal stumps in vertebrates and invertebrates. Am. Zool. 28:1165-1179.

B.D. Winegar, G.D. Bittner, and S.W. Leslie. 1988. Effects of pentobarbital on behavioral and synaptic plasticities in crayfish. Brain Res. 475:21-27.

T.A Viancour, R.A. Sheller, G.D. Bittner, and K.R. Seshan. 1988. Protein transport between crayfish lateral giant axons. Brain Res. 439:211-221.

G.D. Bittner and J.P. Segundo. 1989. Effect of stimulus timing on transmitter release and postsynaptic membrane potential at crayfish neuromuscular junctions. J. Comp. Physiol. 165:371-382.

G.D. Bittner. 1989. Synaptic plasticity at the crayfish opener neuromuscular preparation. J. Neurobiol. 20:386-408.

J.A. Blundon, R.A. Sheller, J.W. Moehlenbruck, and G.D. Bittner. 1990. Effect of temperature on long term survival of anucleate giant axons in crayfish and goldfish. J. Comp. Neurol. 297:377-391.

T.L. Krause and G.D. Bittner. 1990. Rapid morphological fusion of severed myelinated axons by polyethylene glycol. PNAS. 87:1471-1475.

S. Sivaramakrishnan, G.D. Bittner, and M.S. Brodwick. 1991. Calcium-activated potassium conductance in presynaptic terminals at crayfish neuromuscular junction. J. Gen. Physiol. 98:1161-1180.

S. Sivaramakrishnan, M.S. Brodwick, and G.D. Bittner. 1991. Presynaptic facilitation at crayfish neuromuscular junctions: role of calcium-activated potassium conductance. J. Gen. Physiol. 98:1181-1196.

R.A. Sheller, M.L. Ballinger, and G.D. Bittner. 1991. Long term survival of severed crayfish giant axons is not associated with an incorporation of glial nuclei into axoplasm. Neurosci. Letters 133:113-116.

T.L. Krause, R.M. Marquis, A.W. Lyckman, M.L. Ballinger, and G.D. Bittner. 1991. Rapid artificial restoration of electrical continuity across a crush lesion of a giant axon. Brain Res. 561:350-353.

G.D. Bittner. 1991. Long term survival of anucleate axons and its implications for nerve regeneration. Trends in Neurosci. 14:188-193.

G.D. Bittner and D.A. Baxter. 1991. Mechanisms of synaptic plasticity at crayfish neuromuscular junctions: facilitation and augmentation. Synapse. 7:235-243.

D.A. Baxter and G.D. Bittner. 1991. Mechanisms of synaptic plasticity at crayfish neuromuscular junctions: pre-synaptic inhibition. Synapse 7:244-251.

A.W. Lyckman and G.D. Bittner. 1992. Axonal conduction and electrical coupling in regenerating earthworm giant axons. Exp Neurol. 117:299-306.

R.A. Sheller and G.D. Bittner. 1992. Maintenance and synthesis of proteins for an anucleate axon. Brain Res. 580:68-80.

A.W. Lyckman, S.M. Thomas and G.D. Bittner. 1992. Analysis of neuritic outgrowth from severed giant axons in *Lumbricus terrestris*. J. Comp. Neurol. 318:426-438.

J.A. Blundon and G.D. Bittner. 1992. Effects of ethanol and other drugs on excitatory and inhibitory neurotransmission in the crayfish. J. Neurophysiol. 67:576-587.

J.A. Blundon, S.N. Wright, M.S. Brodwick and G.D. Bittner. 1993. Residual free calcium is not responsible for facilitation of transmitter release. PNAS 90:9388-9392.

R.A. Sheller and G.D. Bittner. 1993. Whole intact tissue electrophoresis of nerve proteins. J. Neurosci. Methods 49:185-191.

J.W. Moehlenbruck, J.A. Cummings and G.D. Bittner. 1994. Long term survival followed by degradation of neurofilament proteins in severed Mauthner axons of goldfish. J. Neurobiol. 25:1637-1651.

T.L. Krause, H.M. Fishman, M.L. Ballinger, and G.D. Bittner. 1994. Extent and mechanism of sealing in transected giant axons of squid and earthworms. J. Neurosci. 14:6638-6651.

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M.A. Todora, H.M. Fishman T.L. Krause, and G.D. Bittner. 1994. Shortening of a severed squid giant axon is non-uniform and occurs in two phases. Neurosci. Lett. 179:57-59.

T.L. Krause, Y. Magarshak, H.M. Fishman, and G.D. Bittner. 1995. Membrane potential and input resistance are ambiguous measures of sealing of transected cable-like structures. Biophys. J. 68:795-799.

S.L. Tanner, E.E. Storm, and G.D. Bittner. 1995. Protein transport in intact and severed (anucleate) crayfish medial giant axons. J. Neurochem. 64:1491-1501.

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S.L. Tanner, E.E. Storm, and G.D. Bittner. 1995. Maintenance and degradation of proteins in intact and severed axons: Implications for the mechanism of long term survival of anucleate crayfish axons. J. Neurosci. 15:540-548.

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C.B. Herbert, G.D. Bittner, and J. A. Hubbell. 1996. Effects of fibrinolysis on neurite growth from dorsal root ganglia cultured in two- and three-dimensional fibrin gels. J. Comp. Neurol., 365:380-391. doi: 10.1002/(SICI)1096-9861(19960212)365:3<380::AID-CNE4>3.0.CO;2-0. PubMed PMID: 8822177.

T.D. Raabe, T. Nguyen, C. Archer, and G.D. Bittner. 1996. Mechanisms for the maintenance and eventual degradation of neurofilament proteins in the distal segments of severed goldfish Mauthner axons. J. Neurosci., 16: 1605-1613. PubMed PMID: 8774429.

S.N. Wright, M.S. Brodwick, and G.D. Bittner. 1996. Presynaptic calcium currents at voltage- clamped excitor and inhibitor terminals of crayfish. J. Physiol., 496:347-361. PubMed PMID: 8910221; PubMed Central PMCID: PMCPMC1160882.

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Ghergherehchi CL, Mikesh M, Sengelaub DR, Jackson DM, Smith T, Shores JT, Bittner GD. (2018) Polyethylene glycol (PEG) and other bioactive solutions with neurorrhaphy for rapid and dramatic repair of peripheral nerve lesions by PEG-fusion. J Neurosci Methods. Submitted.

1. *PATENTS filed by G.D. Bittner*

 *Issued*

Materials and food additives free of endocrine disruptive chemicals and method for detecting endocrine disruptive activity. Filed 5/10/02. US Patent #6,894,093 Issued May 17, 2005.

*Pending*

Plastic formulations free of estrogenic activity. Filed 5/10/05.

Method to Produce Polymer-based (Plastics, Silicones, Rubber, Etc.) Products, Foodstuffs, and Paper Products free of Estrogenic Activity (EA), anti-EA, Androgenic Activity (AA), anti-AA, or other Hormonal Activity and Method to Determine such Hormonal Activity in the Chemicals or Substances (Monomers, Additives, and/or Fibers) Used to Produce such Products. Filed 11/06

Materials free of endocrine disruptive activity. Provisional patent filed 9/6.06; Final patent filed 11/3/06. Application # 11/560,535

 Materials free of endocrine disruptive activity. Application # 12/046851 filed on 3/12/08

 Immediate Axon Fusion with Polyethylene Glycol. EFS ID 9537805, Application number 61446803, Confirmation # 2953, Filed 2/25/2011, Provisional Patent filed on behalf of UTAustin.

**Additional Service and Research**

In my off-campus research begun in 2000, I develop sensitive *in vitro* robotic assays to detect xenobiotic chemicals having mammalian hormonal activity (i.e. endocrine disruptors). I use such data to develop polymer formulations and bio-engineer protocols to produce plastic and silicone products that do not release chemicals having hormonal activity (especially estrogenic or androgenic activity). In the last decade, this basic and applied research has been funded by more than 15 NIH and NSF grants totaling over $8M (over $12M from all sources). **The University of Texas at Austin is also recognized on all papers published describing these data.** I believe that my scientific colleagues and I are now the leading researchers in this field, i.e., an intersection of cellular/molecular endocrinology and polymer chemistry that has obvious implications for human health and environmental contamination. This off-campus research has much potential to help solve a major health problem that until recently has gone largely unrecognized—the release of xenobiotic chemicals having hormonal activity by plastics and other substances. Our conclusions are strongly supported by scientists and administrators at NIH and NSF—and strongly opposed by the American Chemistry Council.

 This off-campus research is performed by CertiChem (aka CCi) and PlastiPur (aka PPi). The mission of CertiChem is to develop sensitive, accurate, high throughput assays to detect hormonal activity. CertiChem is primarily an R&D entity. The mission of PlastiPure is to develop polymer formulations, resins and manufacturing procedures/protocols for plastic and silicone-based products that do not release chemicals having hormonal activity. Our data show that almost all existing plastics and silicone products release chemicals having easily detectable estrogenic activity. PlastiPure completed the transition from an R&D entity in 2008 to a viable commercial entity in 2011.

 As consulting CEO for CertiChem and consulting Chief Scientific Officer for PlastPure, my main task is to direct scientific research and development of patentable chemicals, formulations and/or products, and direct and write SBIR grant proposals in collaboration with PIs employed by the firm. An NSF or NIH SBIR PI (or co-PI) must be employed at least 51% time by CertiChem or PlastiPure (My total time combined for both firms is less than 18%). In this capacity, I have been largely responsible for writing peer-reviewed research papers, deciding the Specific Aims and directing the writing of the following grants awarded since 2001:

 **For CertiChem:**

NIH/NIEHS R44 ES026470 01-01 (PI= CZ Yang) ~12/1/2015 - 5/30/2018

 Validation of an In Vitro Assay for Androgenic Activity

 Total award $1,213,515

NIH/NIEHS R43 ES025075-01 (PI = CZ Yang) 09//01/2014 – 2/28/2015

 Safer Personal Care Products

 Total Award $141,079

NSF 0912601-03 (PI = CZ Yang) 09/15/2010 – 8/31/2014

Food antioxidants With or Without Estrogenic Activity

Total award: $500,000

Supplement about $400,000 (final amount pending)

NSF 0912601-01 (PI = CZ Yang) 07/01/2009 – 12/31/2009

Food antioxidants With or Without Estrogenic Activity

Total award: $99,898

NIH/NIEHS 5R44ES014806-03 (PI = CZ Yang) 9/01/2008 – 8/31/2009

In Vitro Robotic Assay for Anti-Estrogenic Activity

Total award: $446,359

NIH/NIEHS 2R44ES014806-02 (PI = Yang) 9/11/2007 – 8/31/2008

In Vitro Robotic Assay for Anti-Estrogenic Activity

Total Award: $476,510

NIH/NIEHS 1 R43 ES011806-01 PI = C.Z. Yang) 06/01/2006 – 12/31/2006

In vitro Robotic Assay for Anti-Estrogenic Activity

Direct Cost: $72,788, total Cost = $121,756

NIH/NIEHS 1 R44 ES011469-02 PI = C..Z. Yang 04/01/2004 – 04/30/2007

In vitro Robotic Assay for Estrogenic Activity

Direct Cost: $901,209, Total Cost: $1,350,618

1 R43 ES011469-01 PI = C.Z. Yang (PI) 04/01/2001 – 10/01/2001

In vitro Robotic Assay for Estrogenic Activity

Direct Cost: $75,000

**For PlastiPure**

NIEHS 1 R43 ES018083-02 PI = D.Kline 08/20/2013 – 8/19/2015

A Hard and Clear, Estrogen-Free Replacement for Bisphenol-A Based Polycarbonates

Total Cost: $956,000

 NSF IIP-1127553 PI = D Kline 09/15/2011-08/31/2014

 Flexible Plastic Packaging Without Estrogenic Activity (EA)

 Total cost: $488,236

 Supplement$100,000

NIEHS 1R44ES019442-02,03 PI = S. Yaniger 01/01/2011 – 2/28//2013

Baby bottles that release no chemicals having estrogenic activity

Total Cost: $1,285,871

NIEHS 1R44ES019442-01 PI = S. Yaniger 09/01/2010 – 12/31/2010

Baby bottles that release no chemicals having estrogenic activity

Total Cost: $141,830

NSF IIP-1013865 PI = D. Klein 07/01/2010 - 12/31/2010

Flexible Plastic Packaging Without Estrogenic Activity (EA)

Total Cost: $150,000

NIEHS 1 R43 ES018083-01 PI = S.Yaniger 06/01/2010 – 11/30/2010

A Hard and Clear, Estrogen-Free Replacement for Bisphenol-A Based Polycarbonates

Total Cost: $222,248

NIEHS 2R44ES016964-02 PI= S. Yaniger / D. Klein 08/14/2009 – 07/31/2010

Estrogen free Polymer Formulations for Food Packaging and Baby Products

Total Cost: $1,207,230

NIEHS 1R43ES016964-01 PI = J Laiz 06/01/2008 – 11/30/2008

Estrogen Free Polymer Formulations for Food Packaging and Baby Products

Total Cost: $134,264

CCi has been selected by ICCVAM/NICEATM to perform a single-lab validation study using MDA-Kb2 cells to detect androgenic activity (AnA in robotic and manual formats. Items **C1 and C2** below lists some of our basic (**C1**) and applied (**C2**) peer-reviewed publications. My role in both firms is to guide their scientific direction and take the lead in writing grant proposals and peer-reviewed papers.

At CCi, we have developed, robotized, and validated with ICCVAM/NICEATM/OECD (or undergoing validation) a battery of *in vitro* assays using MCF-7 cells or BG1-Luc cells to detect EA\*\* and MDA-Kb2-cells to detect AnA\*\* that are the most accurate and sensitive currently available, in part due to our developing Confirmation Assays. Using these assays, we have demonstrated that the great majority of plastic, silicone and personal care products (PCPs) release a variety of chemicals having EA\*\*/AnA\*\*. Using these assays, we have created a knowledge base of commonly-used chemicals and materials that are EA\*\*/AnA\*\* or EA/AnA\*\*-free and can be used to make plastics and PCPs. Using this knowledge base and a knowledge of polymer and other chemistry, we have identified or developed formulations for products that leach ***no*** chemicals having detectable EA\*\*/AnA\*\* after extraction with hydrophilic or hydrophobic solvents or after common-use stresses of heating, boiling microwaving, UV radiation. This approach differs from that currently used by various commercial, academic, regulatory or government entities that address problematic ingredients having EA\*\*/AnA\*\* (e.g., BPA) one-at-a time without considering that many other ingredients also have significant hormonal activity -- and that more than one solvent is needed for appropriate extraction and that products need be exposed to common use stresses that can create new chemicals. Furthermore, replacing chemicals one-by-one is much more costly than reformulating to eliminate all ingredients having EA\*\*/AnA\*\*.

At CCi, my fellow scientists and I believe that when a large variety of EA\*\*/AnA\*\*-free\*\* products become available to the public, this will reduce the potential health problems associated with EDCs of which the most frequent types of hormonal activity in the “chemical commons” are from leached chemicals having EA\*\*/AnA\*\*. I believe that CCi is ***the*** leading laboratory in the intersection of hazard analysis, public awareness and genuine health-related product solutions to a problem now being recognized by government agencies and consumer groups.

**C1. Recent representative peer-reviewed papers on assays to detect EDCs with EA**

C.Z. Yang, W. Casey, M. Stoner, G.J .Kollessery, A.W. Wong and G.D. Bittner. 2014. A robotic MCF-7:WS8 cell proliferation assay to detect agonist and antagonist estrogenic activity. Toxological Sci. 137:335-349.

M.A.Stoner, C.Z.Yang, and G.D.Bittner. 2014. A Robotic BG1Luc Reporter Assay to Detect Estrogen Receptor Agonists. Toxicology in Vitro. 28: 916–925.

These two papers describe our robotic assays for EA that have very high concordance with ICCVAM/ECCVAM meta-analyses for test chemicals. Specifically, our robotic BG1Luc assay has high (100%) concordance for the presence or absence of detectable EA with ICCVAM meta-analyses for 27 test chemicals. When chemicals tested in common by both assays are compared, this robotic BG1Luc assay has 100% concordance with the ICCVAM manual BG1 assay for 27 test chemicals, 100% concordance with CERI for 20 test chemicals, and 100% concordance with a robotic MCF-7 assay for 27 test chemicals. In contrast, the yeast estrogen screening (YES) assay has only 47% (7/15) concordance with any of these other assays for 15 test chemicals. When sensitivities of these different assays are compared to detect the EA of the same test chemical as defined by its EC50, our robotic BG1Luc assay is more sensitive for 15/20 and one tie out of 21 chemicals reported by ICCVAM meta-analyses , i.e., is more sensitive (p < 0.001, Chi Squared test) for 15 chemicals whose EC50s can be directly compared.  Compared to ICCVAM BG1 manual data for 22 chemicals, our robotic BG1Luc assay is more sensitive for 14/22 (p < 0.0.001).  Compared to CERI manual assays, the robotic BG1 is more sensitive for 18/20 test chemicals (p <0.0001). Compared to the YES assay, the robotic BG1 assay is more sensitive (p < 0.0001) for 15/15 chemicals whose EC50s can be directly compared. In contrast, with respect to the robotic MCF-7 assay as reported for ICCVAM validation results, the BG1Luc is more sensitive for only 4/27 chemicals whose EC50 can be directly compared, i.e. the MCF-7 assay is more sensitive (and has as high a concordance) with a high significance (p < 0.0001) compared to our EC50 from our robotic BG1Luc, ICCVAM manual BG1Luc, CERI, and YES assays and ICCVAM EC50 meta-analyses.

 **C2.** **Recent representative peer-reviewed papers on release of EDCs having EA from various consumer products.**

C. Z. Yang, S. I. Yaniger, V. C. Jordan, D. Klein and G.D. Bittner. 2011. Most Plastic Products Release Estrogenic Chemicals: A Potential Health Problem That Can Be Solved. Environmental Health Perspectives. 119: 989-996.

S.L. Myers, C.Z.Yang, G.D. Bittner, K.L. Witt, R.R. Tice, D.D. Baird. 2014. Estrogenic and Anti-Estrogenic Activity of Off –The-Shelf Hair and Skin Products. Journal of Exposure Science and Environmental Epidemiology. 25:271-277.

G.D.Bittner, M. A. Stoner, C. Z. Yang. 2014. Estrogenic chemicals often leach from BPA-free plastic products that are replacements for BPA-containing polycarbonate products. Environmental Health 13:41-54.

G.D. Bittner, M.S. Denison, C. Z. Yang.  2014. Chemicals having estrogenic activity can be released from some BPA-free, hard and clear, thermoplastic resins. Environmental Health. 13:103-121.

These papers report that consumer products in two general categories--—plastics and personal care products (PCPs) – release chemicals thast have easily-detectable EA as measured by our two robotic assays for EA. The data for PCPs are described in the body of this proposal. The results of our two hazard studies of BPA-replacement resins (aka polycarbonate or PC resins) and PC-replacement products. Like PC resins, these PC-replacement resins are “hard, clear, and reusable”. Some (4/14) of these unstressed and stressed BPA-free resins leached chemicals having significant levels of EA, including one polystyrene, and three Tritan™ resins, the latter reportedly EA-free. Exposure to UV radiation in natural sunlight resulted in an increased release of EA from Tritan™ resins. Ten unstressed or stressed glycol-modified polyethylene terephthalate (PETG), cyclic olefin polymer (COP) or copolymer (COC) thermoplastic resins did not release chemicals with detectable EA under any test condition. Similarly, many unstressed and stressed, PC-replacement-products made from acrylic, polystyrene, polyethersulfone, and Tritan™ resins leached chemicals with EA, including products made for use by babies. Exposure to various forms of UV radiation often increased the leaching of chemicals with EA. In contrast, some BPA-free PC-replacement products made from glycol-modified polyethylene terephthalate or cyclic olefin polymer or co-polymer resins did not release chemicals with detectable EA under any conditions tested.

These two hazard assessment surveys showed that many BPA-free PC- replacement resins and products still leached chemicals having significant levels of EA, as did their BPA-containing PC counterparts they were meant to replace. That is, BPA-free did not mean EA-free. However, this study also showed that some PC-replacement resins and products did ***not l***each chemicals having significant levels of EA. That is, EA-free PC-replacement resins and products can be made in commercial quantities at prices that compete with PC-replacement products that are not BPA-free. Since plastic products often have advantages (price, weight, shatter-resistance, etc.) compared to other materials such as steel or glass, our data show that is not necessary to forgo those advantages of plastics in order to avoid release into foodstuffs or the environment of chemicals having EA that may have potential adverse effects on our health or the health of future generations.

8/31/2018



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