A.Gordon Smith

Project Title: *Axonal mitochondrial failure precedes chemotherapy induced neurotoxicity in breast cancer patients*

Requested Amount: $75,000

Contents

Vote Tabulations

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Reviewer Comments:

- It is an interesting proposal and should be easy to study and investigate. Dr. Smith is an internationally recognized expert in the field and has extensive experience with skin biopsies. However, I am not aware of his expertise in electronmicroscopy and the application does not detail any equipment details or expertise details about electron microscopy. Since these are crucial to the study design and conduct, i believe these are important omissions and should be addressed before a funding decision can be made. Otherwise the study is a good study.

- This is an interesting and novel proposal that addresses an extremely important, and somewhat neglected aspect of neurology/neuromuscular disease; namely, chemo-induced neuropathy. The project builds on prior work done by the investigator and colleagues, who has become a leader in this field. Although the actual project is a little esoteric and may be difficult for donors to comprehend in a deep way, this is offset by the fact that the drug is used in breast cancer and other common neuropathies. My only (mild) criticism is that comments on next steps are where this research might lead are a little nebulous on the one hand (i.e. better treatments with no specifics) and grandiose on the other (i.e. may help us understand fibromyalgia). Again, this is mild criticism as this is solid proposal worthy of funding by ABF donor mechanism.

ABF Letter of Intent

Letter of Intent Form

Prefix
Dr.
First Name
A. Gordon
Last Name
Smith
Suffix
MD
Title
Professor and Vice Chair of Neurology
Institution
University of Utah
Office Address
Department of Neurology 30 North 1900 East SOM3R242
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Project Details

Project Title
Axonal mitochondrial failure precedes chemotherapy induced neurotoxicity in breast cancer patients
General focus
ALS & Neuromuscular Technology & Innovation
Specific Disease Focus
Chemotherapy Induced Peripheral Neuropathy
Project Description
Chemotherapy-induced peripheral neuropathy (CIPN) is the most common dose-limiting side effect of first line chemotherapeutic agents including the microtubule inhibitor paclitaxel, a common agent in the treatment of

breast cancer. Paclitaxel infusion frequently causes acute widespread pain that is thought to be neuropathic in origin (paclitaxel acute pain syndrome, P-APS). Our preliminary data suggest patients with P-APS have a higher risk of subsequent CIPN. The mechanisms by which paclitaxel causes P-APS and CIPN are unknown, and there are no effective preventative or treatment strategies.

Data from animal models of CIPN suggest paclitaxel and other neurotoxic chemotherapy agents impair microtubular dynamics and mitochondrial calcium signaling leading to increased mitochondrial permeability, swelling, and toxicity. Mitochondrial injury is a well recognized contributor to axonal degeneration in other forms of neuropathy, including diabetes (which is itself a CIPN risk factor). We hypothesize that paclitaxel leads to acute mitochondrial stress in small unmyelinated nociceptive axons resulting in P-APS. Continued exposure leads to length dependent mitochondrial toxicity and, ultimately axonal degeneration manifested as clinical CIPN. Preliminary data indicate that 70% of paclitaxel patients develop P-APS and 42% CIPN. Among those with clinically defined CIPN, nerve conduction studies (NCS) are normal in 46%, and 86% of these have normal intraepidermal nerve fiber density (IENFD). These findings are consistent with functional axonal failure preceding axonal degeneration.

We propose to address our hypothesis by fulfilling the following two specific aims:

Specific Aim #1: Determine if mitochondrial injury leads to functional axonal failure prior to degeneration. 20 breast cancer patients with planned paclitaxel therapy will undergo a baseline evaluation including validated neuropathy scales, NCS and distal leg skin biopsy for IENFD determination. Immunohistochemistry with quantitative image analysis will be used to evaluate axonal mitochondrial numbers and distribution. Electron microscopy (EM) will be used to directly visualize and analyze the size and structure of mitochondria in axons and keratinocytes for comparison. These procedures will be repeated 2 weeks after the final paclitaxel dose. We anticipate that patients with functional axonal failure (CIPN with normal NCS and IENFD) will have greater axonal mitochondrial injury compared to keratinocytes, and that the severity will be intermediate between those without CIPN and those with evidence of axonal degeneration based on NCS and IENFD.

Specific Aim #2: Determine if PAP-S is associated with abnormalities of mitochondrial structure. The first 5 patients who develop PAP-S will undergo a distal leg skin biopsy, which will be processed and analyzed as outlined in SA#1. We anticipate that mitochondria from both axons and keratinocytes will have abnormal structure and distribution, suggesting generalized mitochondrial injury. If mitochondrial or other structural axonal abnormalities are observed, skin biopsies will be obtained from 5 patients without P-APS at the same time point for comparison.

How will your project contribute to the treatment, prevention or cure of a neurological disease(s)?

Multiple forms of peripheral and central nervous system neurodegeneration share mitochondrial injury as a common element. Among these, CIPN represents an ideal model in which to study axonal degeneration because it is foreseeable, predictable, can be followed from onset through recovery, and the target tissue is accessible for investigation. Peripheral nervous system axons (particularly unmyelinated nociceptive fibers) have excellent regenerative capacity, making peripheral neurodegeneration an appealing target for therapeutic approaches that can subsequently be applied to other neurodegenerative disorders. The results of the proposed studies promise to fundamentally impact our understanding of CIPN. Demonstration of mitochondrial changes in P-APS would provide the first evidence of disease mechanism for this enigmatic and clinically significant condition. Association with mitochondrial derangement would inform new mechanistic research and therapeutic approaches for CIPN prevention, potentially leading to significantly improved quality of life for cancer survivors. Development of preventative strategies for CIPN will permit more aggressive chemotherapy dosing leading to improved survival. Recognition of mitochondrial failure as an important mechanism in P-APS and CIPN would suggest a similar role in other common neurological disorders such as diabetic and idiopathic peripheral neuropathies and diffuse unexplained pain syndromes such as fibromyalgia.

Project Budget

Total expense budget

An estimated total is acceptable.

$150,000

Value of existing funding or in-kind support

What portion of the above total expense has funding already received or promised?

$75,000

Portion to be raised through crowdfunding

How much are you seeking from the crowdfunding platform?

$75,000

Attachments and Verifications

Please download, fill out, and upload the Financial Disclosures & Conflict of Interest form.

Financial Disclosures & Conflicts of Interest Form

Package1.pdf

CV of Principal Investigator

SmithCV02-01-2017.pdf

I understand that the American Brain Foundation will not post approved projects for crowdfunding until documentation of IRB approval or exemption is provided.

Yes

ABF Full Application

Applicant Information

Prefix

Dr.

First Name

A. Gordon

Last Name

Smith

Suffix

Title

Professor and Vice Chair of Neurology

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Project Details

Project Title

Axonal mitochondrial failure precedes chemotherapy induced neurotoxicity in breast cancer patients

Project Start Date

July 01, 2017

Project End Date

June 30, 2018

Disease focus

ALS & Neuromuscular
Technology & Innovation

Specific Disease Focus

Chemotherapy Induced Peripheral Neuropathy

Project Summary/Abstract

Chemotherapy induced peripheral neuropathy (CIPN) is the most common dose-limiting side effect of paclitaxel, a first line breast adenocarcinoma treatment. CIPN causes disability due to pain, numbness, and gait instability. Up to 45% of patients develop acute widespread neuropathic pain (paclitaxel acute pain syndrome, P-APS). P-APS patients are at risk for greater CIPN severity. The etiologies of P-APS and CIPN are poorly understood; there are no effective treatments. Half of patients with early CIPN have normal nerve conduction studies

(NCS) and intraepidermal nerve fiber density (IENFD) consistent with pre-degenerative functional failure. CIPN animal models show impaired axonal microtubular dynamics, mitochondrial permeability with swelling and vacuolization. We hypothesize P-APS is due to axonal mitochondrial stress that progresses to distal axonal failure and axon loss. 20 Breast adenocarcinoma patients who will receive paclitaxel will undergo CIPN specific disease severity scales, NCS and skin biopsy for IENFD prior to treatment. Immunohistochemistry with quantitative image analysis will evaluate mitochondrial size, number and distribution in epidermal axons and keratinocytes. This evaluation will be repeated 2 weeks following the final paclitaxel dose. The first 5 patients who develop P-APS have a skin biopsy. If mitochondrial changes are noted 5 age-matched patients without P-APS will evaluated at the same time point for comparison. We anticipate P-APS will be associated with structural mitochondrial changes including increased distal mitochondrial volume with vacuolization, swelling, and clusters of small mitochondria, and that these changes will increase in severity with progression to functional axonal failure and ultimately degeneration among CIPN patients.

Project Narrative

Nerve damage is the most common dose limiting side effect of paclitaxel, one of the most important chemotherapy drugs used to treat breast cancer. Nerve damage (chemotherapy induced peripheral neuropathy -- CIPN) causes numbness and pain in the feet and legs and can lead to trouble walking and falls. Some patients treated with paclitaxel develop pain all over their body after infusions. This is called paclitaxel acute pain syndrome (P-APS). P-APS is associated with more severe CIPN. We do not know what causes P-APS or CIPN and there are no treatments. Animals treated with paclitaxel develop abnormalities in the mitochondria in the nerves. Mitochondria are responsible for producing energy for the cell. We hypothesize that P-APS is due to damaged mitochondria in the nerves and that with more paclitaxel the damage worsens resulting in abnormal nerve function and ultimately nerve damage. We will test this theory by evaluating nerve function in 20 people with breast cancer who will be treated with paclitaxel. We will perform a small skin biopsy above the ankle about the size of the letter "O". Using a powerful microscope we will look at the nerve mitochondria. We will repeat this evaluation after the end of chemotherapy. We will also do this test in 5 people who develop P-APS and 5 more who do not have P-APS. We expect to see increasing severity of mitochondrial damage from P-APS to CIPN. This observation could lead to new treatments to prevent or treat CIPN.

Facilities and Equipment

The Cutaneous Nerve Laboratory serves as a core resource for NIH and foundation-funded research projects as well as industry sponsored studies in humans and animal models. The laboratory has experience using multiple immunohistochemistry markers of peptidergic and non-peptidergic innervation, nerve regeneration, growth factor receptor expression and inflammation. Through the University of Utah's Cell

Imaging Core Facility, the lab has access to four inverted confocal microscopes, including a Nikon A1 and A1R, and two Olympus FV1000 spectral confocal microscopes. The core utilizes software analysis tools for quantitative analysis of image data, including Metamorph, Imaris and Volocity software for 2D and 3D analysis. In the Cutaneous Nerve Laboratory, a Nikon Eclipse 80i microscope with a digital camera and image analysis system is used for nerve quantitation and morphometric analysis (Spot Diagnostics Imaging software 5.2). An Olympus BH2 microscope is also located in the lab. Other laboratory equipment include two Microm freezing-sliding microtomes, two Olympus SZ61 dissecting microscopes, a mixing plate, and a pH meter as well as other essential equipment. Four freezers with backup systems and alarms are located in the lab. Peter Hauer, the laboratory manager, is responsible for coordinating scheduled quality control procedures in collaboration with labs at Johns Hopkins University, University of Rochester and Icahn Mount Sinai medical center. As a clinical diagnostic/research laboratory, the lab is CAP and CLIA certified, and FDA-compliant.

The University of Utah Neurophysiology Core Laboratory provides electophysiologic testing for NIH, foundation, investigator and industry funded studies. Equipment Oxford Synergy and Viking-Natus electrodiagnostic equipment.

Specific Aims

Chemotherapy-induced peripheral neuropathy (CIPN) is the dose-limiting side effect of paclitaxel, a commonly used agent for breast adenocarcinoma. Paclitaxel causes acute widespread neuropathic pain in 45% of patients (paclitaxel acute pain syndrome, P-APS); over 40% develop CIPN. Animal models suggest paclitaxel is mitotoxic(1). We hypothesize paclitaxel causes acute mitochondrial stress in small unmyelinated axons resulting in P-APS; continued exposure causes length-dependent mitochondrial toxicity and axonal degeneration.

SA#1: Determine if mitochondrial injury is associated with predegenerative functional axonal failure. CIPN scales, nerve conduction studies (NCS) and calf skin biopsy for intraepidermal nerve fiber density (IENFD) determination will be performed on 20 patients prior to paclitaxel. Immunohistochemistry with quantitative image analysis will evaluate axonal mitochondrial number and distribution(2). Electron microscopy will measure mitochondrial size and structure. These procedures will be repeated 2 weeks after the final dose. We anticipate patients with functional axonal failure (CIPN with normal NCS and IENFD) will have greater axonal mitochondrial injury (e.g. swelling, vacuolization, reduced size and increased numbers) compared to keratinocytes, and that the severity will be greater in those with evidence of axonal degeneration.

SA#2: Determine if PAP-S is associated with mitochondrial structural changes. The first 5 patients who develop PAP-S will undergo a repeat biopsy and clinical scales at that time. We anticipate that axonal, but not keratinocyte, mitochondria will have abnormal structure, size and distribution, but that IENFD and NCS will remain normal. If

mitochondrial axonal abnormalities are observed, 5 age-matched patients without P-APS will be evaluated at the same time.

Research Strategy

Significance, Innovation, Approach, Timeline

Significance

CIPN is the most common dose limiting side effect of many of the most commonly used chemotherapies. CIPN causes numbness, weakness, pain and gait instability, leading to reduced quality of life and increased fall risk(3,4). Over 1/3rd of CIPN patients have a significant reduction in chemotherapy dose or cessation of therapy, likely leading to suboptimal outcomes and potentially reduced survival(5). There are no effective prevention or treatment strategies. The microtubular inhibitor Paclitaxel, a first-line therapy for breast adenocarcinoma, causes CIPN in over 40% of patients. Infusion causes widespread neuropathic pain (PAP-S) in 45%. Our preliminary data suggest PAP-S is associated with greater CIPN severity. The pathophysiology of P-APS is unknown.

Animal models suggest paclitaxel impairs microtubular dynamics and mitochondrial calcium signaling, increasing permeability and causing swelling, and vacuolization(1). Mitochondrial injury is a well-recognized contributor to axonal degeneration in other neuropathies, including diabetes (a CIPN risk factor)(6). We hypothesize paclitaxel leads to acute mitochondrial stress in small unmyelinated nociceptive axons resulting in P-APS. Continued exposure causes length-dependent mitochondrial toxicity and axonal degeneration. Preliminary data suggest 45% develop P-APS and 42% CIPN. Among those with CIPN signs and symptoms, NCS are normal in 46%, of whom 86% have normal IENFD, consistent with functional, potentially reversible, axonal failure.

The results promise to fundamentally enhance understanding of CIPN, link the mechanism of PAP-S to CIPN, and suggest novel therapeutic approaches. Demonstration of mitochondrial changes in P-APS would provide the first evidence of a disease mechanism for this enigmatic condition. Association with mitochondrial derangement would inform new mechanistic research and therapeutic approaches for CIPN prevention, potentially leading to significantly improved quality of life for cancer survivors. Development of preventative strategies for CIPN will permit more aggressive chemotherapy dosing leading to improved survival.

Innovation

Skin biopsies are routinely used to assess IENFD for neuropathy diagnosis and as an outcome measure in clinical trials(7). Use of human skin biopsies for discovery research has been limited. We have previously utilized the proposed techniques to study painful versus non-painful diabetic neuropathy(2). Application of similar techniques in this population is innovative and promises to further establish skin biopsy as a promising method explore disease mechanism in human subjects across neuropathy subtypes.

Approach

We are currently completing a natural history study of CIPN that is enrolling patients receiving potentially neurotoxic chemotherapy. We propose to enroll 20 additional breast cancer patients with planned paclitaxel therapy in this protocol. Those with a history of existing neuropathy or prior exposure to neurotoxic chemotherapy will be excluded.

SA#1: Prior to receiving paclitaxel the following procedures will be performed: EORTC-CIPN20 (a PRO)(8), Rasch Transformed Total Neuropathy Scale(9), CIPN-RODS (CIPN disability scale)(10), NCS and distal leg skin biopsy. IENFD will be determined using standard techniques and immunohistochemistry with quantitative image analysis will be used to evaluate axonal mitochondrial numbers and distribution as we have previously described(2). EM will be used to measure mitochondrial number, size and structure in epidermal axons and keratinocytes. The evaluation will be repeated 2-weeks after paclitaxel completion. Total dose will be recorded and modifications cataloged.

Expected results and potential problems: We anticipate axonal mitochondrial volume will increase from baseline, and there will be similar morphological changes to those observed in diabetic neuropathy(2). EM is expected to show vacuolization and swelling with clusters of small mitochondria, consistent with animal models(1). We expect mitochondria from keratinocytes to be relatively normal. These findings will be milder in those with functional axonal failure compared to those with evidence of axonal degeneration based on NCS and IENFD. We do not anticipate difficulty with recruitment based on our ongoing CIPN natural history study. Our collaborative team has experience with the proposed immunohistochemical studies. While we have not used EM in this fashion our laboratory manager has extensive EM experience and we do not foresee difficulties (we have reviewed the proposed studies and protocol with our microscopy core in preparation for this submission).

SA#2: The first 5 patients recruited for SA#1 who develop PAP-S will be asked to undergo the procedures outlined in SA#1 at that time. If mitochondrial or other structural axonal abnormalities are observed, 5 age-matched patients without P-APS will be recruited for comparison at a similar time point.

Expected results and potential problems: We anticipate that axonal, but not keratinocyte, mitochondria will have abnormal structure and distribution, suggesting generalized mitotoxicity. We expect those with the greatest degree of mitochondrial changes will be at greatest CIPN risk (recognizing this study is underpowered for this analysis). One potential problem is that patients may be reluctant to undergo additional evaluation. Given our recruitment success in other CIPN studies and the small number of patients we do not expect recruitment to be a challenge.

Timeline

Recruitment will be completed over 5 months and data acquisition by 9 months. Pathological studies and data analysis will require an additional 3 months.

List up to 5 milestones you will reach within the first 6 months of your study.

We anticipate the full project to take approximately 12 months to complete. During the first 6 months we will complete the following 5 milestones.

1. Month 1: We will enroll the first participants by the end of the first month.
2. Month 2: During the first two months we will refine the immunohistochemistry and electron microscopy protocols using banked tissue from a normal control, a patient with CIPN and normal IENFD, and a CIPN patient with reduced IENFD. This will allow us to identify and resolve any unanticipated technical issues.
3. Month 3: By the end of the third month we anticipate having enrolled 5 P-APS patients.
4. Month 4: By the end of the fourth month we project recruitment will be 50% completed
5. Month 5: By the end of month 5 we will have determined if there are mitochondrial changes in P-APS patients and if so will have enrolled 5 non P-APS patients. If there is uncertainty regarding the extent of mitochondrial abnormalities we will enroll non P-APS patients for comparison.

Age of Population Group(s) that will potentially benefit from this research

(check boxes that apply)

All Ages

Scientific Literature References

Reference 1

1. Cashman CR, Höke A. Mechanisms of distal axonal degeneration in peripheral neuropathies. Neurosci Lett. 2015 Jun;596:33--50. PMCID: PMC4428955

Reference 2

2. Hamid HS, Mervak CM, Münch AE, Robell NJ, Hayes JM, Porzio MT, et al. Hyperglycemia- and neuropathy-induced changes in mitochondria within sensory nerves. Ann Clin Transl Neurol. 2014 Oct;1(10):799--812. PMCID: PMC4241807

Reference 3

3. Cavaletti G. Chemotherapy - induced peripheral neurotoxicity (CIPN): what we need and what we know. Journal of the Peripheral Nervous System. Wiley Periodicals, Inc; 2014 Jun 1;19(2):66--76.

Reference 4

4. Kolb NA, Smith AG, Singleton JR, Beck SL, Stoddard GJ, Brown S, et al. The Association of Chemotherapy-Induced Peripheral Neuropathy

Symptoms and the Risk of Falling. JAMA Neurol. American Medical Association; 2016 Jul 1;73(7):860--6.

Reference 5

5. Speck RM, Sammel MD, Farrar JT, Hennessy S, Mao JJ, Stineman MG, et al. Impact of chemotherapy-induced peripheral neuropathy on treatment delivery in nonmetastatic breast cancer. J Oncol Pract. 2013 Sep;9(5):e234--40.

Reference 6

6. Vincent AM, Edwards JL, McLean LL, Hong Y, Cerri F, Lopez I, et al. Mitochondrial biogenesis and fission in axons in cell culture and animal models of diabetic neuropathy. Acta Neuropathol. 2010 ed. 2010 Oct;120(4):477--89.

Reference 7

7. Lauria G, Hsieh ST, Johansson O, Kennedy WR, Leger JM, Mellgren SI, et al. European Federation of Neurological Societies/Peripheral Nerve Society Guideline on the use of skin biopsy in the diagnosis of small fiber neuropathy. Report of a joint task for

Reference 8

8. Alberti P, Rossi E, Cornblath DR, Merkies ISJ, Postma TJ, Frigeni B, et al. Physician-assessed and patient-reported outcome measures in chemotherapy-induced sensory peripheral neurotoxicity: two sides of the same coin. Ann. Oncol. 2014 Jan;25(1):257--64

Reference 9

9. Binda D, Cavaletti G, Cornblath DR, Merkies ISJ. Rasch-Transformed Total Neuropathy Score clinical version (RT-TNSc((c))) in patients with chemotherapy-induced peripheral neuropathy. Journal of the Peripheral nervous system : JPNS. 2015 Sep;20(3):328--

Reference 10

10. Binda D, Vanhoutte EK, Cavaletti G, Cornblath DR, Postma TJ, Frigeni B, et al. Rasch-built Overall Disability Scale for patients with chemotherapy-induced peripheral neuropathy (CIPN-R-ODS). Eur. J. Cancer. 2013 Sep;49(13):2910--8.

Budget, Attachments and Acknowledgements

Budget

We recognize that changes may have occurred since the time you submitted your Letter of Intent. Please share the most recent accurate numbers below:

Total Project Budget

150145

Total existing funding or in-kind support

75145

Amount to be raised through crowdfunding campaign

75000

Evidence of institutional support (letter)

Smith, Gordon LOS_ABF_CIPN_3.27.17.pdf

Full budget

Paclitaxel Budget justification_3-27-17.docx

Documentation of IRB/IUCAC approval or exemption, if applicable.

IRB Approval Documentation.pdf

Completed conflict of interest & disclosure form

AGS_Other Support_MM_2-9-17.docx

I understand that the ABF will not list approved projects for general public crowdfunding campaigns until documentation of IRB/IUCAC approval or exemption is provided.

Yes

I understand that approval of the project to be shared on the crowdfunding campaign site is dependent on providing and working with the ABF staff to create the requisite materials that present the project in an engaging, easy-to-understand website presentation. I am amenable to working with the ABF staff to create such materials.

Yes

I understand that approval once a project has been completed, I will be required to submit a summary of my findings to be posted online (one page), and will submit this in a reasonably timely fashion. I also agree to submit a financial report, and to co-sign a thank you letter with the ABF that will be sent to donors.

Yes

I understand and agree that the ABF may share the information that I provide (including but not limited to the project description and relevant biographical/background details) in conversations with other potential funders outside the website to bolster fundraising efforts.

Yes

American Brain Foundation Release Agreement

American Brain Foundation
Release Agreement – Research

1. **Grant**. For good and valuable consideration, the receipt and sufficiency of which is hereby acknowledged, I grant to the American Brain Foundation ("ABF") and to the ABF's affiliates (including the American Academy of Neurology), and their respective contractors, agents, assigns, licensees, and successors (collectively, the "ABF Group"), a worldwide, royalty-free, perpetual, irrevocable right to take and use my image, likeness, voice, verbal statements, written testimonials and name and all images, videos, sound recordings, and written and verbal materials that I provide to the ABF (collectively, the "Materials "), in all forms and media, including composite or modified representations, for the purpose of promoting and supporting the missions of the ABF. For the avoidance of doubt, the Materials include all research project proposal information, project reports and other research-related information submitted to the ABF. I understand and agree that the ABF may publish the Materials on any and all media, including printed matter, promotional materials, e-mail, websites and social media platforms.

2. **Acknowledgement of Use**. I understand that the ABF Group may use the Materials on any and all media, including printed matter,

   promotional materials, e-mail, websites and social media platforms. I understand that the ABF's use of the Materials may intentionally or unintentionally give rise to the impression that either I or a family member suffers from brain/neurologic disease, and I nevertheless consent to this use. The ABF is not obligated to utilize any of the rights granted in this agreement. I waive the right to inspect or approve any uses of the Materials in connection with this grant.
3. **Warranty**. I warrant that I have the full power to enter into this agreement and to grant the aforementioned rights.
4. **Release**. I release the ABF Group from all liability for any claims that may arise regarding the use of Materials, including any claims of defamation, invasion of privacy, or infringement of moral rights, rights of publicity, or copyright. The ABF is permitted, although not obligated, to include my name as a credit in connection with any use of the Materials.**I have read and understood this agreement, I understand that it contains a release of liability, and I am over the age of 18**. This agreement expresses the complete understanding of the parties and shall be binding on me and my heirs, legal representatives and assigns. I understand that I am entering into a legally binding agreement and that clicking "I Accept" below shall have the same legal effect as my signature on this Release Agreement.

I Accept

Budget: Early distal axonal mitochochondrial injury with paclitaxel

Personnel	Role	FTE	Salary	Benefits	Total
	Cutaneous Nerve Laboratory Technician	0.5	$80,000	0.37	$54,800
	Study Coordinator	0.75	$60,000	0.37	$61,650
	Total				$116,450
Participant evaluations	Baseline	25			
	Paclitaxel paresthesias	5			
	Controls	5			
	Followup visits	20			

Study procedures		number	cost	Total
Light microscopy	Confocal Imaging	55	$45	$2,475
	Imaris Image Analysis	55	$21	$1,155
Electron microscopy	Epon processing	55	$30	$1,650
	Electron microscopy grids	55	$48	$2,640
	Electron Microscopy analysis	55	$240	$13,200
Nerve conduction studies	Sural and Peroneal with conduction and F	55	$165	$9,075
Materials	reagents for immunohistochemistry and electron microscopy		$3,500	$3,500
Total				$150,145

Budget justification

Personnel.
Summer Malia Karafiath MD will be the Study coordinator (75% FTE). She has extensive experience leading and coordinating CIPN clinical research and is responsible for an ongoing CIPN natural history study from which patients will be recruited for this project. She will be responsible for participant recruitment from among breast cancer clinic at the Huntsman Cancer Institute. She will obtain consent, schedule and coordinate all in-person study procedures including performance of skin biopsies.

Peter Hauer will be the Skin Technician (50% FTE). Mr. Hauer led the development of the currently used technique to study cutaneous nerves during his 25 year tenure leading the Cutaneous Nerve Lab at the Johns Hopkins School of Medicine. He was recruited to lead the University of Utah Laboratory in 2014. Mr. Hauer currently oversees a multi-university quality control consortium of similar laboratories. He has trained over 50 other laboratories world-wide and has extensive experience with all of the techniques proposed in this proposal, including successful use of each proposed antibody. He has overseen use of skin biopsy in many large multicenter clinical trials (including international trials). Under Mr. Hauer's leadership, the Cutaneous Nerve laboratory current provides similar research support to NIH funded investigators at other Universities. He will be responsible for oversight of all biopsy processing, interpretation/quantitation, and laboratory data management. He will fix, and process skin biopsies for light microscopic immunohistochemical analysis, and will provide all quantification of intraepidermal nerve fiber density and axonal mitochondrial number. He will coordinate confocal and EM imaging with the Cellular Imaging Core.

Study procedures. 25 women with breast cancer scheduled for paclitaxel chemotherapy will be recruited, and each will undergo baseline evaluation consisting of physical exam, *nerve conduction studies (NCS)* following a standardized protocol, and skin biopsy for assessment of IENFD using brightfield PGP9.5 immunohistochemistry (IHC). Fluorescent IHC using confocal microscopy will be used to image axonal and keratinocyte mitochondria. EM will be performed to directly visualize axonal mitochondria. A 20% attrition rate is anticipated. Therefore, 20 participants will undergo the same evaluation following chemotherapy (on average 3 months). 5 Patients with P-APS will undergo this evaluation at the time of P-APS development. Assuming there are axonal mitochondrial changes compared to baseline, 5 more participants without P-APS will be evaluated. In total there will be 55 biopsy and NCS evaluations. The imaging costs above include reagent and Cell Imaging Core costs.

Cost sharing
This project will be embedded in an ongoing IRB approved study of CIPN natural history and risk factors. The Division of Neuromuscular Medicine will provide matching funds to those raised by the ABF crowdfunding platform. We are therefore requesting a total of $75,000 to support this project.

University Health Care
Department of Neurology

Stefan-M. Pulst, M.D., Dr. med
Professor and Chair
Stefan.Pulst@hsc.utah.edu

27 March 2017

A. Gordon Smith, M.D.
Professor of Neurology
Vice Chair for Research
Chief of Neuromuscular Medicine
University of Utah Health

Dear Dr. Smith:

I am delighted to write in support of your application to the American Brain Foundation requesting selection of your proposal to study mitochondrial structure in chemotherapy induced peripheral neuropathy (CIPN) for a crowdfunding philanthropic campaign. CIPN is a major cause for morbidity among cancer survivors. Your proposal is innovative, and builds on your ongoing project examining CIPN natural history and risk factors. Given your team's extensive experience in neuropathy clinical research I have no doubt regarding the project's successful completion. The Utah Cutaneous Nerve Laboratory is internationally recognized as a leader in the study of cutaneous innervation in peripheral neuropathy, and you will benefit from the substantial resources of the University of Utah Cell Imaging Core.

I can assure the review panel that you will continue to benefit from the resources necessary to carry out this proposal including laboratory space and administrative support.

I wish you the best of luck in your efforts to raise funds to support this exciting project.

Sincerely,

Stefan-M. Pulst, M.D., Dr. med.
Professor and Chair
Department of Neurology
University of Utah

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INSTITUTIONAL REVIEW BOARD
THE UNIVERSITY OF UTAH

75 South 2000 East Salt Lake City, UT 84112 | 801.581.3655 | IRB@utah.edu

IRB: IRB_00070295

PI: Noah Kolb

Title: Predicting and Characterizing Chemotherapy Induced Peripheral Neuropathy

CR: CR_11/16/2016 2:41 PM

Date: 12/12/2016

Effective 12/12/2016, the above-referenced Continuing Review is approved to continue research procedures outlined in the University of Utah IRB-approved application and documents.

APPROVAL DOCUMENTATION

Review Type: Convened Board Review
Risk Level: Greater Than Minimal
Approval Date: 12/7/2016
Expiration Date: 12/6/2017 11:59 PM

APPROVED DOCUMENTS

Informed Consent Document
Consent Clean 2017 (no changes)

Company Protocol
protocol 2017 (no changes)

Other Documents
TissueBankManagementPlanCIPN.doc

ONGOING SUBMISSIONS FOR APPROVED PROJECTS

- **Continuing Review:** The research protocol must be re-reviewed and re-approved prior to the expiration date via the continuing review application: http://irb.utah.edu/submit-application/reviews/index.php
- **Amendment Applications:** All changes to the research application, protocol, or approved documents must be submitted and approved prior to initiation: http://irb.utah.edu/submit-application/amendments.php
- **Report Forms:** The research must adhere to the University of Utah IRB reporting requirements for unanticipated problems and deviations: http://irb.utah.edu/submit-application/forms/index.php
- **Final Project Reports for Study Closure:** The research application must be closed with the IRB once the research activities are complete: http://irb.utah.edu/submit-application/final-project-reports.php

Click CR_00023919 to view the application and access the approved documents.

Please take a moment to complete our customer service survey. We appreciate your opinions and feedback.

Dear Applicant:

In the increasingly complex world of scientific publication, concerns about commercial influence and other possible conflicts make it important for authors to disclose all potential sources of bias. Our system of reviewing conflicts of interest aligns with the policies of the American Academy of Neurology and allows donors to judge whether conflicts exist. Please complete this form, referring to the definitions in the beginning regarding commercial entities, compensation, expert witness, and "immediate family member." At first glance, this task may seem onerous, but will likely take less than 10 minutes.

What to expect: You will be asked whether you have disclosures relating to each question (check yes or no) and will be provided a field in which to list the disclosures. Filling out the forms on the next few screens will be easiest if you have a list of the following items regarding your activity (either commercial or non-profit) and that of any immediate family members during the period of your project. Disclosures are required for any dollar amount, except for gifts valued under $1000. Names of commercial and non-profit entities are required along with specific roles, grant numbers for grants, and specific years. No dollar amounts need to be included. Please indicate complete names of sponsors or companies.

DEFINITIONS

Personal compensation:
Serving on a scientific advisory board
Gifts worth more than $1000
Travel funded by a commercial entity
Serving as a journal editor, associate editor, or on an editorial advisory board
Patents held or pending
Royalties from publishing
Honoraria for speaking engagements
Corporate appointments or consultancies
Speakers' bureaus
Clinical, neurophysiology, or imaging studies in your practice and % effort devoted if the result of this paper will benefit your practice, affiliated unit, or a sponsor

Research support:
Commercial research support
Government research support (including funding organization, grant number, and role)
Academic research support not attributed in the manuscript
Support from a non-profit foundation or society
Stock options for serving on a Board of Directors
License fee payments
Royalty payments from technology or inventions

Stocks, stock options, and royalties
Stock options in a company in which you are (were) an investigator
Stock options in medical industry

Legal proceedings
Expert testimony for a legal proceeding on behalf of industry
Affidavit for a legal proceeding on behalf of industry
Witness or consultant for a legal proceeding on behalf of industry

Optional non-financial
Non-financial disclosures you wish to share

Definitions of Terms in Disclosure Agreement
Commercial entity: A for-profit business that manufactures, distributes, markets, sells, or advertises pharmaceutical or scientific products or medical devices.
Compensation: Anything of monetary value including a salary, honorarium, stipend, gift, or payment of travel-related expenses.
Expert witness: A person who has provided expert medical testimony during a trial or administrative hearing, in a deposition or an affidavit, or in any other type of legal proceeding.
"Immediate family member": Any person who would benefit financially from the publication of the manuscript because of their relationship to the author. This includes a member of an applicant's immediate family or anyone else who has a significant relationship with the applicant.

Please provide all financial relationships (and those of your "immediate family members") from the past two years regardless of whether these relationships are related to the project described in your application.

FINANCIAL DISCLOSURE
Personal Compensation from Commercial and Non-Profit Entities that benefits you directly or indirectly. Within the past two years (and during the course of the study under consideration if the study exceeded two years), I or one of my "immediate family members" received personal compensation for the following:

All compensation received during the past two years regardless of the relationship to your project must be disclosed; for the period exceeding two years, only compensation relevant to the topic of the study needs to be disclosed.

1. Serving on a scientific advisory board or data safety monitoring board. List specific disclosures in the following format: (1) Commercial or non-profit entity (2) Commercial or non-profit entity... If none, please say "None":

None

2. Gifts (other than travel or compensation for consulting or for educational efforts) worth more than USD $1000. List specific disclosures in the following format: (1) Commercial or non-profit entity, brief description of gift, (2) Commercial or non-profit entity, brief description of gift... If none, please say "None":

None

3. Funding for travel or speaker honoraria to the individual from a commercial or non-profit entity not included in the study funding [Exclude CME activities and Grand Rounds]. List specific disclosures in the following format: (1) Commercial or non-profit entity, type of payment, (2) Commercial or non-profit entity, type of payment... If none, please say “None”:

None

4. Serving as a journal editor, an associate editor, or editorial advisory board member. This may include a journal published by your national medical/scientific organization. Please include regardless of whether you receive compensation. List specific disclosures in the following format: (1) Full journal name, role, year(s), (2) Full journal name... If none, please say “None”:

Editor of NeuroLearn.

5. Patents issued or pending. List specific disclosures in the following format: (1) Brief description of invention/technology, (2) Brief description of invention/technology... If none, please say “None”:

None

6. Publishing Royalties (do not include honoraria for occasional writing). List specific disclosures in the following format: (1) Full title of work, full name of publisher, year(s) of publication (or receipt of royalties), (2) Full title of work... If none, please say “None”:

None

7. Employment. If you are currently employed by a commercial entity, please disclose below. In addition, if your past employment at a commercial entity is directly related to this manuscript, please disclose below. List specific disclosures in the following format: (1) Commercial entity, position, years (2) Commercial entity, position, years... If none, please say “None”:

None

8. Consultancies. List specific disclosures in the following format: (1) Commercial or non-profit entity, (2) Commercial or non-profit entity... If none, please say “None”:

None

9. Speakers' bureau. List specific disclosures in the following format: (1) Commercial or non-profit entity, (2) Commercial or non-profit entity... If none, please say “None”:

None

10. Other activities not covered in designations above (if in doubt, provide full disclosure). List specific disclosures in the following format: (1) Commercial or non-profit entity, brief description of activity, (2) Commercial or non-profit entity... If none, please say “None”:

None

11. Some studies have potential for financial gain for the project investigators or the sponsor. The following question seeks to provide transparency regarding any financial benefits to investigators or sponsors.

Do you perform clinical procedures or imaging studies in your practice or unit that overlap with the content of your proposed project, practice parameter, or clinical practice guideline and would your sponsor or this part of your practice or unit benefit if the conclusions were widely followed?
Note: This is the only item in this Agreement that applies to an interest that is related specifically to this particular study, practice parameter, or clinical practice guideline.

List specific disclosures in the following format: (1) Name of Practice or Research Unit, Clinical procedure/imaging study, % of effort (e.g. 35%), year(s), (2) Name of Practice or Research Unit, Clinical procedure/imaging study, % of effort (e.g., 35%)... If none, please say “None”:

None

RESEARCH SUPPORT
Within the past two years and during the course of the study under consideration if the study exceeded two years, I or one of my "immediate family members" received financial or material research support or compensation from the following:

All support received during the past two years regardless of the relationship to the study must be disclosed; for the period exceeding two years, only support relevant to the topic of the study needs to be disclosed.

12. Commercial entities. List specific disclosures in the following format: (1) Commercial entity, (2) Commercial entity... If none, please say “None”:

See other support

13. Government entities. List specific disclosures in the following format: (1) Sponsor/funding source, grant number(s), role, year(s), (2) Sponsor/funding source... If none, please say “None”:

See other support

14. Academic entities other than those attributed in the manuscript. List specific disclosures in the following format: (1) Academic entity, (2) Academic entity... If none, please say “None”:

None

15. Foundations or societies (include grant number if required by funding agency). List specific disclosures in the following format: (1) Full name of Foundation or Society, (2) Full name of Foundation or Society... If none, please say “None”:

See other support

STOCK, STOCK OPTIONS & ROYALTIES

In the past two years and during the course of the study under consideration if the study exceeded two years, I or one of my "immediate family members":

All revenues during the past two years regardless of the relationship to the study must be disclosed; for the period exceeding two years, only revenues relevant to the topic of the study needs to be disclosed.

16. Stock or stock options or expense compensation for serving on a board of directors. List disclosures in the following format: (1) Commercial entity, (2) Commercial entity... If none, please say “None”:

None

17. License fee payments. List specific disclosures in the following format: (1) Invention/technology, source of payment, (2) Invention/technology... If none, please say “None”:

None

18. Royalty payments or have contractual rights for receipt of future royalty payments from technology or inventions (this does not include royalties from publishing). List specific disclosures in the following format: (1) Technology/invention, source of payment, year(s), (2) Technology/invention... If none, please say “None”:

None

19. Stock or stock options in a commercial entity sponsoring research with which the author or "immediate family member" was involved as an investigator (Excludes investments in mutual funds held by the author or dependents). List specific disclosures in the following format: (1) Company, year(s), (2) Company, year... If none, please say “None”:

None

20. Stock or stock options in a commercial entity whose medical equipment or other materials related to the practice of medicine. (Exclude investments in mutual funds held by the author or dependents). List specific disclosures in the following format: (1) Company, year(s), (2) Company, year... If none, please say “None”:

None

LEGAL PROCEEDINGS

In the past two years and during the course of the study under consideration if the study exceeded two years, I or one of my "immediate family members" have (whether or not it pertains to the topic of the current study):

All compensation received during the past two years regardless of the relationship to the study must be disclosed; for the period exceeding two years, only compensation relevant to the topic of the study needs to be disclosed.

21. Given expert testimony, acted as a witness or consultant, or prepared an affidavit for any legal proceeding involving a commercial entity (do not include proceedings for individual patients). You may specify role, e.g., 'expert witness for plaintiff' if desired. (Include year only if activity is directly related to the present study.)

List specific disclosures in the following format: (1) Commercial entity, activity, year(s), (2) Commercial entity, activity, year(s)... If none, please say “None”:

None

OPTIONAL: NONFINANCIAL DISCLOSURE

22. I have chosen to declare one or more non-financial competing interests (e.g., special interest groups you represent or others that may be affected if your paper is published or that could be perceived as biasing the study; the corresponding author should be aware of conflicts of interest that Co-investigators or Contributors may have). Non-financial disclosures will not be published.

List specific disclosures, if none, please say “None”:

None

☑ I have completed this Disclosure Statement fully and to the best of my ability. I understand that all Applicants must complete this Disclosure Statement and that the information disclosed may be published if their project is accepted for crowdfunding.

By my electronic signature, I verify the completeness and accuracy of the contents of this form.

Click in the box above to add your electronic signature

Date 03/22/17

Please refer to the NIH formatted Other Support document below. I have no other conflicts of interest or disclosures.

For New and Renewal Applications (PHS 398) – DO NOT SUBMIT UNLESS REQUESTED
For Non-competing Progress Reports (PHS 2590) – Submit only Active Support for Key Personnel

PHS 398/2590 OTHER SUPPORT

Provide active support for all key personnel. **Other Support includes all financial resources, whether Federal, non-Federal, commercial or institutional, available in direct support of an individual's research endeavors, including but not limited to research grants, cooperative agreements, contracts, and/or institutional awards.** Training awards, prizes, or gifts do not need to be included.

SMITH, A.G.
ACTIVE

1U10NS077305-01 (Smith) 09/01/2011-06/30/2018 1.2 calendar
NIH/NINDS $1,400,000
The Utah Regional Center for Excellence in Neuroscience Clinical Trials (UR-NEXT)

UR-NEXT will provide an ideal mechanism ideal mechanism for coordinating recruitment and access throughout a 5 state region in the Intermountain West. The coordinated efforts of a leadership team with a track record of collaboration and experience in both pediatric and adult clinical studies and trials and an experienced clinical trials manager will ensure the performance of high quality neuroscience trials across a broad range of diseases.
Role: PI

Impeto-Medical, Inc. (Smith) 01/01/2014-01/31/2018 0.6 calendar
Chemotherapy Induced Peripheral Neuropathy $365,760

The major goals of this project are to determine if Sudoscan can be used in a screening paradigm to predict CIPN risk or identify patients with subclinical CIPN early in their course of chemotherapy and include development of Sudoscan as a potential endpoint for future clinical trials and use of CIPN as a disease model to establish the clinical meaning of decline in Sudoscan.
Role: PI

R01DK064814-09 (Smith/Singleton) 04/01/2015-03/31/2020 1.8 calendar
NIH/ NIDDK $2,446,785
Activity for the Diabetic Polyneuropathy: The ADAPT Study

The major goals of this project are to evaluate the efficacy of a lifestyle intervention that integrates moderate supervised exercise and actigraphy based counseling to reduced sedentary behavior on diabetic peripheral neuropathy with a focus on patient relevant outcomes and quality of life and validation of biomarkers including intraepidermal nerve fiber density (IEFND).
Role: Co-PI

DP3 DK104394 (Smith/Singleton) 09/30/2014-08/31/2017 3.6 calendar
NIH/NIDDK $999,141
Developing Corneal Confocal Microscopy as a Screening Tool and Biomarker for Diabetic Neuropathy

The major goal of this project is to develop corneal confocal microscopy (CCM) as a screening tool that can be used to identify patients with, or at high risk for, early neuropathy.
Role: Co-PI

SMITH, A.G.
PENDING

U01NS095388 (Smith) 12/01/2016-11/30/2020 1.2 calendar
NIH/NINDS $7,563,257
Topiramate as a Disease Altering Therapy for Cryptogenic Sensory Peripheral Neuropathy (The TopCSPN Study)

Double blind randomized controlled trial of topiramate for CSPN associated with obesity and metabolic syndrome using the NeuroNEXT clinical trials network.
Role: PI

OVERLAP:
None

Last Updated: 01/26/2017

A. Gordon Smith, M.D., FAAN
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Salt Lake City, UT 84132
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801-585-2054 (fax)
gordon.smith@hsc.utah.edu

PERSONAL DATA

Birth Place: Richmond, Virginia
Citizenship: United States
Languages: English

EDUCATION

Years	Degree	Institution (Area of Study)
1984 - 1988	B.A.	University of Virginia (Archeology) Charlottesville, VA
1988 - 1992	M.D.	Mayo Medical School (Medicine) Rochester, MN
1992 - 1993	Intern	University of Michigan (Internal Medicine) Ann Arbor, MI
1993 - 1996	Resident	University of Michigan (Neurology) Ann Arbor, MI
1996 - 1997	Fellow	University of Michigan (Neuromuscular Fellowship) Ann Arbor, MI
1997		Johns Hopkins University (Cutaneous Innervation) Baltimore, MD
2004		University of Utah Hospital School of Medicine (Physician Executive Course) Salt Lake City, UT

BOARD CERTIFICATIONS

05/05/1997 - 12/31/2017	American Board of Psychiatry & Neurology (Neurology), Certified [Recertified 04/16/2007]
04/04/1998 - 12/31/2018	American Board of Electrodiagnostic Medicine, Certified [Recertified 12/31/2008]
04/13/1999 - 12/31/2009	American Board of Psychiatry & Neurology (Sub: Clinical Neurophysiology), Certified
08/17/2011 -	American Board of Psychiatry & Neurology (Sub: Neuromuscular

Present Medicine), Certified

LICENSES/CERTIFICATIONS

1999 - 2018 Controlled Substance (UT) - Physician (MD)
1999 - 2018 State License (UT) - Physician (MD)
2006 - 2018 DEA Certificate (UT) - Physician (MD)

CLINICAL AREAS OF SPECIALIZATION

ALS, Botulinum Toxins, EMG, Neurology, Neuromuscular Diseases, Neuropathy, Hemifacial Spasm, Neuromuscular Pathology, Spinal Muscular Atrophy, Botulism

RESEARCH INTERESTS

Peripheral Nervous System Diseases, Obesity, Diabetes, Cutaneous Innervation, Clinical Neurophysiology (EMG), Lambert-Eaton Myasthenic Syndrome

PROFESSIONAL EXPERIENCE

Full-Time Positions

1997 - Present Staff Neurologist, VA Hospital, Salt Lake City, UT
1997 - 2003 Assistant Professor (Clinical) of Neurology, University of Utah School of Medicine, Salt Lake City, UT
Responsibilities: Subspecialty in neuromuscular disease and EMG
1998 - Present Director, University of Utah Department of Neurology, Peripheral Neuropathy Clinic, Salt Lake City, UT
1998 - Present Director, University of Utah, Cutaneous Innervation Laboratory, Salt Lake City, UT
2000 - Present Director, Therapeutic Botulinum Toxin Clinic,
2000 - Present Adjunct Assistant Professor of Pathology, University of Utah, Salt Lake City, UT
2004 - 2012 Associate Professor (Clinical) of Neurology, University of Utah School of Medicine, Salt Lake City, UT
Responsibilities: Subspecialty in neuromuscular disease and EMG
2008 - 2012 Associate Professor, University of Utah School of Medicine, Salt Lake City, UT
2010 - Present Associate Professor of Anesthesiology (Clinical), University of Utah, Salt Lake City, UT
2012 - Present Professor of Neurology (Tenure), University of Utah, Salt Lake City, UT
2013 - Present Vice Chair for Research, University of Utah, Salt Lake City, UT

Editorial Experience

2005 Editor for The Handbook of Peripheral Neuropathy. Taylor and Francis, New York.
2006 Editor for Journal of the Neurological Sciences, Special Issue 2006; 242 (1)

2007 - 2011	Editorial Board for Journal of the Peripheral Nervous System (Advisory)
2010 - 2012	Associate Editor for Education, AAN.com
2011 - Present	Editorial Board for Journal of the Peripheral Nervous System
2012	Editor for Seminars of Neurology, Neuromuscular Medicine from Bench to Bedside
2014 - Present	Editor in Chief for NeuroLearn (AAN Online Learning Program)
2014 - Present	Editorial Board for Annals of Clinical and Translational Science
2016	Editor for Journal of Delivery Science and Innovation

Reviewer Experience

Reviewer for Journal of Delivery Science and Innovation
Abstract Reviewer for American Neurological Association
Experimental Neurology
Expert Opinion on Drug Metabolism and Toxicology
Journal of Neuroscience Methods
Reviewer for Acta Diabetologica
Reviewer for Archives of Internal Medicine
Reviewer for BMJ Open
Reviewer for Brain and Behavior
Reviewer for British Medical Journal
Reviewer for Clinical Endocrinology and Metabolics
Reviewer for Clinical Therapeutics
Reviewer for Clinical Therapeutics
Reviewer for Cytokine
Reviewer for Diabetic Medicine
Reviewer for Expert Opinion on Investigational Drugs
Reviewer for Gerontology
Reviewer for International Journal for Vitamin and Nutrition Research
Reviewer for International Journal of Endocrinology
Reviewer for International Journal of Obesity
Reviewer for Journal of Applied Physiology, Nutrition, and Metabolism
Reviewer for Journal of Biomedical Materials Research: Part A
Reviewer for Journal of Diabetes
Reviewer for Journal of Diabetes Metabolism Research and Reviews
Reviewer for Journal of Diabetes Research
Reviewer for Journal of Diabetes and its Complications
Reviewer for Journal of Immunology Research
Reviewer for Journal of Neuroinflammation
Reviewer for Journal of Pain & Palliative Care Pharmacotherapy
Reviewer for Journal of Pain
Reviewer for Journal of the Peripheral Nervous System
Reviewer for Lipids in Health and Disease
Reviewer for Neuro-oncology
Reviewer for Neuroscience Letters

Reviewer for PLOS 1
Reviewer for Physical Medicine and Rehab
Reviewer for Therapeutic Advances in Endocrinology and Metabolism
Reviewer for American Journal of Managed Care
Reviewer for Annals of Neurology
Reviewer for British Journal of Nutrition
Reviewer for Clinical Journal of Pain
Reviewer for Cochrane Collaboration
Reviewer for Experimental Neurology
Reviewer for Journal of Neurology Neurosurgery and Psychiatry
Reviewer for Journal of the American Medical Association
Reviewer for Journal of the Neurological Sciences
Reviewer for Journal of the Royal Society Interface
Reviewer for Muscle and Nerve
Reviewer for Neurobiology of Disease
Reviewer for Neurology
Reviewer for New England Journal of Medicine
Reviewer for Sleep

SCHOLASTIC HONORS

1985 - 1988	Echols Scholar, University of Virginia
1988	Phi Beta Kappa, University of Virginia
1988	Dean of Faculty Alumni Scholarship, University of Virginia
1988	Magna Cum Laude, University of Virginia
1988 - 1992	Ruth A. Masson Scholar and Dean's Grant recipient, Mayo Medical School
2005	American Academy of Neuromuscular Disease and Electrodiagnostic Medicine Presidential Award

ADMINISTRATIVE EXPERIENCE

Administrative Duties

1998 - Present	Director, Cutaneous Innervation Laboratory.
1998 - Present	Director, University of Utah Peripheral Neuropathy Clinic.
2000 - Present	Director, Therapeutic Botulinum Toxin Clinic.
2006 - Present	Director, Peripheral Neuropathy Association Center of Excellence
2011 - Present	Director, Division of Neuromuscular Medicine
2011 - Present	Director, University of Utah Electrodiagnostic Laboratory
2011 - 2014	Co-Director, Neurology Clinical Trials Unit
2013 - Present	Neurology Department Academic Advisory Committee
2013 - Present	Vice-Chair for Research, Department of Neurology
2014 - Present	Chair, Neurodegeneration Pillar Steering Committee, University of Utah Neurosciences Initiative
2014 - Present	Member, Episodic Brain Dysfunction Pillar Steering Committee
2014 - Present	University of Utah Neuroscience Initiative Scientific Advisory Board

Professional Organization & Scientific Activities

1990 - 1991	Member, American Medical Association, State Governing Council
1990 - 1991	Member, Minnesota Medical Association, Legislation Committee
1990 - 1991	Delegate, American Medical Association, National Convention
1990 - 1991	Treasurer, American Medical Association, local chapter
2000 - 2003	Member, American Association of Electrodiagnostic Medicine, Young Physician Task Force
2003 - 2007	Member, American Association of Electrodiagnostic Medicine, Alternative Media Committee
2005 - 2009	Member, American Academy of Neurology, Annual Meeting Subcommittee with the Education Committee
2006 - Present	Abstract Reviewer, American Neurological Association, Abstract Reviewer
2006 - 2010	Oral Board Examiner, American Board of Electrodiagnostic Medicine
2006 - 2008	Chair, American Academy of Neurology, Topic Work Group for Cognitive Disorders
2006	Member, National Institutes of Health, Consensus Conference on Peripheral Neuropathy
2007 - 2011	Elected Board Member, Peripheral Nerve Society
2007 - 2011	Member, Peripheral Nerve Society, Finance Committee
2008 - 2011	Chair, American Academy of Neurology, Topic Work Group on Neuromuscular Disease and Clinical Neurophysiology
2009 - Present	Committee Member, American Academy of Neurology, Education Committee
2009 - 2011	Member, American Academy of Neurology, Learning Across the Lifetime Taskforce
2009	Member, European Association for the Study of Diabetes, ISDN/Neurodiab, Consensus Conference on Diagnosis of Peripheral Neuropathy, Marker Structure Subgroup
2010 - 2011	Member, American Academy of Neurology, Web Work Group
2011 - Present	Abstract Reviewer, American Academy of Neurology, Annual Meeting-Peripheral Nerve
2011 - 2015	Chair, American Academy of Neurology, Distance Learning Subcommittee
2011 - 2014	Chair, American Academy of Neurology - Neuromuscular Section, Education Work Group
2011 - Present	Member, American Neurological Association, Finance Committee
2012 - 2014	Member, American Academy of Neurology, Web Redesign Work Group (WRWG)
2012	Member, National Institute of Neurological Disorders and Stroke, Neuro NEXT Protocol Working Group 02012012
2012	Member, American Academy of Neurology, Topic Work Group on Child Neurology
2012 - Present	Member, American Academy of Neurology, Topic Work Group on Neuromuscular Disease and Neurophysiology
2012 - Present	Chair, American Academy of Neurology, Topic Work Group on Neuro-

	ophthalmology and Neuro-otology
2012 - 2014	Member, American Academy of Neurology, Navigating Health Care Reform Task Force
2013 - Present	Member, American Academy of Neurology, Membership Subcommittee
2014 - Present	Member, American Diabetes Association, Program Committee
2015 - Present	Member, American Academy of Neurology, Conference Subcommittee (ex officio)
2015 - Present	Board of Directors, American Academy of Neurology
2015 - Present	Chair, American Academy of Neurology, Education Committee
2015 - Present	Member, American Academy of Neurology, Meeting Management Committee
2016 - Present	Member, American Academy of Neurology, Nominations Committee

Grant Review Committee/Study Section

2004	Neuroscience Foundation of New Zealand (Ad Hoc)
2006 - 2014	American Diabetes Association
2008	Juvenile Diabetes Research Foundation
2009	Diabetes UK (Ad Hoc)
2009	NIH ETTN (Ad Hoc)
2009	External Reviewer, University of Michigan MDRTC Pilot and Feasibility Grants
2011	ARG1 MOSS-D12 (SBIR)
2011	ZDK1 GRB-2 (O3) Epidemiology of Diabetes
2011	NSD-K (NINDS Clinical Trials)
2012	Rehabilitation Research and Development (RR&D)
2012	ZDK1 GRB-2 (O4) 1
2014	ZNS1 SRB-G (78) NINDS Clinical Trials
2014	ZDK1 GRB-9(J2) NIDDK Small grants to support diversity (R03)
2014	Reviewer, Michigan Diabetes Interdisciplinary Study Program, Pilot and Feasibility Grants.
2015	Neuroscience Initiative Seed Grant Review Committee
2015	Princess Beatrix Muscle Fund (Netherlands)
2016	Longer Life Foundation Pilot Feasibility Study
2016	ZNSI-SRB G (07) - Clinical Trial Readiness for Rare Neurological Disease

Symposium/Meeting Chair/Coordinator

2006	Session Co-Chair, Genetic Neuropathies, 2006 American Academy of Neurology
2007	Chair, Local Organization Committee. Peripheral Nerve Society Meeting
2009	Session Co-Chair, Diabetic and Metabolic Neuropathies. Peripheral Nerve Society Meeting, Wurzburg Germany
2009	Moderator, Diabetic Neuropathy Case Conference, Peripheral Nerve Society Meeting, Wurzburg Germany

2010	Small vs. Large Fiber Debate, Neurodiab, Stockholm Sweden
2011	Session Moderator, Peripheral Nerve: Clinical and Basic Science Poster Session, American Academy of Neurology, Honolulu Hawaii
2011	Moderator, Diabetic Neuropathy Clinical Poster Tour. Peripheral Nerve Society. Washington D.C.
2012	Session co-chair, Neuropathy Posters, American Academy of Neurology Annual Meeting, New Orleans, LA
2012	Session co-chair, Poster walking tour. Muscle Study Group. Beaver Hollow New York
2013	Session Chair, Plenary Lecture, Peripheral Nerve Society, St. Malo France
2014	Session co-chair, Peripheral Neuropathy Poster Walking Tour, American Academy of Neurology Annual Meeting, Philadelphia PA
2014	Session Chair: The Conundrum of Diabetic Neuropathy. American Diabetes Association Annual Meeting. San Francisco, CA
2015	Session Chair, American Diabetes Association Peripheral Neuropathy Session, Boston Massachusetts

PROFESSIONAL COMMUNITY ACTIVITIES

2011 - 2013	Chair, Baxter, Bioscience Data Monitoring Committee, Protocol 160604
2013 - Present	Board of Trustees, American Brain Foundation, Scientific Advisory Board
2013 - Present	Member, American Brain Foundation, Board of Trustees
2015 - Present	Chair, Celgene Corporation, Celgene CCT-PDA-001-DPN-001 Data Monitoring Board
2015 - Present	Secretary, American Brain Foundation
2015 - Present	Member, American Brain Foundation, Strategic Planning Committee
2015 - Present	Member, Foundation for Peripheral Neuropathy
2015 - Present	Member, Foundation for Peripheral Neuropathy, Scientific Advisory Board

UNIVERSITY COMMUNITY ACTIVITIES

University Level

2008	Member, Search Committee, Physical Therapy Department Search Committee

Health Sciences Level

2010 - 2013	Active Member, University of Utah Medical Group, Finance Committee
2010	Ad Hoc Reviewer, Center for Clinical Translational Science, CCTS K12 Grant
2014 - Present	Member, Health Sciences Center, Neuroscience Initiative, Scientific Advisory Board

University Hospitals & Clinics

2009 - Present Active Member, Pharmacy and Therapeutics Committee
2013 - Present Member, University of Utah Hospitals and Clinics, Academic Advisory Committee
2015 - Present Chair, University of Utah Hospitals and Clinics, Epilepsy Center Director Search Committee

Department Level

1997 - 2004 Member, Neurology, Resident Education Committee
1997 - Present Member, Neurology, Resident Selection Committee
2008 Member, Neurology, Workgroup on Bridge Funding Policy

Programs, Centers & Institutes

2012 - Present Member, Clinical Neurosciences Center, Leadership Team
2013 - Present Executive Committee Member, Clinical Neurosciences Center

SERVICE AT AFFILIATED INSTITUTIONS

1997 - 2011 Medical Staff, Veterans Administration Medical Center, Neurology

CONSULTING

2011 Chair, Pfizer Inc., Advisory board on Tafamadis
2012 Advisory Board Member, Pfizer Inc., Mock FDA Advisory Board for Tafamadis
2012 Consultant, ViroMed Laboratories, Diagnosis of diabetic neuropathy: the MNSI in VM202
2012 - 2014 Consultant, ViroMed Laboratories, Skin biopsy as an endpoint measure in diabetic neuropathy trials and in VM202

MEMBERSHIPS IN PROFESSIONAL SOCIETIES

1993 - Present Member, American Academy of Neurology
1996 - Present Member, American Association of Electrodiagnostic Medicine
1997 - Present Member, Peripheral Nerve Society
2006 - Present Member, American Neurological Association

FUNDING

Active Grants

12/01/16 - 11/30/20 Topiramate as a disease altering therapy for cryptogenic sensory peripheral neuropathy (CSPN): The TopCSPN Study
1U01NS095388-01
Principal Investigator: A. Gordon Smith
Direct Costs: $5,811,767 Total Costs: $7,630,254
National Institute of Neurological Disorders and Stroke
Role: Principal Investigator

09/01/11 - The Utah Regional Center for Excellence in Neuroscience Clinical

06/30/18 Trails (The UR-NEXT) 5U10NS077305-03
Principal Investigator: A. Gordon Smith
Direct Costs: $1,400,000 Total Costs: $2,107,000
National Institute of Neurological Disorders and Stroke
Role: Principal Investigator

10/25/12 - 02/28/16 International Guillain Barré Outcome Study
Principal Investigator(s): Noah Kolb; A. Gordon Smith
Direct Costs: $20,347 Total Costs: $27,000
GBS/CIDP Foundation International
Role: Principal Investigator

09/30/13 - 08/31/18 UT StrokeNet 1U10NS086606-01
Direct Costs: $1,250,000 Total Costs: $1,833,100
National Institute of Neurological Disorders and Stroke
Role: Co-Investigator

02/25/14 - 12/31/16 Sudoscan as a Biomarker for Chemotherapy Induced Peripheral Neuropathy
Principal Investigator: A. Gordon Smith
Direct Costs: $365,760 Total Costs: $485,364
Impeto Medical Sas
Role: Principal Investigator

07/01/14 - 03/31/17 Patient Centered Outcomes Research Institute (PCORI) Pain-Controls
Direct Costs: $35,500 Total Costs: $39,050
University of Kansas
Role: Site Investigator

09/01/14 - 08/31/17 Developing Corneal Confocal Microscopy as a Screening Tool and Biomarker for Diabetic Neuropathy 1DP3DK104394-01
Principal Investigator(s): J. Robinson Singleton; A. Gordon Smith
Direct Costs: $987,594 Total Costs: $1,442,115
NIH National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK)
Role: Principal Investigator

10/01/14 - 09/30/18 NN103-Rituximab In MG
Direct Costs: $68,677 Total Costs: $99,841
National Institute of Neurological Disorders and Stroke (NINDS)
Role: Site Investigator

01/01/15 - 12/31/20 Peripheral Neuropathy Research Registry (PNRR)
Principal Investigator: A. Gordon Smith
Direct Costs: $77,500 Total Costs: $83,700
Foundation for Peripheral Neuropathy
Role: Principal Investigator

04/01/15 - 03/31/20 Activity for Diabetic Polyneuropathy: The ADAPT Study 2R01DK064814-09A1
Principal Investigator(s): J. Robinson Singleton; A. Gordon Smith
Direct Costs: $2,388,109 Total Costs: $3,208,760
NIH National Institute of Diabetes and Digestive and Kidney

Diseases (NIDDK)
Role: Principal Investigator

08/07/15 - 11/30/19
ADAPT-Sudoscan
Principal Investigator: A. Gordon Smith
Direct Costs: $14,580 Total Costs: $19,348
Impeto Medical Sas
Role: Principal Investigator

05/01/16 - 06/30/18
Vmdn-003
Principal Investigator(s): J. Robinson Singleton; A. Gordon Smith
Direct Costs: $214,800 Total Costs: $285,040
Viromed Co Ltd Dba Vm Biopharma
Role: Principal Investigator

07/01/16 - 06/30/17
The Utah Regional Network Of Excellence Cl
Principal Investigator: A. Gordon Smith
Direct Costs: $100,000 Total Costs: $149,000
National Institute of Neurological Disorders and Stroke (NINDS)
Role: Principal Investigator

Pending Grants

09/01/16 - 08/31/18
Nn105 Huntington's Disease
Principal Investigator: A. Gordon Smith
Massachusetts General Hospital
Role: Principal Investigator

09/01/17 - 08/31/21
A Phase 1/2 Trial of Gene Transfer to Prevent CIPN
R01CA203848
Principal Investigator: David Fink
National Cancer Institute
Role: Co-Investigator

Past Grants

01/01/99 - 01/01/00
Fellowship Award, Clinical Mentor for Dr. Victoria Lawson, MD.
Principal Investigator: A. Gordon Smith
Charcot-Marie-Tooth Association
Role: Co-Principal Investigator

08/01/01 - 07/31/04
The Electrophysiology of Motor Neuron Diseases.
Principal Investigator: Mark B. Bromberg
Direct Costs: $200,000 Total Costs: $283,500
National Institute of Neurological Disorders and Stroke
Role: Co-Investigator

09/01/01 - 07/31/02
The Use of Intraepidermal Nerve Fiber Density Measurement as a Research Tool in Peripheral Neuropathy.
Principal Investigator: A. Gordon Smith
Direct Costs: $31,988 Total Costs: $31,988
University of Utah Research Foundation
Role: Principal Investigator

08/01/02 - 07/30/06
Impaired Glucose Tolerance Causing Neuropathy. R01 NS40458
Principal Investigator: J. Robinson Singleton
Direct Costs: $1,076,525 Total Costs: $1,311,550
National Institute of Neurological Disorders and Stroke
Role: Co-Investigator

04/01/04 - 02/28/08
Cutaneous Measures of Diabetic Neuropathy R01DK064814
Principal Investigator: A. Gordon Smith
Direct Costs: $942,112 Total Costs: $1,401,831
National Institute of Diabetes and Digestive and Kidney Diseases
Role: Principal Investigator

01/01/07 - 12/31/08
Metabolic Syndrome and Reinnervation
Principal Investigator: A. Gordon Smith
Direct Costs: $35,000 Total Costs: $35,000
University of Utah Research Foundation
Role: Principal Investigator

04/15/07 - 03/31/08
2007 International Peripheral Nerve Society Meeting at Snowbird, Utah 1R13NS059289-01
Principal Investigator: A. Gordon Smith
Direct Costs: $28,000 Total Costs: $28,000
National Institute of Neurological Disorders and Stroke
Role: Principal Investigator

09/16/08 - 07/31/13
The Utah Diabetic Neuropathy Study 2R01DK064814-05
Principal Investigator: A. Gordon Smith
Direct Costs: $1,274,059 Total Costs: $2,108,701
National Institute of Diabetes and Digestive and Kidney Diseases
Role: Principal Investigator

01/01/09 - 12/31/11
Peripheral Neuropathy and Metabolic Syndrome: A Lifestyle Intervention Study
Principal Investigator: A. Gordon Smith
Direct Costs: $511,983 Total Costs: $588,780
American Diabetes Association
Role: Principal Investigator

09/01/09 - 08/31/11
Chemotherapy Induced Peripheral Neuropathy in Multiple Myeloma Patients Receiving Total Therapy 3
Principal Investigator(s): J. Robinson Singleton; A. Gordon Smith
University of Utah Neurodegenerative Disease Center
Role: Principal Investigator

05/04/10 - 04/30/11
ARRA Administrative Supplement to Fund Additional Recruitment and Retention Efforts for the UDNS
Principal Investigator(s): J. Robinson Singleton; A. Gordon Smith
National Institute of Diabetes and Digestive and Kidney Diseases
Role: Principal Investigator

03/01/11 - 09/22/11
Corneal Confocal Microscopy as a Research Tool in Peripheral Neuropathy (Research Instrumentation Fund)
Principal Investigator: A. Gordon Smith
Direct Costs: $45,000 Total Costs: $45,000

University of Utah Vice President for Research
Role: Principal Investigator

07/01/11 - 06/30/14 The effect of bariatric surgery on peripheral nerve and axonal regeneration (7-11-AEC-23)
Principal Investigator: A. Gordon Smith
Direct Costs: $521,123 Total Costs: $599,292
American Diabetes Association
Role: Principal Investigator

09/01/11 - 01/31/12 Neurogesx, Inc.
Principal Investigator: A. Gordon Smith
Direct Costs: $19,894 Total Costs: $26,399
NeurogesX, Inc.
Role: Principal Investigator

09/01/11 - 08/31/12 Corneal Confocal Microscopy as a Clinical and Research Tool in Peripheral Neuropathy (Funding Incentive Seed Grant)
Principal Investigator: A. Gordon Smith
Direct Costs: $35,000 Total Costs: $35,000
University of Utah Funding Incentive Seed Grant
Role: Principal Investigator

01/01/12 - 06/30/15 Sudoscan As a Diagnostic and Research Tool for Peripheral Neuropathy
Principal Investigator: A. Gordon Smith
Direct Costs: $204,490 Total Costs: $271,358
Inflexion Point Strategy, LLC
Role: Principal Investigator

05/01/13 - 04/30/14 Personalized Medicine in Peripheral Neuropathy
Principal Investigator: A. Gordon Smith
Direct Costs: $30,000 Total Costs: $30,000
R Harold Burton Foundation
Role: Principal Investigator

Active Contracts

09/01/11 - 06/30/14 3,4 DAPPER: randomized placebo controlled trial of 3,4 diaminopyridine for Lambert Eaton myasthenic syndrome
Principal Investigator: A. Gordon Smith
Direct Costs: $167,527 Total Costs: $222,308
Jacobus Pharmaceutical Company, Inc.
Role: Principal Investigator

08/01/13 - 07/01/15 MYSTICOL - Myobloc for Sialorrhea Treatment with Intraglandular Injection - Controlled and Open Label: A Phase 3, Multicenter, Double-Blind, Placebo-Controlled, Single-Treatment Efficacy and Safety Study of MYOBLOC (SN-SIAL-301)
Principal Investigator: A. Gordon Smith
Direct Costs: $242,100 Total Costs: $321,267
US World Med

Role: Principal Investigator

Past Contracts

07/30/98 - 04/15/01	A 24-Month, Double-Blinded, Randomized, Placebo-Controlled, Fixed-Dose, Parallel-Group, Multicenter Study of Zenarestat (CI-1014) in the Treatment of diabetic Neuropathy. Principal Investigator: Mark B. Bromberg Direct Costs: $250,980 Total Costs: $320,000 Warner-Lambert/Parke-Davis Role: Co-Investigator
10/08/99 - 05/31/01	Magnetic Biostimulation in Painful Diabetic Peripheral Neuropathy. Principal Investigator: Mark B. Bromberg Direct Costs: $35,000 Total Costs: $35,000 Michael I. Weintraub, MD Role: Co-Investigator
04/12/00 - 09/30/02	Safety & Efficacy of ABT-594 to Placebo for Patients with Painful Diabetic Polyneuropathy. Principal Investigator: Mark B. Bromberg Direct Costs: $70,736 Total Costs: $87,936 Abbott Laboratories Role: Co-Investigator
07/01/03 - 06/30/05	A Randomized, Double-Blind, Placebo-Controlled, Dose-Ranging Study to Determine the Safety & Efficacy of Avonex When Used in Subjects With Chronic Inflammatory Demyelinating polyradiculoneuropathy (CIDP). Principal Investigator: Mark B. Bromberg Direct Costs: $33,006 Total Costs: $42,000 Biogen Idec Inc Role: Co-Investigator
07/01/03 - 12/31/06	A Randomized, Double-Blind, Placebo-Controlled, Stratified, Parallel-Group, Multi-Center, Dose-Ranging Study Evaluating Four Oral Doses of TCH346 Administered Once Daily in Patients With Amyotrophic Lateral Sclerosis. Principal Investigator: Mark B. Bromberg Direct Costs: $151,670 Total Costs: $191,612 Novartis Pharmaceuticals Corporation Role: Co-Investigator
06/12/06 - 03/01/08	Bi-axial rotating magnetic field therapy in diabetic peripheral neuropathy Principal Investigator: A. Gordon Smith Direct Costs: $45,000 Total Costs: $45,000 New York University Role: Principal Investigator
05/15/07 - 03/31/08	Double Blind Placebo Controlled Study of Myobloc for Troublesome Siallorhea Due to Parkinson's Disease

Principal Investigator(s): A. Gordon Smith; John D. Steffens
Direct Costs: $26,667 Total Costs: $34,000
Solstice Neurosciences Inc
Role: Principal Investigator

06/01/12 - 05/31/15 A PHASE II, DOUBLE-BLIND, RANDOMIZED, PLACEBO-CONTROLLED, MULTICENTER STUDY TO ASSESS THE SAFETY AND EFFICACY OF VM202 IN SUBJECTS WITH PAINFUL DIABETIC PERIPHERAL NEUROPATHY
Principal Investigator: A. Gordon Smith
Direct Costs: $187,498 Total Costs: $248,810
ViroMed
Role: Principal Investigator

07/01/12 - 05/31/14 VM202 Central Laboratory Contract for Processing Skin Biopsies for IENFD
Principal Investigator: A. Gordon Smith
Direct Costs: $216,100 Total Costs: $286,765
ViroMed
Role: Principal Investigator

Clinical Studies

2008 - Present Clinical versus Neurophysiology Study I and II (Rochester Diabetic Neuropathy Study, Mayo Clinic, Rochester, MN).

TEACHING RESPONSIBILITIES/ASSIGNMENTS

Course and Curriculum Development

1997 - 2004 Director, Clinical Neurology Lecture Series, University of Utah Department of Neurology.

2007 - Present Botox Cervical Dystonia Injection Center (Director)

2009 Organizer & Speaker, Peripheral Neuropathy Society, Peripheral Neuropathy Conference: Neuropathy and You

2010 Planning Committee, Neuropathy Association's Peripheral Neuropathy Summit, Washington D.C.

2011 - Present American Academy of Neurology : On-line Assessment Design Framework Curriculum Design Course Development

Courses Directed

2005 Skin Biopsy for Peripheral Neuropathy, American Academy of Electrodiagnostic Medicine, Monterey California

2006 Neuromuscular Therapy: The Top Ten, The American Academy of Neurology Annual Meeting, San Diego California

2009 Diabetic Neuropathy Case Conference, Peripheral Nerve Society, Wurzburg Germany

2010 Neuromuscular Skills Pavilion: Neuromuscular Bedside Rounds, American Academy of Neurology Annual Meeting, Toronto Canada

2011 Neuromuscular Skills Pavilion, Neuromuscular Bedside Rounds.

	American Academy of Neurology Annual Meeting. Honolulu Hawaii.
2012	Neuromuscular Skills Pavilion, Neuromuscular Bedside Rounds. American Academy of Neurology Annual Meeting. New Orleans LA.
2013	Neuromuscular Skills Pavilion, Neuromuscular Bedside Rounds, American Academy of Neurology Annual Meeting, San Diego California

Course Lectures

1988 - 1992	Lecturer, University of Michigan Medical School. medical student physical examination course
2004	Instructor, NEURO 7020 (1): Neurology OS - Small Groups, University of Utah, Neurology
2004	Instructor, NEURO 7020 (1): Neurology OS - Small Groups 3, University of Utah, Neurology
2004	Instructor, NEURO 7020 (1): Neurology OS - Small Groups 4 - Dementia New cases MID, AD, PD, Depression, University of Utah, Neurology
2004	Instructor, NEURO 7020 (1): Neurology OS - Small Groups, University of Utah, Neurology
2006	Instructor, NEURO 7020 (1): Neurology OS - Small Groups: Cases 2 - 6, University of Utah, Neurology
2006	Instructor, NEURO 7020 (1): Neurology OS - Small Groups, University of Utah, Neurology
2007	Instructor, NEURO 7020(1): Neurology OS - Small Groups, University of Utah, Neurology
2008	Instructor, NEURO 7020(1): Neurology OS - Small Groups, University of Utah, Neurology
2009	Instructor, NEURO 7020(1): Neurology OS - Small Groups, University of Utah, Neurology
2009	Instructor, NEURO 7020 (1): Neurology - Cases Set 1 - 6, University of Utah, Neurology
2009	Instructor, NEURO 7020 (1): Neurology - Small Groups - Cases 2 - 6 - Quiz 1%, University of Utah, Neurology
2009	Instructor, NEURO 7020 (1): Neurology - Cases 4-6 Small Group Dementias, University of Utah, Neurology
2010	Instructor, NEURO 7020 (1): Cases, Small Group Discussions, University of Utah, Neurology

Clinical Teaching

1997 - Present	Clinical teaching for residents and students on the inpatient Neurology service at University of Utah Hospital and the Salt Lake City VA 6-12 weeks/year.
1997 - Present	Clinical teaching for all residents and fellows and selected students rotating on the Neuromuscular Service (neuromuscular clinic and EMG laboratory).
1997 - 2003	General Neurology Resident Continuity Clinic

2000 - Present Clinical teaching in Botulinum Toxin Clinic for all rotating residents, fellows and selected medical students.

Small Group Teaching

1997 - Present Small group leader in second year medical school neuroscience course, University of Utah School of Medicine.
2000 - 2001 Small group leader, Introduction to Medicine course.
2005 - 2007 Clinical Small Group for Graduate Bioengineering Students

Trainee Supervision

Fellow

1997 - 1998 Supervisor, Rob McLaughlin, University of Utah. Neuromuscular Fellow
Trainee's Current Career Activities: Private Practice

1997 - 1998 Supervisor, John Steffens, University of Utah. Neuromuscular Fellow
Trainee's Current Career Activities: Faculty, University of Utah

1998 - 1999 Supervisor, Greg Meekins, University of Utah. Neuromuscular Fellow
Trainee's Current Career Activities: Faculty University of Washington

1998 - 1999 Supervisor, Dennis Obrien, University of Utah. Neuromuscular Fellow
Trainee's Current Career Activities: Private Practice

2000 - 2001 Supervisor, Jun Li, University of Utah. Neuromuscular Fellow
Trainee's Current Career Activities: Faculty, Vanderbilt University

2000 - 2001 Supervisor, Ross Lipton, University of Utah. Neuromuscular Fellow
Trainee's Current Career Activities: Private Practice

2000 - 2002 Supervisor, Victoria Lawson, University of Utah. Neuromuscular Fellow, Special Interest in CMT
Trainee's Current Career Activities: Faculty, Ohio State University

2001 - 2002 Supervisor, David Renner, University of Utah. Neuromuscular Fellow
Trainee's Current Career Activities: Faculty, University of Utah

2002 - 2003 Supervisor, Mouaz Sbei, University of Utah. Neuromuscular Fellow
Trainee's Current Career Activities: Private Practice

2004 - 2005 Supervisor, Elizabeth Sunderman, University of Utah. Neuromuscular Fellow
Trainee's Current Career Activities: Private Practice

2006 - 2007 Supervisor, Jeffrey Wagner, University of Utah. Neuromuscular Fellow
Trainee's Current Career Activities: Faculty, University of Utah

2007 - 2008 Supervisor, Mohammed Shoari, University of Utah. Neuromuscular Fellow
Trainee's Current Career Activities: Private Practice Salt Lake City

2008 - 2009 Supervisor, Jackie Whitesell, University of Utah. Neuromuscular Fellow
Trainee's Current Career Activities: Faculty, University of Utah Department of Neurology

2008 - 2009 Supervisor, Nicole Clark, University of Utah
Trainee's Current Career Activities: Practice, Helena Montana
2009 - 2010 Supervisor, Mengjing Huan, University of Utah
Trainee's Current Career Activities: Private Practice, Salt Lake City, Utah
2009 - 2010 Supervisor, Peter Masny, University of Utah
Trainee's Current Career Activities: Practice, California
2011 - 2012 Supervisor, Lia Chebeleu, University of Utah. Neuromuscular Fellow
Trainee's Current Career Activities: Private Practice
2011 - 2012 Supervisor, Emma Burbank, University of Utah. Neuromuscular Fellow
Trainee's Current Career Activities: Private Practice, Oregon
2012 - 2013 Supervisor, Summer Gibson, University of Utah. Neuromuscular Fellow
Trainee's Current Career Activities: Assistant Professor of Neurology University of Utah
2012 - 2013 Supervisor, Noah Kolb, University of Utah. Neuromuscular Fellow
Trainee's Current Career Activities: Assistant Professor of Neurology University of Utah
2013 - 2014 Supervisor, Payam Soltanzadeh, University of Utah. Neuromuscular Fellow
Trainee's Current Career Activities: Staff Cleveland Clinic
2014 - 2015 Supervisor, Christopher Muth, University of Utah. Neuromuscular Fellow
2014 - 2015 Supervisor, Ligia Onofrei, University of Utah. Neuromuscular Fellow
2015 - 2016 Supervisor, Kelsey Juster-Switlyk, University of Utah. Neuromuscular Fellow
2015 - 2016 Supervisor, Yoonhee Hong-Choi, University of Utah. Neuromuscular Fellow
2016 Supervisor, Patrick Nicholson, University of Utah. Neuromuscular

MD, PhD
2001 - 2003 Supervisor, Shawn Smith, University of Utah.
2005 - 2008 Supervisor, Kristi Rose, University of Utah

Medical Student
2012 Supervisor, Ryan Brinn, University of Utah
2016 Supervisor, Joshua Winegar, University of Utah
2016 Supervisor, Melanie Torres, University of Puerto Rico

High School
2011 Supervisor, Grace Hunt, University of Utah. Neuroscience Summer Student

Educational Lectures

Didactic Lectures

1997 - Present Lecturer in the Clinical Neurophysiology Lecture Series, University of Utah, Department of Neurology.

2004 - Present Peripheral Neuropathy, PMR Resident Lecture Series

Continuing Education

CE Courses Developed

2010 Spasticity Pain and Dystonia, University of Utah Departments of PMR, Neurology and Anesthesiology

CE Courses Taught

2004 Peripheral Neuropathy Update, Update in Internal Medicine, Park City Utah

2007 Update on Peripheral Neuropathy, Internal Medicine Update, Park City Utah

2009 Peripheral Neuropathy, Diabetes Educators of Utah, Snowbird, Utah

Other Educational Activities

2007 Director Cervical Dystonia Injection Center

2009 Residents and Fellows Career Forum Fellowship Panel Member, American Academy of Neurology Annual Meeting, Seattle Washington

2009 Dystonia Injection Workshop Faculty Member

2010 Residents and Fellows Career Forum Fellowship Panel Member, American Academy of Neurology Annual Meeting, Toronto Canada

2010 Dystonia Injection Workshop Faculty Member

2011 Moderator, Residents and Fellows Career Forum Fellowship Panel, American Academy of Neurology Annual Meeting, Honolulu Hawaii

2011 American Academy of Neurology Assessment Design Framework Model (ADFM) Workshop for NeuroLearn Faculty

2012 American Academy of Neurology Assessment Design Framework Model (ADFM) Workshop for NeuroLearn Faculty

PEER-REVIEWED JOURNAL ARTICLES

1. Windebank AJ, **Smith AG**, Russell JW (1994). The effect of nerve growth factor, ciliary neurotrophic factor, and ACTH analogs on cisplatin neurotoxicity in vitro. *Neurology*, *44*(3 Pt 1), 488-94.
2. **Smith AG**, Wald J (1996). Acute ventilatory failure in Lambert-Eaton myasthenic syndrome and its response to 3,4-diaminopyridine. *Neurology*, *46*(4), 1143-5.
3. **Smith AG**, Albers JW (1997). n-Hexane neuropathy due to rubber cement sniffing. *Muscle Nerve*, *20*, 1445-50.
4. **Smith AG**, Cornblath WT, Deveikis JP (1997). Local thrombolytic therapy in deep cerebral venous thrombosis. *Neurology*, *48*, 1613-9.
5. **Smith AG**, Bromberg MB, Singleton JR, Forshew DA (1999). The use of "clinic

room" presentation as an educational tool in the ambulatory care setting. *Neurology*, *52*(2), 317-20.
6. Bromberg MB, **Smith AG**, Bauerle J (1999). A comparison of two commercial quantitative electromyographic algorithms with manual analysis. *Muscle Nerve*, *22*(9), 1244-8.
7. Entezari-Taher M, Singleton JR, Jones CR, Meekins G, Petajan JH, **Smith AG** (1999). Changes in excitability of motor cortical circuitry in primary restless legs syndrome. *Neurology*, *53*(6), 1201-5.
8. Carey MJ, **Smith AG**, Townsend JJ (2000). Pathologic quiz case: progressive diffuse weakness after chemotherapy for large cell lymphoma in a middle age woman. Lymphomatous meningitis with neurolymphomatosis. *Arch Pathol Lab Med*, *124*, 645-6.
9. **Smith AG**, Urbanits S, Blaivas M, Grisold W, Russell JW (2000). Clinical and pathologic features of focal myositis. *Muscle Nerve*, *23*(10), 1569-75.
10. **Smith AG** (2001). Charcot-Marie-tooth disease. *Arch Neurol*, *58*(6), 1014-6.
11. Singleton JR, **Smith AG**, Bromberg MB (2001). Increased prevalence of impaired glucose tolerance in patients with painful sensory neuropathy. *Diabetes Care*, *24*(8), 1448-53.
12. Moore KR, Blumenthal DT, **Smith AG**, Ward JH (2001). Neurolymphomatosis of the lumbar plexus: high-resolution MR neurography findings. *Neurology*, *57*(4), 740-2.
13. Singleton JR, **Smith AG**, Bromberg MB (2001). Painful sensory polyneuropathy associated with impaired glucose tolerance. *Muscle Nerve*, *24*(9), 1225-8.
14. **Smith AG**, Ramachandran P, Tripp S, Singleton JR (2001). Epidermal nerve innervation in impaired glucose tolerance and diabetes-associated neuropathy. *Neurology*, *57*(9), 1701-4.
15. Li J, Petajan J, Smith G, Bromberg M (2002). Electromyography of sternocleidomastoid muscle in ALS: a prospective study. *Muscle Nerve*, *25*(5), 725-8.
16. Lawson VL, **Smith AG**, Bromberg MB (2003). Assessment of axonal loss in Charcot Marie Tooth neuropathies. *Exp Neurol*, *184*(2), 753-7.
17. Bonkowsky JL, Johnson J, Carey JC, **Smith AG**, Swoboda KJ (2003). An infant with primary tooth loss and palmar hyperkeratosis: a novel mutation in the NTRK1 gene causing congenital insensitivity to pain with anhidrosis. *Pediatrics*, *112*(3 Pt 1), e237-41.
18. **Smith AG**, Singleton JR (2004). The diagnostic yield of a standardized approach to idiopathic sensory-predominant neuropathy. *Arch Intern Med*, *164*(9), 1021-5.
19. **Smith AG**, Howard JR, Kroll R, Ramachandran P, Hauer P, Singleton JR, McArthur J (2005). The reliability of skin biopsy with measurement of intraepidermal nerve fiber density. *J Neurol Sci*, *228*(1), 65-9.
20. **Smith AG**, Singleton JR (2006). Idiopathic neuropathy, prediabetes and the metabolic syndrome. *Journal of Neurological Sciences*, (242), 9-14.
21. Singleton JR, **Smith AG** (2006). Therapy insight: neurological complications of prediabetes. *Nat Clin Pract Neurol*, *2*(5), 276-82.
22. **Smith AG**, Russell J, Feldman EL, Goldstein J, Peltier A, Smith S, Hamwi J, Pollari D, Bixby B, Howard J, Singleton JR (2006). Lifestyle intervention for pre-diabetic

neuropathy. *Diabetes Care*, *29*(6), 1294-9.
23. Sampson JB, Smith SM, **Smith AG**, Singleton JR, Chin S, Pestronk A, Flanigan KM (2007). Paraneoplastic myopathy: response to intravenous immunoglobulin. *Neuromuscul Disord*, *17*(5), 404-8.
24. Orme HT, **Smith AG**, Nagel MA, Bert RJ, Mickelson TS, Gilden DH (2007). VZV spinal cord infarction identified by diffusion-weighted MRI (DWI). *Neurology*, *69*(4), 398-400.
25. Singleton JR, **Smith AG** (2007). Neuropathy associated with prediabetes: what is new in 2007? *Curr Diab Rep*, *7*(6), 420-4.
26. **Smith AG**, Singleton JR (2008). Impaired glucose tolerance and neuropathy. *Neurologist*, *14*(1), 23-9.
27. Feldman EL, Cornblath DR, Porter J, Dworkin R, Scherer S, Attendees of the NIH Peripheral Neuropathy Conference (2008). National Institute of Neurological Disorders and Stroke (NINDS): advances in understanding and treating neuropathy, 24-25 October 2006; Bethesda, Maryland. *J Peripher Nerv Syst*, *13*(1), 1-6.
28. Singleton JR, Bixby B, Russell JW, Feldman EL, Peltier A, Goldstein J, Howard J, **Smith AG** (2008). The Utah Early Neuropathy Scale: a sensitive clinical scale for early sensory predominant neuropathy. *J Peripher Nerv Syst*, *13*(3), 218-27.
29. Shprecher DR, Flanigan KM, **Smith AG**, Smith SM, Schenkenberg T, Steffens J (2008). Clinical and diagnostic features of delayed hypoxic leukoencephalopathy. (PMID: 19196933). *J Neuropsychiatry Clin Neurosci*, *20*(4), 473-7.
30. **Smith AG**, Rose K, Singleton JR (2008). Idiopathic neuropathy patients are at high risk for metabolic syndrome. *J Neurol Sci*, *273*(1-2), 25-8.
31. Peltier A, **Smith AG**, Russell JW, Sheikh K, Bixby B, Howard J, Goldstein J, Song Y, Wang L, Feldman EL, Singleton JR (2009). Reliability of quantitative sudomotor axon reflex testing and quantitative sensory testing in neuropathy of impaired glucose regulation. *Muscle Nerve*, *39*(4), 529-35.
32. Blackburn MK, Lamb RD, Digre KB, **Smith AG**, Warner JE, McClane RW, Nandedkar SD, Langeberg WJ, Holubkov R, Katz BJ (2009). FL-41 tint improves blink frequency, light sensitivity, and functional limitations in patients with benign essential blepharospasm. *Ophthalmology*, *116*(5), 997-1001.
33. Weintraub MI, Herrmann DN, **Smith AG**, Backonja MM, Cole SP (2009). Pulsed electromagnetic fields to reduce diabetic neuropathic pain and stimulate neuronal repair: a randomized controlled trial. *Arch Phys Med Rehabil*, *90*(7), 1102-9.
34. Lauria G, Hsieh ST, Johansson O, Kennedy WR, Leger JM, Mellgren SI, Nolano M, Merkies IS, Polydefkis M, **Smith AG**, Sommer C, Valls-Sole J (2010). European Federation of Neurological Societies/Peripheral Nerve Society Guideline on the use of skin biopsy in the diagnosis of small fiber neuropathy. Report of a joint task force of the European Federation of Neurological Societies and the Peripheral Nerve Society. *Eur J Neurol*, *17*(7), 903-12, e44-9.
35. Dyck PJ, Overland CJ, Low PA, Litchy WJ, Davies JL, Dyck PJ, O'Brien PC, Albers JW, Andersen H, Bolton CF, England JD, Klein CJ, Llewelyn JG, Mauermann ML, Russell JW, Singer W, **Smith AG**, Tesfaye S, Vella A (2010). Signs and symptoms versus nerve conduction studies to diagnose diabetic sensorimotor polyneuropathy: CI vs. NPhys trial. *Muscle Nerve*, *42*(2), 157-64.

36. Lauria G, Bakkers M, Schmitz C, Lombardi R, Penza P, Devigili G, **Smith AG**, Hsieh ST, Mellgren SI, Umapathi T, Ziegler D, Faber CG, Merkies IS (2010). Intraepidermal nerve fiber density at the distal leg: a worldwide normative reference study. *J Peripher Nerv Syst*, *15*(3), 202-7.
37. Tesfaye S, Boulton AJ, Dyck PJ, Freeman R, and the Toronto Consensus Conference (2010). Diabetic neuropathies: update on definitions, diagnostic criteria, estimation of severity, and treatments. *Diabetes Care*, *33*(10), 2285-2293.
38. Joint Task Force of the EFNS and the PNS (2010). European Federation of Neurological societies/Peripheral Nerve Society Guideline on the use of skin biopsy in the diagnosis of small fiber neuropathy. Report of a joint task force of the European Federation of Neurological Societies and the Peripheral Nerve Society. *J Peripher Nerv Syst*, *15*, 79-92.
39. Zilliox L, Peltier AC, Wren PA, Anderson A, **Smith AG**, Singleton JR, Feldman EL, Alexander NB, Russell JW (2011). Assessing autonomic dysfunction in early diabetic neuropathy: the Survey of Autonomic Symptoms. *Neurology*, *76*(12), 1099-105.
40. Dyck PJ, Albers JW, Andersen H and the Toronto Consensus Group (2011). Diabetic polyneuropathies (DPNs): update on research definition, diagnositc criteria and estimation of severity. *Diabetes Metab Res Rev*, *27*(7), 620-628.
41. Malik R, Veves A, Tesfaye S, **Smith AG**, CameronN, Zochodne D, Lauria G. on behalf of The Toronto Consensus Panel on Diabetic Neuropathy (2011). Small fiber neuropathy role in the diagnosis of DSPN. *Diabetes Metab Res Rev*, *27*(7), 674-684.
42. Tesfaye S, Vileikyte L, Rayman G, Sindrup SH, Perkins, BA, Baconja J, Vinik AI, Boulton AJM, on behalf of The Toronto Expert Panel on Diabetic Neuropathy (2011). Painful diabetic peripheral neuropathy: consensus recommendations on diagnosis, assessment and management. *Diabetes Metab Res Rev*, *27*(7), 629-638.
43. French KF, Hoesch RE, Allred J, Wilder M, **Smith AG**, Digre KB, La Barge DV 3rd (2012). Repetitive use of intra-arterial verapamil in the treatment of reversible cerebral vasoconstriction syndrome. *J Clin Neurosci*, *19*(1), 174-6.
44. **Smith AG** (2012). Diagnosis of neuropathy: comment on "tests and expenditures in the initial evaluation of peripheral neuropathy". *Arch Intern Med*, *172*(2), 132-3.
45. **Smith AG** (2012). Neuromuscular therapy from bench to bedside. *Semin Neurol*, *32*(3), 171-2.
46. Singleton JR, **Smith AG** (2012). The diabetic neuropathies: practical and rational therapy. *Semin Neurol*, *32*(3), 196-203.
47. Boger MS, Hulgan T, Haas DW, Mitchell V, **Smith AG**, Singleton JR, Peltier AC (2012). Measures of small-fiber neuropathy in HIV infection. *Auton Neurosci*, *169*(1), 56-61.
48. **Smith AG**, Marcus R (2012). Exercise for diabetic neuropathy: A toe in the therapeutic door. *J Diabetes Complications*, *26*(5), 361-2.
49. Burns TM, **Smith AG** (2012). "Measure twice, cut once": improving diagnostic accuracy of skin biopsy. (PMID: 23100394). *Neurology*, *79*(22), 2164-5.
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63. Hamid HS, Hayes JM, Robell NJ, Porzio M, Singleton JR, **Smith AG**, Lentz SI, Feldman EL (2010). *Alterations in mitochondrial dynamics within intraepidermal nerve fibers associated with the progression of diabetic neuropathy* [Abstract]. *Annals of Neurology*.
64. Zilliox L, Peltier A, Wren PA, Anderson A, **Smith AG**, Singleton JR, Feldman E,

Alexander NB, Russell JW (2011). *Assessing Autonomic Dysfunction in Early Diabetic Neuropathy: The Survey of Autonomic Symptoms (SAS)* [Abstract]. *CR01 2011 Boston: 18th Conference on Retroviruses and Opportunistic Infections*.

65. Singleton JR, Arsenault C, Porzio M, Wange H, **Smith AG** (2011). *Early decline in intraepidermal nerve fiber density predicts progression to symptomatic neuropathy in patients with diabetes* [Abstract]. *Neurology*.
66. Arsenault C, Sinlgeton JR, Porzio M, Wang H, **Smith AG** (2011). *Nerve regenerative capacity in diabetes and metabolic syndrome* [Abstract]. *Neurology*.
67. Singleton JR, Latner C, Arsenault CJ, Porzio MT, **Smith AG** (2011). *Accelerated intraepidermal nerve fiber density (IENFD) decline precedes progression to neuropathic symptoms in patients with diabetes* [Abstract]. *Diabetes*, *60*(S1).
68. Singleton JR, Marcus R, Arsenault CJ, Porzio MT, Cameron JM, **Smith AG** (2011). *Weight loss and lowered triglycerides improves cutaneous re-innervation in non-neuropathic subjects with diabetes or prediabetes* [Abstract]. *Diabetes*, *60*(S1).
69. **Smith AG**, Singleton JR (2011). *Early loss of epidermal nerve fibers in asymptomatic subjects predicts future development of symptomatic diabetic neuropathy* [Abstract]. *Journal of the Peripheral Nervous System*.
70. Gibbons CH, Lafo J, **Smith AG**, Singleton JR, Freeman R (2011). *The quantification of sudomotor nerve fibers: a multicenter study in diabetes* [Abstract]. *Journal of the Peripheral Nervous System*.
71. Zilliox LA, Peltier AC, Wren PA, Anderson A, **Smith AG**, Singleton JR, Feldman EL, Alexander NB, Russell JW (2011). *Assessing autonomic dysfunction in early diabetic neuropathy: the survey of autonomic symptoms* [Abstract]. *Journal of the Peripheral Nervous System*.
72. Cheng HT, Dauch JR, **Smith AG**, Singleton JR, Yanik BM, Feldman EL (2011). *Characterization of intraepidermal nerve fiber morphology in pain associated with diabetic neuropathy and impaired glucose tolerance* [Abstract]. *Journal of the Peripheral Nervous System*.
73. Hamid HS, Hayes JM, Robell NJ, Porzio M, Singleton JR, **Smith AG**, Lentz SI, Feldman EL (2011). *Quantifying changes in mitochondria within human intraepidermal nerve fibers associated with diabetes and diabetic peripheral neuropathy* [Abstract]. *Journal of the Peripheral Nervous System*.
74. **Smith AG**, Singleton JR, Chung L, Burbank E, Afra P, Hoesch R, Ledyard H, Dolan C, Smith S (2012). *Clinical and Electrodiagnostic Features of an Outbreak of Foodborne Botulism Due to Home-Brew Alcohol among Prisoners* [Abstract]. *The American Academy of Neurology*.
75. **Smith AG**, Leonard M, Gerardi R, Porzio M, Kim G, Digre K, Mifline M, Keung B, Singleton JR (2013). *Corneal Confocal Microscopy (CCM) is a sensitive measure of early diabetic neuropathy* [Abstract]. *Journal of the Peripheral Nervous System*.
76. **Smith AG**, Gerardi R, Lessard M, Reyna SP, Singleton JR (2013). *Sudoscan as a diagnostic tool for peripheral neuropathy* [Abstract]. *Journal of Peripheral Nervous System*.
77. **Smith AG**, and Singleton JR (2013). *Corneal Confocal Microscopy as surrogate measure of diabetic neuropathy* [Abstract]. *Annals of Neurology*.
78. Singleton JR, Marcus R, **Smith AG** (2013). *Weight loss and lowered glucose*

improve cutaneous reinnervation in non-neuropathic subjects with diabetes or prediabetes [Abstract]. *Journal of Peripheral Nervous System*.

79. Boger MS, Hulgan TM, Wang L, **Smith AG**, Singleton JR, Peltier AC (2013). *Comparison of quantitative sudomotor axon reflex test, Utah early neuropathy score, and skin biopsy in detecting neuropathy in HIV-infected persons receiving antiretroviral therapy* [Abstract]. *Neurology*, *169*(1), 56-61.
80. **Smith AG**, Kim G, Keung B, Allen B, Porzio M, Latner C, Singleton JR (2012). *The reliability of corneal nerve fiber assessment using corneal confocal microscopy* [Abstract]. *Neurology*.
81. **Smith AG**, Kim G, Porzio M, Alen B, Digre, K, Mifflin M, Singleton JR (2013). *Confocal microscopy is a reliable measure of corneal innervation* [Abstract]. *Annals of Neurology*.
82. Chenge H, Dauch JR, Porzio M, Yanik BM, Hsieh W, **Smith AG**, Singleton JR, Feldman E (2012). *Useful biomarkers for the diagnosis of painful diabetic neuropathy* [Abstract]. *Neurology*.
83. Singleton JR, Marcus R, Arsenault CJ, Porzio M, Jackson JE, **Smith AG** (2012). *Metabolic syndrome reduces cutaneous nerve regenerative capacity* [Abstract]. *Annals of Neurology*.
84. Nevoret ML, Vinik A, **Smith AG**, Freedman B, Singleton JR (2014). *Sudoscan: An alternative tool in the understanding of the microvascular complications of diabetes* [Abstract]. *American Academy of Clinical Endocrinology*.
85. Singleton JR, Volckmann E, Graham T, **Smith AG** (2014). *[I6-1.008] Neuropathy Associated with Nondiabetic Obesity* [Abstract]. *Neurology*.
86. **Smith AG**, Lessard M, Singleton JR (2014). *[P7.003] Sudoscan as a Diagnostic Tool for Diabetic and Idiopathic Peripheral Neuropathy* [Abstract]. *Neurology*.
87. Hannon PM, Austin J, McCauley M, Smith D, **Smith AG**, Salari A, Majersik JJ (2014). *Telestroke: Expanding Access and Coordination of Care From Acute Stroke to Follow-up* [Abstract]. *Poster Session at AHA/ASA Quality of Care and Outcomes Research (QCOR) Meeting 2014, Baltimore, MD*.
88. Kolb N, **Smith AG**, Singleton JR, Brown SM, Wong B, Dunson WA, Wujcik D, Beck SL, Mooney KF (2015). *A novel evidenced based phone system reduces symptoms of chemotherapy induced neuropathy* [Abstract]. *Neurology*.
89. Kolb N, **Smith AG**, Singleton JR, Brown SM, Wong B, Beck SL, Mooney KF (2015). *Neuropathy symptoms are associated with increased fall risk in patients receiving potentially neurotoxic chemotherapy [P7.082]* [Abstract]. *Neurology*, *84*(14).
90. **Smith AG**, Lessard M, Singleton JR (2015). *The diagnostic utility of nerve conduction studies and skin biopsy for diabetic neuropathy: a Bayesian analysis (S42.007)* [Abstract]. *Neurology*, *84*(14).
91. Ajroud-Driss S, Vinik AI, **Smith AG**, Cha B-S, Choi SH, Wymer JP, Shaibani A, Kessler JA, and the VM202 DPN-II Study Group (2015). *Double-blind, placebo-controlled study of hepatocyte growth factor gene therapy in painful diabetic neuropathy* [Abstract]. *The Journal of Peripheral Nervous System*.
92. Kolb N, Brown SM, Singleton JR, **Smith AG** (2015). *The impact of neuropathy severity of neurotoxic chemotherapy dose modification* [Abstract]. *The Journal of Peripheral Nervous System*.

93. Baets J, Duan X, Wu Y, **Smith AG**, Seeley W, Mademan I, McGrath NM, Beadell NC, Khoury J, Botuyan M-V, Mer G, Worrell GA, Hojo K, DeLeon J, Laura M, Liu Y-T, Senderek JP, Weis J, Van den Bergh P, Merrill SL, Reilly MM, Houlden H, Grossman M, Scherer SS, De Jonghe P, Dyck PJ, Klein CJ (2015). *Defects of mutant DNMT1 are linked to a spectrum of neurological disorders* [Abstract]. *The Journal Peripheral Nervous System*.
94. Kolb N, Brown SM, Wang V, Wong B, Beck SL, Mooney K, Singleton JR, **Smith AG** (2015). *The association between chemotherapy induced peripheral neuropathy related numbness and tingling and falls in cancer patients* [Abstract]. *The Journal of Peripheral Nervous System*.
95. **Smith AG**, Volkmann E, Graham T, Solis V, Singleton JR (2015). *Neuropathy risk among bariatric surgery candidates* [Abstract]. *The Journal of Peripheral Nervous System*.
96. Ajroud-Driss S, Simpson D, **Smith AG**, Freeman RL, Hoke A (2015). *Peripheral neuropathy research registry* [Abstract]. *The Journal of Peripheral Nervous System*.
97. Brown SM, Wang V, **Smith AG**, Singleton R, Kolb N (2015). *A prospective study examining the association of paclitaxel acute pain syndrome and chemotherapy induced peripheral neuropathy [P0053]* [Abstract]. *Translational Cancer Epidemiology: From Cells To Clinic And Population*.
98. Daniel C, Abenroth A, **Smith AG**, Greenlee JE, Clardy SL (2015). *Lambert-Eaton Myasthenic Syndrome: Epidemiology and Therapeutic Response in the National Veteran Affairs (VA) Population* [Abstract]. *Annals of Neurology*, *78*(S19), 10.
99. Sanders DB, Juel VC, Harratt Y, **Smith AG**, Peltter A, Marburger T, Lou J-S, Pascuzzi RM, Richman DP, Xte T, Jacobus LR, Ales KL, Jacobus DP, DAPPER Study Team (2015). *Results From the Dapper Study: Inpatient Double-Blinded Placebo-Controlled Withdrawal Study of 3,4-Diaminopyridine Base (3,4-DAP) in Subjects with Lambert-Eaton Myasthenic Syndrome (LEMS)* [Abstract]. *AANEM*.
100. Abenroth D, **Smith AG**, Greenlee J, Clardy S (2015). *Epidemiology of Lambert-Eaton Myasthenic Syndrome in the Veterans Affairs Population* [Abstract]. *AANEM*.
101. Sanders DB, Juel VC, Harati Y, **Smith AG**, Peltier A, Marburger T, Lou JS, Pascuzzi RM, Richman DP, Xie T, Jacobus LR, Alex KL, Jacobus DP, DAPPER Study Team (2015). *Results of a Double-Blind Placebo-Controlled Study of 3,4-Diaminopyridine (DAP) in Lambert-Eaton Myasthenic Syndrome (LEMS)* [Abstract]. *Annals of Neurology*, *78*(S19), 16.
102. Kolb NA, Singleton JR, Brown SM, Curtin K, **Smith AG** (2015). *Prevalence of Chemotherapy Induced Peripheral Neuropathy (CIPN)* [Abstract]. *Annals of Neurology*, *78*(S19), 10.
103. Ajroud-Dris S, Vinik A, **Smith AG**, Cha BS, Choi SH, Whymer J, Shaibani A, Kessler JA, VM202 DPN-II Study Group (2015). *Double-Blind, Placebo-Controlled Study of Hepatocyte Growth Factor Gene Therapy in Painful Diabetic Neuropathy* [Abstract]. *Ann Neurol*, *78*(S19), 15.
104. Thakkar N, Peloquin C, Ales K, Jacobus D, Jacobus L, Cohen-Wolkowiez M, Guptill J.T., Gonzalez D, for the DAPPER Study Group, University of North Carolina at Chapel Hill, Chapel Hill, NC, University of Florida, Gainsville, FL,

Jacobus Pharmaceutical Company, Inc., Plainsboro NJ, Duke Clinical Research Institute, Durham NC, Duke University, Department of Neurology, Durham NC, DAPPER Study Group site investigators: Juel VC, Harati Y, **Smith AG**, Peltier A, Lou J-S, Marbuger T, Pacuzzi RM, Richman DP (2016). *Population Pharmacokinetics/Pharmacodynamics of 3,4-Diaminophridine Free Base In Patients with Lambert-Eaton Myasthenic Syndrome* [Abstract].

105. O'Donnell s, Majersik J, Chung L, **Smith AG**, Dunleavy B, deHavenon A (2016). *CT-Based Collateral Scoring Can Predict Ischemic Penumbra Volume in Acute Ischemic Storke [P2.330]* [Abstract]. *American Academy of Neurology, 2016 Annual Meeting, Vancouver, BC*.
106. **Smith AG**, Graham T, Volckmann E, Hauer P, Aperghis A, Solis V, Singleton J (2016). *Bariatric Surgery Improves Peripheral Nerve Function and Intraepidermal Nerve Fiber Density in Obese Patients without Symptomatic Neuropathy [P1.44]* [Abstract]. *American Academy of Neurology, 2016 Annual Meeting, Vancouver BC,*.
107. deHavenon A, O'Donnell S, Wang H, Chung L, **Smith AG**, Majersik J (2016). *A Comparison of Three Different CTA Collateral Scoring Systems' Ability to Predict MR Lesion Volume and Outcome after Ischemic Stroke [P6.010]* [Abstract]. *American Academy of Neurology, 2016 Annual Meeting, Vancouver, BC*.
108. **Smith AG**, Kowalsky G, Hauer P, Aperghis A, Singleton J (2016). *The Diagnostic Performance and Clinical Relevance of Corneal Confocal Microscopy (CCM) in Patients with Diabetic Peripheral Neuropathy [S44.001]* [Abstract]. *American Academy of Neurology, 2016 Annual Meeting, Vancouver, BC*.
109. Kolb N, Brown S, Singleton J, **Smith AG** (2016). *Carefully Phenotyped Changes in Neuropathy Measures with Exposure to Neurotoxic Chemotherapy [P4.231]* [Abstract]. *American Academy of Neurology, 2016 Annual Meeting, Vancouver, BC*.
110. Brown S, **Smith AG**, Singleton JR, Kolb N (2016). *The Clinical Phenotyped and Neuropathic Outcomes of Paclitaxel-Acute Pain Syndrome [P4.233]* [Abstract]. *American Academy of Neurology, 2016 Annual Meeting, Vancouver, BC*.

ORAL PRESENTATIONS

Keynote/Plenary Lectures

International

2012	Why do therapies that work in rodent models fail to do so in humans? Innovative Therapies for Peripheral Neuropathies, the 2012 Foundation for Peripheral Neuropathy International Research Symposium
2012	Measurement of Painful Neuropathy--Correlations of Nerve Conduction Velocity, Skin Biopsy and Nerve Biopsy, and Corneal Nerve Measurements. American Diabetes Association Scientific Meetings, Philadelphia PA
2014	Advances in the diagnosis and clinical interventions for metabolic neuropathy, International Congress on Neuromuscular Diseases, Nice France

National

2009	Speaker & Organizer, Peripheral Neuropathy Society, Peripheral Neuropathy Conference: Neuropathy and You
2010 - Present	Impaired Glucose Tolerance and Neuropathy, The Neuropathy Association, Peripheral Neuropathy Summit, Washington D.D.

Local/Regional

2009	Therapeutic Development for Diabetic Neuropathy, Western Intermountain Neurological Organization, Salt Lake City Utah

Meeting Presentations (Not Published Abstracts and Not Unpublished Posters)

International

2001	A Diagnostic Approach to Peripheral Neuropathy, American Academy of Neurology Peripheral Neuropathy Course, Philadelphia PA
2001	Motor Unit Number Estimation and Strength Correlates, First International Symposium on MUNE, Snowbird, UT
2005	The effect of diet and exercise on neuropathy progression in subjects with impaired glucose tolerance, Peripheral Nerve Society, Tuscany Italy
2009	Early diabetic neuropathy is characterized by progressive small fiber loss, Meeting of the Peripheral Nerve Society, Wurzberg, Germany
2012	Diabetic Neuropathies. Peripheral Neuropathy Course. American Academy of Neurology Annual Meeting. New Orleans LA.
2013	Inclusion Exclusion Criteria. Food and Drug Administration Peripheral Neuropathy Consensus Meeting
2013	Neuromuscular Update. Neurology Update. American Academy of Neurology Annual Meeting, San Diego California
2014	Therapy in Neurology: Neuromuscular, American Academy of Neurology Annual Meeting, Philadelphia, PA
2014	Neurology Update II: Neuromuscular, American Academy of Neurology Annual Meeting, Philadelphia, PA
2015	Peripheral Neuropathies - Diabetic Neuropathy. American Academy of Neurology Annual Meeting. Washington, DC.
2015	Diagnosis of Small Fiber Neuropathy: Pearls and Pitfalls of Skin Biopsy as a Diagnostic Test. American Association of Neuromuscular and Electrodiagnostic Medicine Annual Meeting. Honolulu, HI.
2015	Population Screening for Diabetic Neuropathy: Has Its Time Arrived?, American Association of Neuromuscular and Electrodiagnosis Medicine Annual Meeting, Honolulu, HI
2016	Plenary Session: Neurology Year in Review, Neuromuscular, American Academy of Neurology Annual Breakthroughs in Neurology Conference, Orlando, FL.
2016	AAN/ABPN Maintenance of Certification Informational Session, American Academy of Neurology, Breakthroughs in Neurology

Conference, Orlando, FL.

2016 The Diagnostic Performance and Clinical Relevance of Corneal Confocal Microscopy (CCM) in Patients with Diabetic Peripheral Neuropathy. American Academy of Neurology, Annual Meeting, Vancouver, Canada

National

2000 The Effect of Electrode Size on Nerve Conduction Study Reproducibility, American Academy of Electrodiagnostic Medicine, Philadelphia PA

2001 A Prospective Evaluation of a Standardized Approach to Peripheral Neuropathy, American Academy of Neurology, Philadelphia PA

2001 A quantitative analysis of spinal accessory nerve function following neck dissection. American Academy of Electrodiagnostic Medicine, Albuquerque, NM

2002 The Reliability of Skin Biopsy with Measurement of Intraepidermal Nerve Fiber Density, American Academy of Neurology, Denver CO

2003 A Diagnostic Approach to Peripheral Neuropathy, American Academy of Neurology Peripheral Neuropathy Course, Honolulu HI

2004 A Diagnostic Approach to Peripheral Neuropathy, American Academy of Neurology, Peripheral Neuropathy Course, San Francisco CA

2005 The Utah Early Neuropathy Scale Is a Sensitive Measure of Early Neuropathy Associated with Impaired Glucose Tolerance, American Academy of Neurology, Miami Beach Florida

2005 The Efficacy of a Practical Diet and Exercise Counseling Regimen on Metabolic Parameters and Neuropathy Progression in Patients with Impaired Glucose Tolerance and Neuropathy, American Academy of Neurology, Miami Beach Florida

2006 Increased prevalence of metabolic syndrome in peripheral neuropathy, American Academy of Neurology, San Diego CA

2006 Diet and exercise result in epidermal reinnervation in impaired glucose tolerance neuropathy, American Academy of Neurology, San Diego California

2007 Counting Rules Count: Effects of Counting Criteria on Quantitation of Capsaicin-Induced Epidermal Denervation. American Academy of Neurology Annual Meeting, Portland, Oregon

2008 Diagnosis of early diabetic neuropathy, American Academy of Neurology Annual Meeting, Chicago, Illinois

2008 Skin biopsy is a highly sensitive measure of early diabetic neuropathy progression, American Academy of Neurology Annual Meeting, Chicago, Illinois

2010 The Effect of Lifestyle Intervention on Nerve Regeneration in Metaboloc Syndrome, American Academy of Neurology, Toronto, Canada

2012 Neuromuscular Emergencies. Brainstorm. Park City Utah

2012 Neuromuscular Update. American Academy of Neurology Fall Meeting. Las Vegas, Nevada

Local/Regional

1998 Current Thought in Diabetic Neuropathy. Western Intermountain Neurologic Organization (WINO) biannual meeting

2001 The Therapeutic Use of Botulinum Toxin, Western Intermountain Neurologic Organization biannual meeting

2005 Post Polio Syndrome, Western Intermountain Neurologic Organization, Salt Lake City Utah

2012 NOMAD - NeuroNEXT

2015 Continuum: Test Your Knowledge: A Multiple Choice Question Review, American Academy of Neurology Fall Conference, Las Vegas, NV

2015 Neurology Update III: Neuro-Infectious Disease, Neuro-Ophthalmology and Neuromuscular Disease, American Academy of Neurology Fall Conference, Las Vegas, NV

Invited/Visiting Professor Presentations

International

2012 Impaired Glucose Tolerance and Neuropathy: smoking gun, guilt by association or therapeutic window. University of Toronto, Citywide Endocrinology Rounds

2015 Painful generalized diabetic polyneuropathy. AAPT Neuropathic Pain, Copenhagen, Denmark

2016 New Strategies to Treat or Prevent Diabetic Neuropathy, 59th Annual Meeting of
Diabetes Society

National

1997 Toxic neuropathy. Grand rounds, Creighton University, Omaha Nebraska

1997 Models of neurotoxicity. Grand rounds, State University of New York (SUNY) Stonybrook

2002 A Diagnostic Approach to Peripheral Neuropathy, American Academy of Neurology Peripheral Neuropathy Course, Denver CO

2004 Peripheral Neuropathy Emergencies. Pearls and Pitfalls of Emergency Neurology Course, San Francisco CA

2006 A Neuromuscular CPC, Indiana University Department of Neurology

2006 Symptomatic Management of Diabetic Neuropathy - Meet the Professor, Endo Annual Update, San Francisco California

2007 Symptomatic Management of Diabetic Neuropathy - Meet the Professor, Endo Annual Update, San Antonio Texas

2008 "Update of Impaired Glucose Tolerance Neuropathy", Peripheral

	Neuropathy Update, Wayne State University
2008	"Does Hyperglycemia Cause Diabetic Neuropathy" Festscrhift Honoring Dr. James W. Albers, University of Michigan Medical Center, Ann Arbor Michigan
2009	Therapeutic Development for Diabetic Neuropathy, Grand Rounds Beth Israel Deaconess Medical Center, Boston Massachusetts
2012	"Size matters: Small versus Large Nerve Fiber-New Models for Diabetic Neuropathy Trials" UCSD Neuroscience Grand Rounds
2012	Size Matters: Small Versus Large Fibers - New Models of Diabetic Neuropathy Clinical Trials, University of California San Diego Neurology Grand Rounds
2013	The conundrum of diabetic neuropathy - new models for therapeutic development. Grand Rounds, New York University
2013	The conundrum of diabetic neuropathy - new models for therapeutic development. University of Michigan
2015	Metabolic Neuropathy: A Tale of Two Trials Grand Rounds, Kansas University Medical Center, Kansas City, KS
2016	Metabolic Neuropathy: A Tale of Two Trials. Grand Rounds University of Vermont Medical Center, Burlington, VT

Local/Regional

1997	Spinal Cord Compression, Emergency Neurology Lecture Series, University of Utah Neurology
1997	Campylobacter and GBS, University of Utah Infectious Disease Conference
1998	Peripheral Neuropathy, Clinical Neuroscience Series, University of Utah Neurology
1998	Axonal Transport, Basic Neuroscience Series, University of Utah Neurology
1998	Basics of EMG, University of Utah Neuropsychiatric Institute
1999	Peripheral Sensory Organs, Basic Neuroscience Series, University of Utah Neurology
1999	The Effects of Alcohol on the Nervous System, Internal Medicine Conference
1999	CIDP, Idaho State University Family Practice Grand Rounds
2000	Myasthenia Gravis, Clinical Neuroscience Series, University of Utah
2000	Guillain Barré Syndrome, Physical Medicine in-service, University of Utah
2001	Therapeutic Uses of Botulinum Toxin, University of Utah Neurology Special Interest Group
2001	Botulinum Toxin, Utah Dystonia Support Group
2002	New treatment for cervical dystonia, Neurology Association of Southern California
2002	Peripheral Neuropathy, University of Utah Student Interest Group in

Neurology

2003 Time and meeting management. Chief Resident as Manager Course, Salt Lake City, UT

2014 Novel Trial Design For Peripheral Neuropathy Studies. Clinical Trials Day Symposium, University of Utah Clinical Neurosciences Center, Salt Lake City, UT.

Grand Rounds Presentations

1998 Sensory Neuropathy, University of Utah Neurology Grand Rounds

1998 A Case of Mushroom Poisoning, University of Utah Neurology Grand Rounds

1999 Update on Diabetic Neuropathy, University of Utah Family Practice Grand Rounds

2000 Hexosaminidase A deficiency, University of Utah Neurology Grand Rounds

2000 CIDP, University of Utah Neurology Grand Rounds

2001 The Therapeutic Uses of Botulinum Toxin, University of Utah Family Practice Grand Rounds

2002 A Case of Polyneuropathy in Utah, Clinical Pathology Grand Rounds, University of Utah

2005 The problem of idiopathic neuropathy, diabetes prediabetes and metabolic syndrome, University of Utah Neurology Grand Rounds

2006 Therapy in Peripheral Neuropathy, University of Utah Neurology Grand Rounds

2011 Challenges in diabetic neuropathy research, new models for trial design. Endocrinology Grand Rounds. University of Utah

2012 NeuroNEXT, Advancing Therapeutic Development in Neurology

2015 Treating (and Preventing) Metabolic Neuropathy. University of Utah, Neurology Grand Rounds.

Outreach Presentations

2009 Speaker & Organizer, Peripheral Neuropathy Society, Peripheral Neuropathy Conference: Neuropathy and You