

UNITED STATES PATENT AND TRADEMARK OFFICE

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BEFORE THE PATENT TRIAL AND APPEAL BOARD

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RESMED CORP.  
Petitioner

v.

CLEVELAND MEDICAL DEVICES, INC.  
Patent Owner

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CASE PGR: Unassigned  
U.S. Patent No. 11,602,284  
Issue Date: March 14, 2023  
Title: Devices and Methods for Sleep Disorder Diagnosis and Treatment

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**DECLARATION OF ALAN R. SCHWARTZ, M.D.**

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## I. INTRODUCTION

I, Alan R. Schwartz, declare as follows:

1. I have been retained as a technical expert for ResMed Corp. to provide technical assistance in analyzing U.S. Patent No. 11,602,284 (“the ’284 patent”). I may refer to this patent as the ’284 Patent or as the “Challenged Patent” in this Declaration. Additionally, I may refer to ResMed Corp. as simply “ResMed” or “Petitioner.”

2. I understand from the cover of the ’284 patent that the patent application that issued as the ’284 patent was filed May 26, 2022. ’284 patent at Cover, Item 22. I understand that the ’284 patent claims priority through a series of “continuation applications” to an application filed November 4, 2005. ’284 patent at Cover, Item 63, *see also* 1:7-14.

3. I am familiar with the technology at issue at the time of the earliest priority date that is claimed by the ’284 Patent and the period prior to that. I am also familiar with the technology at issue at the time of the May 26, 2022 filing date. In formulating my opinions, I have relied upon my knowledge, education, training, skill, and experience in the relevant art, as well as on the documents and information described below. I have also considered the viewpoint of a person of ordinary skill in the art (“POSITA”). I may review other materials throughout this

proceeding, including any other documents or testimony that may emerge. Those materials may affect my opinions in this matter.

4. I have reviewed the '284 Patent, its prosecution history (application 17/825,266), and the prosecution of its parent applications (16/057,963, 13/440,116, 11/266,899). I have also reviewed the Exhibits cited in this Declaration. A full list of the documents that I have considered in forming these opinions appears in a subsequent section of this Declaration.

5. I have been asked to consider certain prior art and to provide in this Declaration my opinions related to the patentability of the claims recited in the Challenged Patent.

6. I am being compensated at my standard hourly rate of \$600 per hour. My compensation is not dependent on the outcome of this proceeding and in no way affects the substance of my statements in this Declaration. I have no financial interest in or against ResMed, the Challenged Patent, or who I understand to be the Patent Owner, **Cleveland Medical Devices, Inc.**

7. I make this Declaration based on my own personal knowledge and, if called upon to testify, would testify competently to the matters contained herein.

8. This Declaration is a statement of my opinion on issues related to the patentability of claims 1-20 of the '284 Patent (the "challenged claims"). I reserve

the right to supplement my opinions expressed in this Declaration to address any new information obtained in the course of this proceeding.

## II. QUALIFICATIONS

9. A current copy of my curriculum vitae (“CV”) is attached as **Exhibit 1** to this Declaration.

10. I served as a Professor of Medicine at Johns Hopkins University for over 30 years, and played a pivotal role in building the Johns Hopkins Sleep Disorders Center. I launched and directed the Sleep Medicine Fellowship Training Program and built and directed (1999-2018) the *Johns Hopkins Center for Interdisciplinary Sleep Research and Education*, a core facility hosting sleep investigators and clinical research trials.

11. I graduated from the Johns Hopkins School of Medicine in 1981, and completed my residency in Internal Medicine at Mount Sinai Medical Center 1984, and a fellowship in Pulmonary, Critical Care and Sleep Medicine at the Johns Hopkins School of Medicine in 1987.

12. I have investigated mechanisms of sleep disordered breathing with a special emphasis on novel approaches to the diagnosis and management of this disorder. I am an author of over 200 articles and four patents, and am an established investigator with a 30+ year record of continuous NIH and industry sponsored research funding. I have mentored numerous post-doctoral trainees and

junior faculty. My research activities have explored the mechanisms and impact of sleep disordered breathing across a broad range of clinical and societal outcomes.

13. I am currently engaged in NIH and industry sponsored research on neurostimulation treatment strategies for sleep disordered breathing. In interdisciplinary work, I collaborate extensively with colleagues at the University of Pennsylvania Perelman School of Medicine, where I am an Adjunct Professor of Otorhinolaryngology, at Vanderbilt University, where I am a part-time Professor of Otolaryngology, and at the Universidad Peruana Cayetano Heredia (Lima Peru), where I am a Profesor Extraordinario Visitante (Distinguished Visiting Professor). In my role as scientific advisor, I have guided the research and development of novel diagnostic and therapeutic technologies in the sleep and breathing field for many years. I have successfully designed and executed pre-clinical, first-in-man, and clinical trials of medical devices and digital technologies. I have participated extensively in scientific advisory boards, FDA proceedings, and grants and manuscript preparation and review.

14. I have developed and applied low-and high-tech solutions to sleep and breathing disorders for populations in both the developed and developing world. I am building state-of-the-art clinical and research programs designed to forge cost-effective solutions to the diagnosis and management of sleep and breathing disorders. I am also practicing sleep medicine part-time with the Pulmonary/Sleep

Medical Group at the University of Maryland (SJMC).

15. I have extensive experience in conducting clinical trials of diagnostics and therapeutics for sleep and breathing disorders. I have contributed substantially to the development of diagnostic and therapeutic technologies in snoring, sleep apnea, and respiratory insufficiency, including in the diagnostic areas of peripheral arterial tonometry, breathing flow sensor, prediction tools for sleep disorders including sleep apnea, and in the therapeutics areas of pacemakers for the tongue (hypoglossal nerve) and diaphragm (phrenic nerve) to treat obstructive and central sleep apnea, high flow tracheal and nasal insufflation, low level CPAP (Cloud 9), and postural intervention for treating sleep disordered breathing in highlanders in Low to Middle Income Countries.

16. I have participated in the development and testing of devices designed to monitor PAP compliance, sleep disordered breathing patterns and respiratory parameters on PAP machines, home sleep apnea testing equipment and inhalational techniques for patients using aerosolized bronchodilators.

17. My teaching activities over the years include lectures for residents, post-doctoral fellows and health care professionals of all types. These talks and seminars include many invited lectures to institutions, organizations and advisory boards throughout the world. Some of these talks and keynote addresses have been given at international professional conferences such as the American Thoracic

Society, International Sleep Surgery Society, American Physiologic Sleep Society, all of which I am a long-standing member, and other organizations (e.g., recently to the Mexican Sleep Society, Peruvian Sleep Society, University of Palermo Italy).

18. I have received awards for mentoring trainees (David Levine award at Johns Hopkins), the Ludwig Engel award as visiting professor with lectures at University of New South Wales) and the Goode award at Stanford University/Sleep Surgery Division). My professional activities include several roles as medical advisor, scientific advisory board member/chair or chief medical advisor to Deerfield Catalyst/Lunaire, Invicta Medical, LivaNova, Nyxoah, Periodic Breathing and Respicardia/Zoll among others.

19. A detailed list of my other professional activities, memberships, and speaking engagements, along with my articles, patents, and grant awards, is included in my CV.

20. I have reviewed the '284 patent and its prosecution file history, including prosecution file histories of certain family members, and references cited in the prosecution file histories. I am familiar with the subject matter of the '284 patent and its related family members, which is within the scope of my education, background and professional experience. Based at least on my background including over 30 years of in the field of sleep disordered breathing diagnosis and

treatment, and development of diagnostic and therapeutic technologies in the sleep and breathing field, I am familiar with many of the technologies used for the diagnosis and treatment of sleep disordered breathing including in-lab and home sleep testing, PAP (in its various therapeutic modes of operation), nasal and tracheal insufflation, and hypoglossal nerve stimulation. Having practiced sleep and respiratory medicine over the past 35 years, I also understand what a person of ordinary skill in the art in 2004-2007 would accept, and how that person would understand the terminology used in the '284 patent and its related family members.

### III. INFORMATION CONSIDERED IN FORMING OPINION

21. In forming my opinions, I have considered, in addition to my knowledge and experience, the documents and materials listed below. Additional documents might be referenced in the body of this Declaration.

<b>Exhibit No.</b>	<b>Description</b>
EX1001	U.S. Patent No. 11,602,284
EX1002	File History of U.S. Patent No. 11,602,284
EX1004	File History of U.S. Patent No. 8,172,766
EX1005	File History of U.S. Patent No. 10,076,269
EX1006	File History of U.S. Patent No. 11,375,921
EX1021	<i>Cleveland Medical Devices, Inc., v. ResMed Inc.</i> , case no. 1:22-cv-00794-GBW, Claim Construction Memorandum Opinion, October 30, 2023

### IV. LEGAL STANDARDS

22. I have been informed by ResMed counsel of the legal standards that apply with respect to patent validity and invalidity, and I have applied them in

arriving at my conclusions.

**A. The Written Descriptions Requirement**

23. I am told that the patent statute includes a “written description requirement” at 35 U.S.C. §112(a) that says: “The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same, and shall set forth the best mode contemplated by the inventor or joint inventor of carrying out the invention.”

24. I understand that the term patent “specification” refers to the full application, claims, and drawings as originally filed in a provisional application or a U.S. non-provisional or PCT international application. The specification does not necessarily include patent claims that were filed in a later continuing application after the priority date unless it is shown that the specification complies with the written description and enablement requirements for those continuation claims. I understand from counsel that a later filed patent claim is only supported by the written description of a patent specification if the specification reasonably conveys to the POSITA that the inventor had possession of the full scope of the claimed subject matter as of the filing date. I have been informed that this requirement is in place to ensure that the claims do not overreach the scope of the inventor’s

contribution to the field of art as described in the patent specification.

25. I am also told that to establish that the inventors had possession of the claimed invention, the specification must describe the invention with all of its limitations using such descriptive means as words, structures, figures, diagrams, and formulas that fully set forth the claimed invention. I understand that compliance with the written description requirement is a fact-based inquiry that depends on the nature of the invention.

26. I have also been told that under U.S. patent law, new matter cannot be introduced into a patent application after its asserted priority filing date. I understand that this serves to prevent a patent applicant from adding information that goes beyond the subject matter of the originally filed application. Therefore, if new claims are added that do not find clear support in the priority specification, then new matter has been added to the application.

27. I have also been informed that a patent application is entitled to the benefit of the filing date of an earlier filed application only if the disclosure of the earlier application provides support for the claims of the later application, as required by the patent statute (35 U.S.C. § 112(a)). I understand that each application in the chain leading back to the earlier application must comply with the written description requirement of the patent statute (U.S.C. § 112(a)).

28. I have also been informed that the test for adequate written description support requires an objective inquiry into the “four corners” of the specification from the perspective of a person of ordinary skill in the art. In other words, I understand the test to require looking only at the content of the specification from the perspective of a POSITA, and does not consider, for example, information outside the specification such as statements by the patentee during prosecution. Based on that inquiry, the specification must describe an invention understandable to that skilled artisan and show that the inventor actually invented the invention claimed.

29. I have also been informed that it is not enough to show that the written description would render the claimed invention obvious. I have further been informed that it is also not enough to point to disjointed language in the written description that separately covers each limitation of a claim.

30. I have further been informed that patent claims that lack written description support are invalid. Moreover, dependent claims that depend on an independent claim that is invalid for lack of written description are consequently also invalid.

**B. The Enablement Requirement**

31. I have also been informed by counsel that the patent statute includes an “enablement requirement” at 35 U.S.C. §112(a) that requires that the

specification of a patent must teach the POSITA how to make and use the full scope of the claimed subject matter “without undue experimentation.” I understand that whether experimentation is “undue” is a conclusion reached by weighing many factual considerations, including (1) the quantity of experimentation necessary, (2) the amount of direction or guidance presented, (3) the presence or absence of working examples, (4) the nature of the invention, (5) the state of the prior art, (6) the relative skill of those in the art, (7) the predictability or unpredictability of the art, and (8) the breadth of the claims. I understand that these factors are illustrative and not mandatory, and that some factors may be more important than others depending on the circumstances.

32. I have further been informed that claims that lack enablement are invalid. Moreover, dependent claims that depend on an independent claim that is invalid for enablement are consequently also invalid.

## **V. OVERVIEW OF THE '284 PATENT**

### **A. Summary of the '284 Patent Specification**

33. The '284 patent claims a positive airway pressure (PAP) sleep disorder treatment system that determines “data of severity” of a subject’s “sleep disorder symptoms” and transmits certain data amongst a PAP device, a cell phone, and a remote internet site. The patent owner acknowledged that prior art PAP devices already adjusted pressure through sensors built into the device that treats sleeping disorders. EX1001, 2:25-34. The '284 patent describes

determining “the severity of the subject’s sleeping disorder and/or symptoms,” but only generally describes that this is “used at least in part to regulate the physical or chemical treatment of the subject.” EX1001, 19:7-14, *see also* 22:38-48 (“The CPAP machine would preferably be set up to receive some type of signal, which would cause an adjustment in the flow rate or pressure”). The patent does not provide any details or examples of how “data of severity” is used beyond these generic statements, and therefore fails to guide the POSITA as to what the “data of severity” might be at least because it does not describe how the data are used. Furthermore, “symptoms” are typically information about, for example, daytime sleepiness, that are elicited by talking with the patient or questionnaire. The patent specification does not describe how data about such “symptoms” are collected, gauged, quantified, or otherwise used by the disclosed system.

34. The '284 patent acknowledges that “the most common method of treating the sleeping disorder of sleep apnea is by apply[ing] a continuous positive gas pressure to the patient’s airway, which has the effect of forcing the patient to breath[e] through application of the pressure. More advanced, but still very basic *devices have been developed that adjust this continuous positive gas pressure through sensors built into the device* for creating the positive gas pressure, *which measure gas flow through the device.*” EX1001, 2:25-34 (emphasis added). I disagree that CPAP “forc[es] the patient to breath[e] through the application of

pressure”—instead, the *continuous* pressure opens the throat to relieve the obstruction and allows the patient to ventilate when they breathe spontaneously. However, I agree that devices *had already* been developed and were being used to ventilate patients by forcing air into their lungs at varying intervals. These pre-existing devices adjusted the gas pressure using sensors built into the device, where the sensors included those that measure gas flow and/or pressure through the device and breathing circuit. Furthermore, the claims of the '284 patent do not restrict the “sleep disorder” to “sleep apnea,” and the specification does not explain how a PAP device as claimed allegedly treats sleep disorders other than “sleep apnea.”

**B. The '284 Patent's Prosecution History**

35. I have considered the history of the '284 patent in order to determine, for example, when certain claim terms first appeared in the '284 patent's family history and whether there was any disclosure in those applications that provided the required written description and enablement for those claim terms. I understand that the '284 patent was filed as the '266 application on May 26, 2022 as a continuation of the '963 application (issued as U.S. Patent No. 11,375,921), which is a continuation of the '116 application (issued as U.S. Patent No. 10,076,269), which is a continuation of the '899 application filed on November 4, 2005 and issued as U.S. Patent No. 8,172,766. EX1001, cover page (63). I have

considered the file histories of each of these applications/patents.

36. Claim 1 of the earliest application, the '899 application, initially broadly recited a “sleeping disorder treatment system” comprising:

- “a first device for diagnosing and creating a quantitative output of a level of severity of a subject’s sleeping disorder or symptoms;” and
- “a second device for physically or chemically treating a subject’s sleeping disorder or symptoms, which can be adjusted using in part the output of the level of severity of the subject’s sleeping disorder.”

EX1004, 295; EX1002, 235.

37. Over the 17+ years of patent prosecution of the family of applications, Claim 1 of the '284 patent became a “positive airway pressure (PAP) sleep disorder treatment system” comprising, among other things:

- “first software executable by a first processor and configured to be used with a cell phone to display . . . an index of treatment efficacy of the subject using a PAP device . . . on the cell phone,”
- “an index of treatment efficacy . . . based in part on data of severity of sleep disorder symptoms of the subject and data of usage of the PAP device by the subject,”
- a PAP device calculating both “the data of severity of sleep disorder symptoms of the subject and the data of usage of the PAP device by

the subject,”

- a PAP device comprising “a second processor adapted for receiving the airflow sensor data [an airflow sensor internal to the PAP device], for calculating the data of a severity of the symptoms of the subject and/or the index, and for calculating the data of usage of the PAP device;” and
- a “remote internet site adapted to receive the data of the severity of the symptoms of the subject and/or the index, and the data of usage of the PAP device by the subject.”

EX1001, Claim 1.

38. At no point during prosecution of the family of patent applications did the Applicant identify where in the application the claim terms were disclosed or supported in a way that satisfied the written description requirement, particularly during the prosecution of the '266 application, which issued as the '284 patent. *See, e.g.*, EX1002, 67, 107, 172; EX1004, 35, 95, 155, 202; EX1005, 105, 186, 247, 300, 370, 478; EX1006, 181, 229. This is significant because the specification does not meet the written description or enablement requirements for many limitations of independent Claim 1 for at least the reasons discussed in more detail below. *See infra* Sections VIII.A, VIII.B, IX; *see also supra* Section IV (reciting the legal standards for written description and enablement that I have

applied in my analysis).

## **VI. PERSON OF ORDINARY SKILL IN THE ART (POSITA)**

39. I understand that the Petition proposes a POSITA would have had a bachelor's degree in mechanical engineering, electrical engineering, computer science or an equivalent field and two years of industry experience working with diagnostic sensor systems and networked data systems, where an increase in experience could compensate for less education, and vice-versa. A POSITA would have worked with professionals having specialized training in related disciplines such as clinical use and operation of sleep disordered breathing treatment devices. When I refer to the perspective of a "POSITA" below, it is from this perspective as a clinician with specialized training in the field of sleep and breathing disorders and related treatments.

## **VII. CLAIM CONSTRUCTION**

40. I understand that the Petition does not propose an expressed construction or meaning of any claim term of the claims of the '284 patent.

## **VIII. HOW THE CHALLENGED CLAIMS ARE UNPATENTABLE**

### **A. Ground 1: Claims 1-20 are not Supported by the Written Description**

41. In my opinion, challenged claims 1-20 lack written description support for the reasons explained below.

#### **1. "index of treatment efficacy"**

42. Claim 1 recites an "index of treatment efficacy." Specifically, Claim 1

recites an “index of treatment efficacy of the subject using a PAP device” where “the index [is] based in part on data of severity of sleep disorder symptoms of the subject and data of usage of the PAP device by the subject.” EX1001, claim 1. These limitations were added in an amendment on September 20, 2022, shown below.

software is downloaded an index of treatment efficacy of the subject using a PAP device, the first software used for displaying the[[an]] index on the cell phone, the index based in part on a data of severity of sleep disorder symptoms of the subject ~~data~~ and a data of usage related to a subject’s treatment efficacy with of the PAP device by the subject, the data of severity of sleep disorder symptoms of the subject and the data of usage of the PAP device by the subject both calculated by the PAP device and received ~~from a PAP device on~~ aby

EX1002, 102-103 (highlighting added) (amendment to Claim 21, which was renumbered to Claim 1 when the ’266 application was allowed and issued as the ’284 patent). The amendment added that the “symptoms” are specifically “sleep disorder symptoms,” and specified that the index itself is an “index of treatment efficacy” rather than merely an index “related to a subject’s treatment efficacy.” Prior to this amendment, Claim 21 (which was newly added to the ’266 application via a Preliminary Amendment on June 10, 2022) merely recited “an index based in part on a data of severity of symptom data and data of usage related to a subject’s treatment efficacy with the PAP device.” EX1002, 168. When submitting the June 10, 2022 Preliminary Amendment and the subsequent September 20, 2022 Amendment, the Applicant did not provide statements informing the Patent Office

where the '266 application or its priority applications allegedly provided a written description of these new claim terms or where the applications allegedly enabled these claim limitations as required by the written description and enablement requirements. *See* Section IV (legal standards for written description and enablement), Section VIII.B *infra* (discussing lack of enablement for these claim terms). In my opinion, no such support exists.

43. Neither the term “efficacy” or any related term appears in the '284 patent’s specification, let alone an “index of treatment efficacy.” Moreover, the term “index” is used only in reference to the prior art’s “respiratory disturbance index”<sup>1</sup> or “RDI.” EX1001, 1:59-64. The patent specification only mentions RDI as a parameter obtained via all night polysymnography to diagnose sleep apnea. *Id.* The independent claim does not mention diagnosis and instead is directed to a “treatment system.” The patent specification does not describe or link RDI to a parameter calculated by a PAP sleep disorder treatment device, or “based in part on data of severity of sleep disorder symptoms of the subject” as claimed.

44. Moreover, there is no disclosure in the '284 patent specification of any other parameter, whether or not referred to as an index, that is “based in part on data of severity of sleep disorder symptoms of the subject *and* data of usage of

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<sup>1</sup> I further note that “index” is also used in the '284 patent to refer to a patient’s index finger, EX1001, 8:35-36, and when referring to an index for opcodes used by a microcontroller. EX1001, 17:54-57.

the PAP device by the subject.” That correlation is simply not disclosed or contemplated by the ’284 patent’s specification.

45. Furthermore, the claims do not specify the “sleep disorder” or “sleep disorder symptoms” that are being treated. The patent purports to be directed generally to “sleep diagnosis and treatment” (which does not specify what is it about “sleep” being diagnosed) (*see* ’284 patent at Abstract), “some type of sleep disorder” (1:35-36), and identifies “[s]leeping disorders such as for example narcolepsy and sleep apnea” (1:48-49). The ’284 patent specification also refers generally to “a device for physically or chemically treating a subject’s sleeping disorder.” *See, e.g.*, ’284 patent at 22:17-36. The patent further contemplates taking into account “electro-physiological signals such as EEG, ECG, EMG, EOG and the like,” but does not specify that they are used in any way (or how they might be used) in connection with a “sleep disorder,” “sleep disorder symptoms,” or the “index of treatment efficacy” that is only recited in the claims. Although the patent specification discusses “sleep apnea” at 5:53-6:20, the patent otherwise only uses the generic phrase “sleeping disorder and/or symptoms.” The patent specification does not describe, for example, how a PAP device treats sleep disorders other than sleep apnea. The claims of the ’284 patent, and the majority of the patent specification, do not specify what type of sleeping disorder is allegedly being diagnosed, evaluated, or treated, nor does the patent identify a

single “symptom” being detected, evaluated, or treated. To determine an “efficacy” of treatment, it is necessary to know what is being treated, and neither the claims nor the specification provide this guidance. For example, efficacy would mean something different for narcolepsy as compared to COPD (chronic obstructive pulmonary disease). Additionally, the term “efficacy” implies a comparison to some historical information or marker, and neither the ’284 patent claims nor the specification discuss any comparison. Moreover, “efficacy” typically refers to a marker for the disease progress, such as AHI or RDI for sleep apnea, hemoglobin for anemia, whereas “effectiveness” typically includes efficacy plus clinical manifestation or outcomes of the disease process. In this context, symptoms support effectiveness, but the patent provides no description as to how a patient’s symptoms allegedly figure into assessment of treatment efficacy.

46. Also, during prosecution of the ’116 application, the Applicant argued that the prior art Wright reference does not teach a “*processor adapted for receiving sensor data from both the signal processing module and the airflow sensor and calculating symptom data based in part on both the respiratory airflow data and pulse oximetry sensor data of level of severity and/or an index of a level of severity of the subject's sleep disorder symptoms,*” but “Wright uses the data collected with its system to *calculate and analyze stroke indicators* **not to calculate a level of severity or an index of a level of severity of the subject’s**

**sleep disorder breathing symptoms** as claimed.” EX1005, ’269 patent FH (’116 Application), 3/27/2018 Remarks at 10 (bold added, italics and underline in original). The Applicant also repeatedly argued that Wright did not disclose the claimed “calculating symptom data,” but “rather calculates and stores stroke recovery information,” citing paragraphs 30-45 of Wright. EX1005, ’269 patent FH (’116 Application), 3/27/2018 Remarks at 10-11; *see also* page 12. CleveMed argued its alleged invention was different from Wright, but CleveMed did not explain why they believed “sleep disorder breathing symptoms” were different from “stroke indicators.” Looking at what Wright disclosed, Wright’s paragraphs 30-45 describe monitoring “patient health characteristics including, for example, oral and/or nasal airflow, snore, ... oximetry, pulse rate, ... and flattening index via the diagnosis unit and sensors in the blower” (¶ 34), and generating “several indices,” including “[o]ne such index is based upon a functional relationship between the number of central or obstructive apneas over a particular time period” (¶¶ 35-36), and identifying an apnea (¶ 37). A POSITA would have concluded these disclosed parameters, which were standard sleep disordered breathing metrics, were well validated indicators of the type and severity of sleep disordered breathing long before the ’269 patent. However, the examiner then allowed the claims despite these disclosures in Wright (after some amendments “for grammatical/typographical errors”).

47. Thus, a POSITA, having considered these statements, would understand that the “symptom data of a level of severity ...,” “level of severity,” and “index of a level of severity ...” disputed there are not merely statistics of the measured conditions alone, such as pressure, leak, airflow, pulse rate, or oxygen saturation (e.g., SaO<sub>2</sub> or SpO<sub>2</sub>), snore, or flattening index, that *could be used to determine stroke* related parameters. Instead, according to the Patentee’s arguments, the claims require development of a parameter *from* such data that is specific to a “level of severity or an index of a level of severity of the subject’s sleep disorder breathing symptoms” as claimed. EX1005, ’269 patent FH (’116 Application), 3/27/2018 Remarks at 10. Thus, a POSITA would recognize the similar term used in the ’284 patent claims (“data of severity of sleep disorder symptoms”) does not find written description support in the specification by a disclosure of the same statistics disclosed in Wright, because CleveMed argued those statistics are *not* related to severity of *sleep disorder* symptoms. Moreover, Wright provides a description of how to use sensors to calculate, for example, a flattening index that might be used to identify apneas and adjust treatment. In contrast, the ’284 patent fails to provide such information that a POSITA would need to make and use the claimed system that includes the calculated “index of treatment efficacy” and “data of severity of the symptoms of the subject.”

48. As such, in my opinion, a POSITA would have understood from the

specification that the applicant did not actually invent, or possess, any of the claim limitations reciting an “index of treatment efficacy,” or an “index of treatment efficacy of the subject using a PAP device” where “the index [is] based in part on data of severity of sleep disorder symptoms of the subject and data of usage of the PAP device by the subject.” Claim 1 therefore does not have written description support in the ’284 patent specification.

49. Accordingly, in my opinion Claim 1 is invalid at least because an “index of treatment efficacy,” “index of treatment efficacy of the subject using a PAP device” and “the index based in part on data of severity of sleep disorder symptoms of the subject and data of usage of the PAP device by the subject” are not supported by the written description of the ’284 patent. Dependent Claims 2-20 are invalid for at least the same reasons.

**B. Ground 2: Claims 1-20 are not Enabled**

50. In my opinion, challenged claims 1-20 are not enabled because the specification does not teach a POSITA how to make and use the full scope of the claimed invention without undue experimentation. This lack of enablement arises from the same written description issues noted above.

51. First, the challenged claims are not enabled regarding the “index of treatment efficacy” claim elements. Outside of the claim language, there is no mention in the ’284 patent or any of its priority applications of such an “index of

treatment efficacy,” let alone an index “based in part on data of severity of sleep disorder symptoms of the subject and data of usage of the PAP device by the subject.” *See supra* Sections VIII.A.1.

52. The specification thus provides absolutely *no* direction or guidance on how to actually determine the “index of treatment efficacy.” There are no working examples in the ’284 patent or its priority applications for determining the “index of treatment efficacy,” let alone determining it “based in part on data of severity of sleep disorder symptoms of the subject and data of usage of the PAP device by the subject.” While the claim requires “the data of severity of sleep disorder symptoms of the subject and the data of usage of the PAP device by the subject” to “both [be] calculated by the PAP device,” there is no teaching in the ’284 patent or its priority applications to support these calculations either. As just one example, the claim recites “symptoms” but the patent does not describe how the PAP device assesses a patient’s symptoms, which a POSITA would recognize are typically elicited by interview or questionnaire. Also, “efficacy” typically refers to a marker for the disease process, such as AHI or RDI for sleep apnea, hemoglobin for anemia. “Effectiveness” typically includes efficacy plus clinical manifestation or outcomes of the disease process. In this context, symptoms support *effectiveness*, but the patent provides no guidance as to how a patient’s symptoms allegedly figure into assessment of treatment *efficacy*.

53. Moreover, the claim requires the PAP device to receive airflow sensor data from an internal sensor—but the claim is unclear whether this airflow sensor data is used to determine the “index of treatment efficacy.” If the use of airflow sensor data is required, this is also not supported by the ’284 patent or its priority documents. If it is not, then there is an even more insurmountable lack of instruction in the specification or the claims because there is no teaching of what inputs to use for the calculations.

54. If Patent Owner alleges that the “techniques” provided in the ’284 patent specification at column 20, lines 19 through column 22, line 8 provide description or enablement support for the “index of treatment efficacy” term, I disagree. I have used these signal processing techniques as off-the-shelf tools in the art for many years for processing physiological sensor signals. The ’284 patent does not provide any guidance or examples on which signals (e.g., airflow, oxygen saturation, ECG) are being processed in which way or in any particular combination, does not provide any guidance or examples as to any thresholds or parameters to use in such analysis, and does not provide any guidance or examples on what the “output” of such processing techniques is. The patent specification mentions using the provided “output” “either automatically to adjust the treatment device or by a clinician or the subject to adjust the device which provides the physical or chemical treatment device ... .” ’284 patent, 22:9-14. If the “output”

were an “index” such as an apnea-hypopnea index (AHI), a POSITA would recognize that AHI does not alone provide information on the type of apnea, e.g., obstructive or central, and therefore may not provide enough information to modify the treatment. For example, for central sleep apnea, an increase in pressure may not be the appropriate approach, whereas the pressure should be increased for obstructive events. Nothing in the patent describes how to discern between obstructive and central events in a way that generates an “output” useful to adjust treatment. Thus, a POSITA would not conclude that the “output” described in the patent tells them how to determine the claimed “index of treatment efficacy” upon which to base treatment adjustments.

55. In my opinion, because the '284 patent and its priority applications are completely silent with respect to these requirements for, and use of, the “index of treatment efficacy,” a POSITA would have recognized and continue to recognize that, given the wide range of sleep disorders the claim and patent purport to encompass and the different aspects and goals of treatment for each, absent specific guidance, a significant amount of experimentation would be needed to determine a treatment efficacy, and an index for quantifying that efficacy so that it could be displayed and used in the claimed sleep disorder treatment system.

56. The lack of any enabling disclosure is even more evident in view of the claim terms themselves, which broadly claim the determination, display,

transmission, and receipt of the “index of treatment efficacy,” but there is no guidance in the specification to enable these claimed elements. Thus, in my opinion, the “index of treatment efficacy” claim elements are not enabled.

**IX. NO WRITTEN DESCRIPTION IN THE PRIORITY CHAIN BEFORE MAY 26, 2022**

57. Independent claim 1 includes several limitations that were first introduced during the prosecution of the '266 application, 17 years after the filing of the initial '899 priority application. *See* Section V.B, *supra*. These limitations include:

- “an index of treatment efficacy of the subject using a PAP device, ... the index based in part on data of severity of sleep disorder symptoms of the subject and data of usage of the PAP device by the subject;”
- “the data of the severity of the symptoms of the subject and/or the index, and the data of usage of the PAP device by the subject both related to the subject’s treatment and the treatment's efficacy;” and
- “the data of severity of sleep disorder symptoms of the subject and the data of usage of the PAP device by the subject both calculated by the PAP device and received by the cell phone” as required by Claim 1.

I note that the Applicant did not make a statement or provide any evidence of how the specification of the '266 application or any of the priority applications described these limitations in a way that provided the required written description

or enablement of the claim language. *See, e.g.*, EX1002, '284 Patent File History at 67, 107, 172 (addition of these claim limitations during prosecution of the '284 patent).

58. As addressed above in Section VIII.A.1, the '284 patent specification does not provide written description to support these claim limitations.


59. For example, none of the above limitations appear in the '284 patent's specification. Significantly, none of the above limitations appear in any of the priority applications, whose specifications are almost identical to the '284 patent's specification. In my opinion, a POSITA, reading the written description of each priority application, would have understood that the inventor had not invented or had actual possession of the newly claimed subject matter. Instead, a POSITA, reading the written description of each priority application, would have understood that the inventor had not invented nor had actual possession of the newly claimed subject matter. As such, *each* priority application fails to provide proper written description support for at least the above limitations of claim 1.

60. Thus, based on my understanding from counsel, because each of the priority applications lack written description support for the challenged claims, there cannot be a continuous chain of copending applications, each of which satisfies the written description requirement of the patent statute with respect to the subject matter of the '284 patent claims. As such, based on my understanding from counsel, the challenged claims are not entitled to a priority date of any of the prior applications in the chain. Instead, the correct priority date of the challenged claims can therefore be no earlier than the date in which the '266 application was filed – May 26, 2022. EX1001, cover page (22).

**X. CONCLUSION**

61. I hereby declare under penalty of perjury, under the laws of the United States of America, that I believe that the foregoing statements, analysis, and opinions are true and correct.

Date: December 12, 2023

Signed:   
Alan R. Schwartz, M.D.

# EXHIBIT 1

# CURRICULUM VITAE

May 17, 2023

Alan R. Schwartz, M.D.



## DEMOGRAPHIC INFORMATION

### Current Appointments:

**Consulting:** Medical technologies to diagnose and treat sleep and breathing disorders with specific expertise in respiratory physiology, sleep/wake assessment, hardware and software systems, and digital technologies applied to patient-physician interactions and medical consumers.

**Clinical trials and out-patient practice:** University of Maryland St. Joseph Medical Group, Pulmonary and Sleep Medicine.

### University:

Adjunct Professor of Otorhinolaryngology  
University of Pennsylvania Perelman School of Medicine  
Part-time Professor of Otolaryngology  
Vanderbilt University School of Medicine  
Profesor Extraordinario Visitante (Distinguished Visiting Professor)  
Universidad Peruana Cayetano Heredia, Lima PERU  
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### Education and Training

A.B.	1977	Brown University, Providence, R. I. Biochemistry, Magna Cum Laude
M.D.	1981	Johns Hopkins University School of Medicine

Internship	1981-82	Baltimore, Maryland Mt. Sinai Medical Center, New York, N.Y. Internal Medicine
Residency	1982-84	Mt. Sinai Medical Center, New York, N.Y. Internal Medicine
Fellowship	1984-87	Johns Hopkins University, School of Medicine Division of Pulmonary Medicine, Baltimore, MD

### Professional Experience

1981	Research on Leishmaniasis Alexander von Humboldt Institute of Tropical Medicine Cayetano Heredia University, Lima, Peru.
1987 - 1994	Assistant Professor of Medicine Johns Hopkins University, Baltimore, Maryland
1994 - 2002	Associate Professor of Medicine Johns Hopkins University, Baltimore, Maryland
2002 – 2019	Professor of Medicine ( <i>ret.</i> , 2019) Johns Hopkins University, Baltimore, Maryland
1994 – present	Scientific advisor for medical device and digital technologies in sleep and respiratory medicine
2019 – present	Pulmonary and Critical Care Associates of Baltimore, Towson, Maryland; University of Maryland, St. Joseph Medical Group, Pulmonary and Sleep Medicine Clinical trials and practice in sleep and respiratory medicine
2019 – present	Distinguished Visiting Professor (Profesor Extraordinario Visitante), Universidad Peruana Cayetano Heredia, Lima, Peru
2019 – present	Adjunct Professor of Otorhinolaryngology, University of Pennsylvania Perelman School of Medicine, Philadelphia, PA
2019 – present	Child Health Foundation, Board Member and Small Grants Reviewer for international public health projects
2021 – present	Part-time Professor of Otolaryngology, Vanderbilt School of Medicine, Nashville, TN

### Administrative Experience

1987-94	Assistant Director, Johns Hopkins Sleep Disorders Center, Baltimore, MD Co-Director, Johns Hopkins Sleep Disorders Center, Baltimore, MD
1998-2003	Director, Johns Hopkins Sleep Disorders Laboratory at Northpoint
2001-2009	Director, Sleep Core Laboratory, GCRC, Johns Hopkins School of Medicine, Baltimore, MD
2002-2019	Medical Director, Johns Hopkins Sleep Disorders Center, Baltimore, MD
2003-2017	Director, Johns Hopkins Clinical Sleep Fellowship Training Program
2009-2019	Co-Director, Center for Interdisciplinary Sleep Research and Education (CISRE), Johns Hopkins School of Medicine

## RESEARCH ACTIVITIES

### Publications:

#### Peer-Reviewed

1. **Schwartz AR**, Leddy A. The recognition of diabetes insipidus in postpartum hypopituitarism. *Obstetrics and Gynecology*. 1982; 59(3):394-398.
2. **Schwartz AR**, Fishman E, Wang KP. The diagnosis and management of bronchogenic cyst with transbronchial needle aspiration. *Thorax*. 1986; 41(4):326-327.
3. Gold AR, **Schwartz AR**, Bleecker ER, Smith PL. The effect of chronic nocturnal oxygen administration upon sleep apnea. *Am Rev Respir Dis*. 1986; 134(5):925-929.
4. **Schwartz AR**, Smith PL, Wise RA, Gold AR, Permutt S. The induction of upper airway occlusion in sleeping individuals with subatmospheric nasal pressure. *J Appl Physiol*. 1988; 64(2):535-542.
5. Smith PL, Wise RA, Gold AR, **Schwartz AR**, Permutt S. Upper airway pressure-flow relationships in obstructive sleep apnea. *J Appl Physiol*. 1988 64(2):789-795.
6. **Schwartz AR**, Smith PL, Wise RA, Permutt S. Effect of positive nasal pressure on upper airway pressure flow relationships. *J Appl Physiol*. 1989; 66(4):1626-1634.
7. Smith PL, **AR Schwartz**, E Gauda, R Wise, R Brower, S Permutt. The modulation of upper airway critical pressures during sleep. *Prog Clin Biol Res*. 1990; 345:253-258.
8. Gleadhill IC, **Schwartz AR**, Wise RA, Permutt S, Smith PL. Upper airway collapsibility in snorers and in patients with obstructive hypopnea and apnea. *Am Rev Respir Dis*. 1991; 143(6):1300-1303.
9. **Schwartz AR**, Gold AR, Schubert N, Stryzak A, Wise RA, Permutt S, Smith PL. Effect of weight loss on upper airway collapsibility in obstructive sleep apnea. *Am Rev Respir Dis*. 1991; 144(3):494-498.
10. **Schwartz AR**, Schubert N, Rothman W, Godley F, Marsh B, Eisele D, Nadeau J, Permutt L, Gleadhill I, Smith PL. Effect of uvulopalatopharyngoplasty on upper airway collapsibility in obstructive sleep apnea. *Am Rev Respir Dis*. 1992; 145(3):527-532.
11. Kribbs NB, Pack AI, Kline LR, Smith PL, **Schwartz AR**, Schubert NM, Redline S, Henry JN, Getsy JE, Dinges DF. Objective measurement of patterns of nasal CPAP use by patients with obstructive sleep apnea. *Am Rev Respir Dis*. 1993; 147(4):887-895.
12. **Schwartz AR**, Thut D, Russ DB, Seelagy M, Roach D, Brower RG, Permutt S, Wise RA, Smith PL. Effect of electrical stimulation of the hypoglossal nerve on airflow mechanics in the isolated upper airway. *Am Rev Respir Dis*. 1993; 147(5):1144-1150.
13. **Schwartz AR**, Thut D, Brower RG, Gauda EB, Roach D, Permutt S, Smith P. Modulation of maximal inspiratory airflow by neuromuscular activity: Effect of CO<sub>2</sub>. *J Appl Physiol*. 1993; 74(4):1597-1605.
14. Gold AR, **Schwartz AR**, Wise RA, Smith PL. Pulmonary function and respiratory

- chemosensitivity in moderately obese patients with sleep apnea. *Chest*. 1993; 103(5):1325-1329.
15. Thut DC, **Schwartz AR**, Roach D, Wise RA, Permutt S, Smith PL. Tracheal and neck position influence upper airway airflow dynamics by altering airway length. *J Appl Physiol*. 1993; 75(5):2084-2090.
  16. Seelagy MM, **Schwartz AR**, Russ DB, King ED, Wise RA, Smith PL. Reflex modulation of airflow dynamics through the upper airway. *J Appl Physiol*. 1994; 76(6):2692-2700.
  17. Gauda EB, Carroll TP, **Schwartz AR**, Smith PL, Fitzgerald RS. Mechano- and chemo-receptor modulation of respiratory muscles in response to upper airway negative pressure. *J Appl Physiol*. 1994; 76(6):2656-2662.
  18. Marcus CL, McColley SA, Carroll JL, Loughlin GM, Smith PL, **Schwartz AR**. Upper airway collapsibility in children with the obstructive sleep apnea syndrome. *J Appl Physiol*. 1994; 77(2):918-924.
  19. O'Donnell CP, King ED, **Schwartz AR**, Robotham JL, Smith PL. The relationship between blood pressure and airway obstruction during sleep in the dog. *J Appl Physiol*. 1994; 77(4):1819-1828.
  20. O'Donnell CP, King ED, **Schwartz AR**, Smith PL, Robotham JL. The effect of sleep deprivation on responses to airway obstruction in the sleeping dog. *J Appl Physiol*. 1994; 77(4):1811-1818.
  21. Gillespie MB, Flint PW, Smith PL, Eisele DW, **Schwartz AR**. The diagnosis and treatment of obstructive sleep apnea of the larynx. *Arch Otolaryngol Head Neck Surg*. 1995; 121(3):335-339.
  22. Maislin G, Pack AI, Kribbs NB, Smith PL, **Schwartz AR**, Kline LR, Schwab RJ, Dinges DF. A survey screen for prediction of apnea. *Sleep*. 1995; 18(3):158-166.
  23. Eisele DW, **Schwartz AR**, Hari A, Thut DC, Smith PL. The effects of selective nerve stimulation on upper airway airflow mechanics. *Arch Otolaryngol Head Neck Surg*. 1995; 121(12):1361-1364.
  24. Mayor AH, **Schwartz AR**, Rowley JA, Willey SJ, Gillespie MB, Smith PL, Robotham JL. The effect of blood pressure changes on airflow dynamics in the upper airway of the decerebrate cat. *Anesthesiology*. 1996; 84(1):128-134.
  25. O'Donnell CP, Ayuse T, King ED, **Schwartz AR**, Smith PL, Robotham JL. Airway obstruction during sleep increases blood pressure without arousal. *J Appl Physiol*. 1996; 80(3):773-781.
  26. Sonna LA, Smith PL, **Schwartz AR**. Obstructive sleep apnea presenting during infantry field exercises: Does the Army weight control program protect soldiers from obstructive sleep apnea? *Military Medicine*. 1996; 161(6):362-366.
  27. Rowley JA, Permutt S, Willey S, Smith PL, **Schwartz AR**. The effect of tracheal and tongue displacement on upper airway airflow dynamics. *J Appl Physiol*. 1996; 80(6):2171-2178.
  28. Gold AR, Smith PL, **Schwartz AR**. The study of maximal nasal inspiratory flow in humans. *J Appl Physiol*. 1996; 81(2):627-635.

29. **Schwartz AR**, Eisele DW, Hari A, Testerman R, Erickson D, Smith PL. Electrical stimulation of the lingual musculature in obstructive sleep apnea. *J Appl Physiol.* 1996; 81(2):643-652.
30. Tankersley C, Kleeberger S, La H, Russ B, **Schwartz A**, Smith P. Modified control of breathing in genetically obese (ob/ob) mice. *J Appl Physiol.* 1996; 81(2):716-723.
31. O'Donnell CP, **Schwartz AR**, Smith PL, Robotham JL, Fitzgerald RS, and Shirahata M. Reflex stimulation of renal sympathetic nerve activity and blood pressure in response to apnea. *Am J Respir Crit Care Med.* 1996; 154(6): 1763-1770.
32. Eisele DW, Smith PL, Alam DS, **Schwartz AR**. Direct hypoglossal nerve stimulation in obstructive sleep apnea. *Arch Otolaryng Head Neck Surg.* 1997; 123(1):57-61.
33. Lee S, Eisele DW, **Schwartz AR**, Ryugo D. Peripheral Course of Genioglossal Motor Axons within the Hypoglossal Nerve of the Rat. *Laryngoscope.* 1996; 106(10):1274-1279.
34. Weaver TE, Kribbs, NB, Pack AI, Kline LR, Chugh DK, Maislin G, Smith PL, **Schwartz AR**, Schubert NM, Gillen KA, Dinges DF. Night-to-night variability in CPAP use over first three months of treatment. *Sleep.* 1997; 20(4):278-283.
35. Rowley JA, Williams BC, Smith PL, **Schwartz AR**. Neuromuscular activity and upper airway collapsibility. Mechanisms of action in the decerebrate cat. *Am J Respir Crit Care Med.* 1997; 156(2):515-521.
36. Schneider H, Schaub CD, Andreoni KA, **Schwartz AR**, Smith PL, Robotham JL, O'Donnell CP. Systemic and pulmonary hemodynamic responses to normal and obstructed breathing during sleep. *J Appl Physiol.* 1997; 83(5):1671-1680.
37. Weaver TE, Laizner A, Evans LK, Maislin G, Chugh DK, Lyons K, Smith PL, **Schwartz AR**, Redline S, Pack AI, Dinges DF. An instrument to measure functional status outcomes for disorders of excessive sleepiness. *Sleep.* 1997; 20(10):835-843.
38. Goding GS, Eisele DW, Testerman R, Smith PL, Roertgen K, **Schwartz AR**. Relief of upper airway obstruction with hypoglossal nerve stimulation in the canine. *Laryngoscope.* 1998; 108(2):162-169.
39. **Schwartz AR**, O'Donnell CP, Baron J, Schubert N, Alam D, Samadi SD, Smith PL. The Hypotonic Upper Airway in obstructive sleep apnea: role of structures and neuromuscular activity. *Am J Respir Crit Care Med.* 1998; 157(4):1051-1057.
40. Gold AR, Smith PL, **Schwartz AR**. The effect of alae nasi activity on maximal nasal inspiratory airflow. *J Appl Physiol.* 1998; 84(6):2115-2122.
41. Tankersley CG, O'Donnell C, Daood MJ, Watchko, Mitzner W, **Schwartz A**, Smith P. Leptin attenuates respiratory complications associated with the obese phenotype. *J Appl Physiol.* 1998; 85(6):2261-2269.
42. Kim SH, Eisele DW, Smith PL, Schneider H, **Schwartz AR**. Evaluation of Sleep Apnea patients with tracheostomy. *Arch Otolaryng Head Neck Surg.* 1998; 124(9): 996-1000.
43. Schaub CD, Tankersley C, **Schwartz AR**, Smith PL, Robotham JL, O'Donnell CP. Effect of sleep/wake state on arterial blood pressure in genetically identical mice. *J Appl Physiol.* 1998; 85(1): 366-371.

44. O'Donnell CP, Schaub CD, Haines AS, Berkowitz DE, Tankersley CG, **Schwartz AR**, Smith PL. Leptin Prevents Respiratory Depression in Obesity. *Am J Respir Crit Care Med.* 1999; 159(5): 1477-1484.
45. Punjabi NM, O'Hearn DJ, Neubauer DN, Nieto FJ, **Schwartz AR**, Smith PL, Bandeen-Roche, K. Modeling hypersomnolence in sleep-disordered breathing - A novel approach using survival analysis. *Am J Respir Crit Care Med.* 1999; 159(6):1703-1709.
46. McWhorter A, Rowley JA, Eisele DW, Smith PL, **Schwartz AR**. Effect of tensor palatini, stimulation on upper airway airflow dynamics. *Arch Otolaryng Head Neck Surg.* 1999; 125(9):937-940.
47. Marcus CL, Lutz J, Hamer A, Smith PL, **Schwartz A**. Developmental changes in response to subatmospheric pressure loading of the upper airway. *J Appl Physiol.* 1999; 87(2):626-633.
48. Schneider H, Schaub CD, Chen CA, Andreoni KA, **Schwartz AR**, Smith PL, Robotham JL, O'Donnell CP. The effects of arousal and sleep state on systemic and pulmonary hemodynamics in obstructive apnea. *J Appl Physiol.* 2000; 88: 1084-1092.
49. Schneider H, Schaub CD, Chen CA, Andreoni KA, **Schwartz AR**, Smith PL, Robotham JL, O'Donnell CP. Neural and local effects of hypoxia on cardiovascular responses to obstructive apnea. *J Appl Physiol.* 2000; 88: 1093-1102.
50. Schneider H, O'Hearn DJ, LeBlanc K, Smith PL, O'Donnell CP, Eisele DW, Peter JH, **Schwartz AR**. High-flow transtracheal insufflation treats obstructive sleep apnea: A pilot study. *Am J Respir Crit Care Med.* 2000; 161:1869-1876.
51. King ED, O'Donnell CP, Smith PL, **Schwartz AR**. A model of obstructive sleep apnea in normal humans: Role of the upper airway. *Am J Respir Crit Care Med.* 2000; 161:1979-1984.
52. Okazaki J, Isono S, Tanaka A, Tagaito Y, **Schwartz A**, Nishino T. Usefulness of continuous oxygen insufflation into trachea for management of upper airway obstruction during anesthesia. *Anesthesiology.* 2000; 93(1):62-68.
53. Boudewyns A, Punjabi N, Van de Heyning P, De Backer W, O'Donnell CP, Schneider H, Smith PL, **Schwartz AR**. An abbreviated method for assessing upper airway function in obstructive sleep apnea. *Chest.* 2000; 118(4):1031-1041.
54. Goding GS, Eisele DW, Christopherson MS, **Schwartz AR**, Testerman RL. Long-term monitoring of respiration with a mediastinal pressure sensor in the canine. *Ann Otol Rhinol Laryngol.* 2001; 110(3):215-20.
55. Polotsky VY, Wilson JA, Haines AS, Scharf MT, Soutiere SE, Tankersley CG, Smith PL, **Schwartz AR**, and O'Donnell CP. The impact of insulin-dependent diabetes on ventilatory control in the mouse. *Am J Respir Crit Care Med.* 2001; 163:624-632.
56. **Schwartz AR**, Eisele DW, Bennett ML, Smith PL, De Backer W, Boudewyns A, Van de Heyning P, Hedner J, Ejnell H, Hochban W, Knaack L, Podszus T, Penzel T, Peter JH, Goding GS, Erickson DJ, Testerman RL, Ottenhoff F. Electrical stimulation of the hypoglossal nerve in obstructive sleep apnea. *Arch Otolaryngol Head Neck Surg.* 2001; 127(10):1216-1223.

57. Tagaito Y, Polotsky VY, Campen MJ, Wilson JA, Balbir A, Smith PL, **Schwartz AR**, O'Donnell CP. A model of sleep-disordered breathing in the C57BL/6J mouse. *J Appl Physiol*. 2001; 91(6):2758-66.
58. Polotsky VY, Wilson BA, Smaldone MC, Haines AS, Hurn PD, Tankersley CG, Smith PL, **Schwartz AR**, and O'Donnell CP. Female gender exacerbates respiratory depression in leptin-deficient obesity. *Am J Respir Crit Care Med*. 2001; 164(8 Pt 1):1470-5.
59. Litman RS, Hayes JL, Basco MG, **Schwartz AR**, Bailey PL, Ward DS. Use of dynamic negative airway pressure (DNP) to assess sedative-induced upper airway obstruction. *Anesthesiology*. 2002; 96:342-5.
60. Punjabi NM, Sorkin JD, Katzel LI, Goldberg AP, **Schwartz AR**, Smith PL. Sleep-disordered breathing and insulin resistance in middle-aged and overweight men. *Am J Respir Crit Care Med*. 2002; 165:677-682.
61. Punjabi N, Bandeen-Roche K, Marx JJ, Neubauer D, Smith PL, **Schwartz AR**. The association between daytime sleepiness and sleep disordered breathing in NREM and REM sleep. *Sleep*. 2002; 25(3):307-314.
62. Schneider H, Boudewyns A, Smith PL, O'Donnell CP, Allan L, **Schwartz AR**. Modulation of upper airway collapsibility during sleep: Influence of respiratory phase and airflow regimen. *J Appl Physiol*. 2002; 93:1365.
63. O'Donnell CP, Allan L, Atkinson P, **Schwartz AR**. The effect of upper airway obstruction and arousal on peripheral vascular tone in obstructive sleep apnea. *Am J Respir Crit Care Med*. 2002; 166(7):965-71.
64. Campen MJ, Tagaito Y, Jenkins TP, Smith PL, **Schwartz AR**, O'Donnell CP. Phenotypic differences in the hemodynamic response during REM sleep in six strains of inbred mice. *Physiol Genomics*. 2002; 11(3):227-34.
65. Tagaito Y, Schneider H, O'Donnell CP, Smith PL, **Schwartz AR**. Ventilating with tracheal gas insufflation and periodic tracheal occlusion during sleep and wakefulness. *Chest*. 2002; 122(5): 1742-50.
66. Oliven A, O'Hearn DJ, Boudewyns A, Odeh M, De Backer W, Van de Heyning P, Smith PL, Eisele DW, Allan L, Schneider H, Testerman R, **Schwartz AR**. Upper airway response to electrical stimulation of the genioglossus in obstructive sleep apnea. *J Appl Physiol*. 2003; 95(5):2023-9.
67. Rubin AE, Polotsky VY, Balbir A, Krishnan JA, **Schwartz AR**, Smith PL, Fitzgerald RS, Tankersley CG, Shirahata M, O'Donnell CP. Differences in sleep-induced hypoxia between A/J and DBA/2J mouse strains. *Am J Respir Crit Care Med*. 2003; 168(12):1520-7.
68. Polotsky VY, Li J, Punjabi NM, Rubin AE, Smith PL, **Schwartz AR**, O'Donnell CP. Intermittent hypoxia induces insulin resistance in genetically obese mice. *J Physiol*. 2003; 552: 253-64.
69. Schneider H, Patil SP, Canisius S, Gladmon EA, **Schwartz AR**, O'Donnell CP, Smith PL, Tankersley CG. Hypercapnic duty cycle is an intermediate physiological phenotype linked to chromosome 5. *J Appl Physiol*. 2003; 95(1):11-19.
70. Smith PL, O'Donnell CP, Allan L, **Schwartz AR**. A physiologic comparison of nasal

and oral positive airway pressure. *Chest*. 2003; 123(3):689-94.

71. Polotsky VY, Smaldone MC, Scharf MT, Li J, Tankersley CG, Smith PL, **Schwartz AR**, O'Donnell CP. Impact of interrupted leptin pathways on ventilatory control. *J Appl Physiol*. 2004; 96(3):991-8.
72. Rubin AE, Gottlieb SH, Gold AR, **Schwartz AR**, Smith PL. Elimination of central sleep apnea by mitral valvuloplasty: the role of feedback delay in periodic breathing. *Thorax*. 2004; 59(2):174-6.
73. Patil SP, Punjabi NM, Schneider H, O'Donnell CP, Smith PL, **Schwartz AR**. A simplified method for measuring critical pressures during sleep in the clinical setting. *Am J Respir Crit Care Med*. 2004; 170:86-93.
74. Ayuse T, Inazawa T, Kurata S, Okayasu I, Sakamoto E, Oi K, Schneider H, **Schwartz AR**. Mouth-opening increases upper-airway collapsibility without changing resistance during midazolam sedation. *J Dent Res*. 2004; 83(9):718-22.
75. Pichard LE, Patil SP, Gladmon E, Smith PL, **Schwartz AR**, Schneider H. Women have a greater ventilatory response to upper airway obstruction than men. *Conf Proc IEEE Eng Med Biol Soc*. 2004; 5:3878-80.
76. Inazawa T, Ayuse T, Kurata S, Okayasu I, Sakamoto E, Oi K, Schneider H, **Schwartz AR**. Effect of mandibular position on upper airway collapsibility and resistance. *J Dent Res*. 2005; 84(6):554-8.
77. Li J, Grigoryev DN, Ye SQ, Thorne L, **Schwartz AR**, Smith PL, O'Donnell CP, Polotsky VY. Chronic intermittent hypoxia upregulates genes of lipid biosynthesis in obese mice. *J Appl Physiol*. 2005; 99:1643-1648.
78. Li J, Thorne LN, Punjabi NM, Sun CK, **Schwartz AR**, Smith PL, Marino RL, Rodriguez A, Hubbard WC, O'Donnell CP, Polotsky VY. Intermittent hypoxia induces hyperlipidemia in lean mice. *Circ Res*. 2005; 97(7):698-706.
79. Polotsky VY, Rubin AE, Balbir A, Dean T, Smith PL, **Schwartz AR**, O'Donnell CP. Intermittent hypoxia causes REM sleep deficits and decreases EEG delta power in NREM sleep in the C57BL/6J. *Sleep Med*. 2005; 7: 7-16.
80. Litman RS, McDonough JM, Marcus CL, **Schwartz AR**, Ward DS. Upper airway collapsibility in anesthetized children. *Anesth Analg*. 2006; 102(3):750-4.
81. Kirkness JP, **Schwartz AR**, Patil SP, Pichard LE, Marx JJ, Smith PF, Schneider H. Dynamic modulation of upper airway function during sleep - A novel single breath method. *J Appl Physiol*. 2006; 101(5):1489-94.
82. Ayuse T, Hoshino Y, Inazawa T, Oi K, Schneider H, **Schwartz AR**. A pilot study of quantitative assessment of mandible advancement using pressure-flow relationship during midazolam sedation. *J Oral Rehabil*. 2006; 33(11):813-9.
83. de Souza Batista CM, Yang RZ, Lee MJ, Glynn NM, Yu DZ, Pray J, Ndubuizu K, Patil S, **Schwartz A**, Kligman M, Fried SK, Gong DW, Shuldiner AR, Pollin TI, McLenithan JC. Omentin plasma levels and gene expression are decreased in obesity. *Diabetes*. 2007; 56(6):1655-61.

84. Patil SP, Schneider H, Marx JJ, Gladmon E, **Schwartz AR**, Smith PL. Neuromechanical control of upper airway patency during sleep. *J Appl Physiol*. 2007; 102(2):547-56.
85. McGinley BM, Patil SP, Kirkness JP, Smith PL, **Schwartz AR**, Schneider H. A nasal cannula can be used to treat obstructive sleep apnea. *Am J Respir Crit Care Med*. 2007; 176(2): 194-200.
86. Oliven A, Tov N, Geitini L, Steinfeld U, Oliven R, **Schwartz AR**, Odeh M. Effect of genioglossus contraction on pharyngeal lumen and airflow in sleep apnea patients. *Eur Respir J*. 2007; 30(4): 748-58.
87. Oliven A, Odeh M, Geitini L, Oliven R, Steinfeld U, **Schwartz AR**, Tov N. Effect of co-activation of tongue protrusor and retractor muscles on pharyngeal lumen and airflow in sleep apnea patients. *J Appl Physiol*. 2007; 103(5): 1662-8.
88. Kirkness JP, **Schwartz AR**, Schneider H, Punjabi NM, Maly JJ, Laffan AM, McGinley BM, Magnuson T, Schweitzer M, Smith PL, Patil SP. Contribution of male sex, age, and obesity to mechanical instability of the upper airway during sleep. *J Appl Physiol*. 2008; 104(6): 1618-24.
89. McGinley BM, **Schwartz AR**, Schneider H, Kirkness JP, Smith PL, Patil SP. Upper airway neuromuscular compensation during sleep is defective in obstructive sleep apnea. *J Appl Physiol*. 2008; 105(1):197-205.
90. Liu A, Pichard L, Schneider H, Patil SP, Smith PL, Polotsky VY, **Schwartz AR**. Neuromechanical control of the isolated upper airway of mice. *J Appl Physiol*. 2008; 105(4): 1237-45.
91. Savransky V, Jun J, Li J, Nanayakkara A, Fonti S, Moser AB, Steele KE, Schweitzer MA, Patil SP, Bhanot S, **Schwartz AR**, Polotsky VY. Dyslipidemia and atherosclerosis induced by chronic intermittent hypoxia are attenuated by deficiency of stearyl coenzyme A desaturase. *Circ Res* 2008; 103:1173-1180.
92. Sánchez A, **Schwartz AR**, Sánchez PL, Fernández JL, Ramos J, Martín-Herrero F, González-Celador R, Ruano R, Bregón I, Martín-Luengo C, Gómez FP. Hemodynamic and Inflammatory Markers of Sleep Apnea-Hypopnea Syndrome and Nocturnal Hypoxemia: Effects of Treatment with Nasal Continuous Positive Airway Pressure. *Arch Bronconeumol* 2008; 44:531-9.
93. Polotsky V, Patil S, Savransky V, Laffan A, Frame L, Steele K, Schweitzer M, Clark J, Torbenson M, **Schwartz AR**. Obstructive sleep apnea, insulin resistance and steatohepatitis in severe obesity. *Am J Respir Crit Care Med* 2009; 179(3):228-34.
94. Schneider H, Krishnan V, Patil SP, Smith PL, **Schwartz AR**. Inspiratory duty cycle responses to flow limitation predict nocturnal hypoventilation. *European Respir J* 2009; 33(5):1068-76.
95. Hoshino Y, Ayuse T, Kurata S, Ayuse T, Schneider H, Kirkness JP, Patil SP, **Schwartz AR**, Oi K. The compensatory responses to upper airway obstruction in normal subjects under propofol anesthesia. *Resp Physiol Neurobiol* 2009; 166: 24 – 31.
96. Oliven R, Tov N, Odeh M, Gaitini L, Steinfeld U, **Schwartz AR**, Oliven A.J. Interacting effects of genioglossus stimulation and mandibular advancement in sleep apnea. *Appl*

Physiol. 2009; 106(5):1668-73.

97. Trois MS, Capone GT, Lutz JA, Melendres MC, **Schwartz AR**, Collop NA, Marcus CL. Obstructive sleep apnea in adults with Down syndrome. *J Clin Sleep Med.* 2009; 5(4): 317-323.
98. Ayuse T, Hoshino Y, Kurata S, Ayuse T, Schneider H, Kirkness JP, Patil SP, **Schwartz AR**, Oi K. The effect of gender on compensatory neuromuscular response to upper airway obstruction in normal subjects under midazolam general anesthesia. *Anesth Analg.* 2009; 109(4): 1209-1218.
99. McCann UD, Sgambati FP, **Schwartz AR**, Ricaurte GA. Sleep Apnea in Young Abstinent Recreational MDMA (“Ecstasy”) Consumers. *Neurology.* 2009; 73(23):2011-7.
100. Gottlieb JD, **Schwartz AR**, Marshall J, Ouyang P, Kern L, Shetty V, Trois M, Punjabi NM, Brown C., Najjar SS, Gottlieb SS. Hypoxia, not the frequency of sleep apnea, induces acute hemodynamic stress in patients with chronic heart failure. *J Am Coll Cardiol.* 2009; 54(18):1706-12.
101. McGinley B, Halbower A, **Schwartz AR**, Smith PL, Patil SP, Schneider H. Effect of a high-flow open nasal cannula system on obstructive sleep apnea in children. *Pediatrics.* 2009; 124(1):179-88.
102. Brown TT, Patil SP, Jacobson LP, Margolick JB, Laffan AM, Godfrey R, Johnson J, Johnson L, Reynolds S, **Schwartz AR**, Smith PL. Anthropometry in the prediction of sleep disordered breathing in HIV-infected and –uninfected men. *Antiviral Therapy* 2010; 15:651-659.
103. Oliven A, Kaufman E, Kaynan R, Oliven R, Steinfeld U, Tov N, Odeh M, Gaitini L, **Schwartz AR**, Kimmel E. Mechanical parameters determining pharyngeal collapsibility in patients with sleep apnea. *J Appl Physiol.* 2010; 109(4):1037-44.
104. Squier SB, Patil SP, Schneider H, Kirkness JP, Smith PL, **Schwartz AR**. Effect of end-expiratory lung volume on upper airway collapsibility in sleeping men and women. *J Appl Physiol.* 2010; 109(4):977-85.
105. Pallayova M, Steele KE, Magnuson TH, Schweitzer MA, Hill NR, Bevans-Fonti S, **Schwartz AR**. Sleep apnea predicts distinct alterations in glucose homeostasis and biomarkers in obese adults with normal and impaired glucose metabolism. *Cardiovasc. Diabetol.* 2010; 9:83.
106. Reinke C, Bevans-Fonti S, Grigoryev DN, Drager LF, Myers AC, Wise RA, **Schwartz AR**, Mitzner W, Polotsky VY. Chronic intermittent hypoxia induces lung growth in adult mice. *Am. J. Physiol. Lung Cell. Mol. Physiol.* 2011; 300(2):L266-73.
107. Kirkness JP, Verma M, McGinley BM, Erlacher M, **Schwartz AR**, Smith PL, Wheatley JR, Patil SP, Amis TC, Schneider H. Pitot-tube flowmeter for quantification of airflow during sleep. *Physiol. Meas.* 2011; 32(2): 223-37.
108. Pallayova M, Steele KE, Magnuson TH, Schweitzer MA, Smith PL, Patil SP, Bevans-Fonti S, Polotsky VY, **Schwartz AR**. Sleep apnea determines soluble TNF- $\alpha$  receptor 2 response to massive weight loss. *Obes. Surg.* 2011; 21(9): 1413-1423.
109. Kirkness JP, Peterson LA, Squier SB, McGinley BM, Schneider H, Meyer A, **Schwartz**

- AR**, Smith PL, Patil SP. Performance characteristics of upper airway critical collapsing pressure measurements during sleep. *Sleep*. 2011; 34(4):459-67.
110. Kobayashi M, Ayuse T, Hoshino Y, Kurata S, Moromugi S, Schneider H, Kirkness JP, **Schwartz AR**, Oi K. Effect of head elevation on passive upper airway collapsibility in normal subjects during propofol anesthesia. *Anesthesiology*. 2011; 115(2):273-81.
111. Polotsky M, Elsayed-Ahmed AS, Pichard L, Richardson RA, Smith PL, Schneider H, Kirkness JP, **Schwartz AR**. Effect of age and weight on upper airway function in a mouse model. *J. Appl. Physiol*. 2011; 111(3):696-703.
112. Jun JC, Drager LF, Najjar SS, Gottlieb SS, Brown CD, Smith PL, **Schwartz AR**, Polotsky VY. Effects of sleep apnea on nocturnal free fatty acids in subjects with heart failure. *Sleep* 2011; 34(9):1207-13.
113. Eastwood PR, Barnes M, Walsh JH, Maddison KJ, Hee G, **Schwartz AR**, Smith PL, Malhotra A, McEvoy RD, Wheatley JR, O'Donoghue FJ, Rochford PD, Churchward T, Campbell MC, Palme CE, Robinson S, Goding GS, Eckert DJ, Jordan AS, Catcheside PG, Tyler L, Antic NA, Worsnop CJ, Kezirian EJ, Hillman DR. Treating obstructive sleep apnea with hypoglossal nerve stimulation. *Sleep* 2011; 34(11):1479-1486.
114. Hoshino Y, Ayuse T, Kobayashi M, Kurata S, Kawai M, Schneider H, Patil SP, **Schwartz AR**, Kirkness JP, Oi K. The effects of hormonal status on upper airway patency in normal female subjects during propofol anesthesia. *J Clin Anesth* 2011; 3(7):527-33.
115. Kirkness JP, McGinley BM, Sgambati FP, Patil SP, Smith PL, **Schwartz AR**, Schneider H. Developing quantitative physiological phenotypes of sleep apnea for epidemiological studies. *Conf. Proc. IEEE Eng. Med. Biol. Soc.* 2011:8319-22.
116. **Schwartz AR**, Barnes M, Hillman D, Malhotra A, Kezirian E, Smith PL, Hoegh T, Parrish D, Eastwood PR. Acute upper airway responses to hypoglossal nerve stimulation during sleep in obstructive sleep apnea. *Am J Respir Crit Care Med*. 2012;185(4):420-426. [PMID:22135343]
117. Hernandez AB, Kirkness JP, Smith PL, Schneider H, Polotsky M, Richardson RA, Hernandez WC, **Schwartz AR**. Novel whole-body plethysmography system for the continuous characterization of sleep and breathing in a mouse. *J Appl Physiol*. 2012;112(4):671-80.
118. Polotsky M, Elsayed-Ahmed AS, Pichard L, Harris CC, Smith PL, Schneider H, Kirkness JP, Polotsky V, **Schwartz AR**. Effects of leptin and obesity on upper airway function. *J Appl Physiol*. 2012;112(10):1637-43.
119. Chin CH, Kirkness JP, Patil SP, McGinley BM, Smith PL, **Schwartz AR**, Schneider H. Compensatory responses to upper airway obstruction in obese apneic men and women. *J Appl Physiol* (1985). 2014;112(3):403-10. PMID: 22096117.
120. Wei T, Erlacher MA, Grossman P, Leitner EB, McGinley BM, Patil SP, Smith PL, Schneider H, **Schwartz AR**, Kirkness JP. Approach for streamlining measurement of complex physiologic phenotypes of upper airway collapsibility. *Computers in Biology and Medicine*. 2013; 43:600-606.
121. Hillman DR, Walsh JH, Maddison KJ, Platt PR, **Schwartz AR**, Eastwood PR. The

effect of diaphragm contraction on upper airway collapsibility. *J Appl Physiol* 2013;115(3):337-45.

122. Drager LF, Yao Q, Hernandez KL, Shin MK, Bevans-Fonti S, Gay J, Sussan TE, Jun JC, Myers AC, Olivecrona G, **Schwartz AR**, Halberg N, Scherer PE, Semenza GL, Powell DR, Polotsky VY. Chronic intermittent hypoxia induces atherosclerosis via activation of adipose angiopoietin-like4. *Am J Respir Crit Care Med*. 2013;188(2):240-8.
123. Dotan Y, Pillar G, Tov N, Oliven R, Steinfeld U, Gaitini L, Odeh M, **Schwartz AR**, Oliven A. Dissociation of electromyogram and mechanical response in sleep apnea during propofol anaesthesia. *Eur Respir J*. 2013;41(1):74-84.
124. Brigham EP, Patil SP, Jacobson LP, Margolick JB, Godfrey R, Johnson J, Johnson-Hill LM, Reynolds S, **Schwartz AR**, Smith PL, Brown TT. Association between systemic inflammation and obstructive sleep apnea in men with or at risk for HIV infection. *Antivir Ther*. 2014;19(8):725-33.
125. Shapiro, SD, Chin CH, Kirkness JP, McGinley BM, Patil SP, Polotsky VY, Biselli PJ, Smith PL, Schneider H, **Schwartz AR**. Leptin and the control of pharyngeal patency during sleep in severe obesity. *J Appl Physiol*. 2014;116(10):1334-41.
126. Kezirian EJ, Goding GS, Malhotra A, O'Donoghue FJ, Zammit G, Wheatley JR, Catcheside PG, Smith PL, **Schwartz AR**, Walsh JH, Maddison KJ, Claman DM, Huntley T, Park SY, Campbell MC, Palme CE, Iber C, Eastwood PR, Hillman DR, Barnes M. Hypoglossal nerve stimulation improves obstructive sleep apnea: 12-month outcomes. *J Sleep Res*. 2014; 23(1):77-83.
127. Patil SP, Brown TT, Jacobson LP, Margolick JB, Laffan A, Godfrey R, Johnson-Hill L, Godfrey R, Johnson J, Reynolds S, **Schwartz AR**, Smith PL. Sleep disordered breathing, fatigue, and sleepiness in HIV-infected and -uninfected men. *PLOS ONE*. 2014;9(7):e99258.
128. Shin MK, Yao Q, Jun JC, Bevans-Fonti S, Yoo DY, Han W, Mesarwi O, Richardson R, Fu YY, Pasricha PJ, **Schwartz AR**, Shirahata M, Polotsky YY. Carotid body denervation prevents fasting hyperglycemia during chronic intermittent hypoxia. *J Appl Physiol*. 2014;117(7):765-76. PMID:25103977
129. Dobrosielski DA, Patil S, **Schwartz AR**, Bandeen-Roche K, Stewart KJ. Effects of exercise and weight loss in older adults with obstructive sleep apnea. *Med Sci Sports Exerc*. 2015;47(1):20-6.
130. Schwartz NG, Rattner A, **Schwartz AR**, Mokhlesi B, Gilman RH, Bernabe-Ortiz A, Miranda JJ, Checkley W. Chronic Cohort Study Group. Sleep disordered breathing in four resource-limited settings in Peru: Prevalence, risk factors and associations with chronic diseases. *Sleep*. 2015;38(9): 1451-1459. PMID: 25845694.
131. Dotan Y, Pillar G, **Schwartz AR**, Oliven A. Asynchrony of lingual muscle recruitment during sleep in obstructive sleep apnea. *J Appl Physiol*. 2015;118(12):1516-24. PMID:25814639.
132. Dalesio NM, McMichael DH, Benke JR, Owens S, Carson KA, Schwengel DA, **Schwartz AR**, Ishman SL. Are nocturnal hypoxemia and hypercapnia associated with desaturation immediately after adenotonsillectomy? *Pediatric Anesthesia*. 2015;25(8):778-85.

PMID:26149770.

133. Lysyl oxidase as a serum biomarker of liver fibrosis in patients with severe obesity and obstructive sleep apnea. Mesarwi OA, Shin MY, Drager LF, Bevans-Fonti S, Jun JC, Putcha N, Torbenson MS, Pedrosa RP, Lorenzi-Filho G., Steele KE, Schweitzer MA, Magnuson TH, Lidor AO, **Schwartz AR**, Polotsky VY. *Sleep* 2015;38(10):1583-91. PMID:26085300  
PMCID: PMC4576332.
134. Pho H, Hernandez AB, Arias RS, Leitner EB, Van Kooten S, Kirkness JP, Schneider H, Smith PL, Polotsky VY, **Schwartz AR**. The effect of leptin replacement on sleep disordered breathing in the leptin-deficient *ob/ob* mouse. *J Appl Physiol* 120: 78–86, 2016.  
PMID:26472867.
135. Jun JC, Unnikrishman D, Schneider H, Kirkness J, Schwartz AR, Smith PL, Polotsky VY. Effect of acute intermittent CPAP depressurization during sleep in obesity patients. *PLoS One*. 2016;11(1):e0146606. PMID:26731735.
136. McGinley BM, Kirkness JP, Schneider H, Lenka A, Smith PL, **Schwartz AR**. Utilizing inspiratory airflows during standard polysomnography to assess pharyngeal function in children during sleep. *Pediatric Pulmonology*. PMID: 26474407
137. Miele CH, **Schwartz AR**, Gilman RH, Pham L, Wise RA, Davila-Roman VG, Miranda JJ, Leon-Velarde F, Checkley W. Increased cardiometabolic risk in the setting of chronic hypoxemia at high altitude. *High Altitude Med Biol*. 2016;17(2):93-100. PMID: 27281472.
138. Llanos OL, Galiatsatos P, Guzman-Velez E, Patil SP, Smith PL, Magnuson T, Schweitzer M, Steele K, Polotsky VY, **Schwartz AR**. Insulin resistance predicts elevations in pharyngeal collapsibility during sleep in severely obese non-diabetic patients. *Eur Resp J*. 2016; 47: 1611–1614.
139. Biselli P, Grossman PR, Kirkness JP, Patil SP, Smith PL, **Schwartz AR**, Schneider H. The effect of increased lung volume in COPD on upper airway obstruction during sleep. *J Appl Physiol* (1985). 2015 Aug 1;119(3):266-71.
140. Yao QL, Pho H, Kirkness J, Ladenheim EE, Bi S, Moran TH, Fuller DD, **Schwartz AR**, Polotsky VY. Localizing effects of leptin on upper airway and respiratory control during sleep. *Sleep*. 2016;39(5):1097-106.
141. Holbrook J, Sugar E, Yasin R, Busk M, Tepper RS, Irvin CG, Drye L, Brown R, Schwartz AR, Wise R. Effect of CPAP on airways reactivity in Asthma: A randomized sham-controlled clinical trial. *Ann Amer Thor Soc*. 2016;13(11):1940-1950. PMID: 27398992.
142. Dotan Y, Brodsky A, **Schwartz AR**, Oliven A. Differential effects of respiratory and electrical stimulation-induced dilator muscle contraction on mechanical properties of the pharynx in the pig. *J Appl Physiol* (1985). 2016;121(3):606-14. PMID: 2731144.
143. Dalesio NM, Hendri CW, McMichael DH, Thompson CB, Lee CK, Pho H, Arias RS, Lynn RR, Galinkin J, Yaster M, Brown RH, Schwartz AR. Effects of obesity and leptin deficiency on morphine pharmacokinetics in a mouse model. *Anesth Analg*. 2016; 123(6): 1611-1617. PMID 27782940
144. Dergacheva O, Yamanaka A, Schwartz AR, Polotsky VY, Mendelowitz D. Direct

projections from hypothalamic orexin neurons to brainstem cardiac vagal neurons. *Neuroscience*. 2016;339:47-53. PMID: 27693474

145. Dergacheva O, Yamanaka A, Schwartz AR, Polotsky VY, Mendelowitz D. Hypoxia and hypercapnia inhibit hypothalamic orexin neurons in rats. *J Neurophysiol*. 2016;116(5):2250-2259.
146. Dalesio NM, Lee CKK, McMichael DH, Thompson C, Pho H, Arias R, Lynn RR, Galinkin J, Yaster M, Brown R, **Schwartz AR**. Obesity and leptin deficiency effects on morphine pharmacokinetics in a mouse model. *Anesth Analg*. 2016;123(6):1611-1617. PMID: 27782940
147. Biselli PJ, Kirkness JP, Grote L, Fricke K, Schwartz AR, Smith P, Schneider H. Nasal high-flow therapy reduces work of breathing compared with oxygen during sleep in COPD and smoking controls: a prospective observational study. *J Appl Physiol*. 2017;22(1): 82-88. PMID: 27815367
148. Dergacheva O, Yamanaka A, Schwartz AR, Polotsky VY, Mendelowitz D. Optogenetic identification of hypothalamic orexin neuron projections to paraventricular spinally projecting neurons. *Am J Physiol Heart Circ Physiol*. 2017;312 (4): H808-H817 PMID 281598808
149. Fleury Curado T, Fishbein K, Pho H, Brennick M, Dergacheva O, Sennes LU, Pham LV, Ladenheim EE, Spencer R, Mendelowitz D, Schwartz AR, Polotsky VY. Chemogenetic stimulation of the hypoglossal neurons improves upper airway patency. *Sci Rep*. 2017;7:44392. PMID: 28281681
150. Pham LV, Meinzen C, Arias RS, Schwartz NG, Rattner A, Miele CH, Smith PL, Schneider H, Miranda JJ, Gilman RH, Polotsky VY, Checkley W, **Schwartz AR**. Cross-Sectional Comparison of Sleep-Disordered Breathing in Native Peruvian Highlanders and Lowlanders. *High Alt Med Biol*. 2017;18 (1): 11-19. PMID: 28306414
151. Guzman MA, Sgambati FP, Pho H, Arias RS, Hawks EM, Wolfe EM, Otvos T, Rosenberg, R, Dakheel R, Schneider H, Kirkness JP, Smith PL, **Schwartz AR**. The Efficacy of Low-Level Continuous Positive Airway Pressure for the Treatment of Snoring. *J Clin Sleep Med*. 2017;13(5):703-711. PMID: 28356182
152. Pham LV, Miele CH, Schwartz NG, Arias RS, Rattner A, Gilman RH, Miranda JJ, Polotsky VY, Checkley W, **Schwartz AR**. Cardiometabolic correlates of sleep disordered breathing in Andean highlanders. *Eur Respir J*. 2017;15:49(6). PMID: 28619952.
153. Oliven R, Cohen G, Dotan Y, Somri M, **Schwartz AR**, Oliven A. Alteration in upper airway dilator muscle coactivation during sleep: comparison of patients with obstructive sleep apnea and healthy subjects. *J Appl Physiol*. 2018;124(2):421-429. PMID: 29191983
154. Pham LV, **Schwartz AR**, Jun JC. Oxyhemoglobin saturation overshoot following obstructive breathing events mitigates sleep apnea-induced glucose elevations. *Front Endocrinol (Lausanne)*. 2018;9:477. PMID: 30190705
155. Oliven R, Cohen G, Somri M, **Schwartz AR**, Oliven A. Peri-pharyngeal muscle response to inspiratory loading: comparison of patients with OSA and healthy subjects. *J Sleep Res*. 2019 28(5):e12756. PMID: 30168231

156. Fleury Curado T, Pho H, Berger S, Caballero-Eraso C, Shin MK, Sennes LU, Pham L, **Schwartz AR**, Polotsky VY. Sleep-disordered breathing in C57BL/6J mice with diet-induced obesity. *Sleep*. 2018;41(8). doi: 10.1093/sleep/zsy089. PMID: 29767787
157. Pham LV, **Schwartz AR**, Polotsky VY. Integrating loop gain into the understanding of obstructive sleep apnoea mechanisms. *J Physiol*. 2018;596(17):3819-3820. PMID: 29968907
158. Fleury Curado TA, Pho H, Dergacheva O, Berger S, Lee R, Ubirajara Sennes L, Mendelowitz D, **Schwartz AR**, Polotsky VY. Silencing of Hypoglossal Motoneurons Leads to Sleep Disordered Breathing in Lean Mice. *Frontiers in Neurology (section Sleep and Chronobiology)*. *Front. Neurol*. 2018;14(9):962.
159. Nishimura Y, Arias RS, Pho H, Pham LV, Fleury Curado, T, Polotsky VY, **Schwartz AR**. A novel non-invasive approach for measuring upper airway collapsibility in mice. *Front. Neurol.*, 2018;9:985. [PMID: 30524362]
160. Arble DM, **Schwartz AR**, Polotsky VY, Sandoval DA, Seeley RJ. *JCI Insight*. 2019;10;4(1):e124469. Doi:10.1172/jci.insight.124469. [PMID: 30626748]
161. Caballero-Eraso C, Shin MK, Pho H, Kim LJ, Pichard LE, Wu ZJ, Gu C, Berger S, Pham L, Yeung HY, Shirahata M, **Schwartz AR**, Tang WY, Sham JSK, Polotsky VY. Leptin acts in the carotid bodies to increase minute ventilation during wakefulness and sleep and augment the hypoxic ventilatory response. *J Physiol*. 2018;1-22.
162. Oliven R, Cohen G, Somri M, **Schwartz AR**, Oliven A. Spectral analysis of peri-pharyngeal muscles' EMG in patients with OSA and healthy subjects. *Respir Physiol Neurobiol*. 2019;260:53-57.
163. Arias RS, Etienne B, Polotsky VY, Checkley W, **Schwartz AR**, Pham LV. Upright posture increases oxyhemoglobin saturation in Peruvian highlanders. *Respir Physiol Neurobiol*. 2019;266:138–43 [PMID 31048020].
164. Dalesio NM, McMichael DH, Benke JR, Owens S, Carson KA, Schwengel DA, **Schwartz AR**, Ishman SL. Are nocturnal hypoxemia and hypercapnia associated with desaturation immediately after adenotonsillectomy? *Pediatric Anesthesia*. 2015;25(8);778-785.
165. Dalesio NM, Lee CKK, Hendrix CW, Kerns N, Hsu A, Clarke W, Collaco JM, McGrath-Morrow S, Yaster M, Brown R, **Schwartz AR**. Effects of Obstructive Sleep Apnea Syndrome and Obesity on Morphine Pharmacokinetics in Children. *Analgesia and Anesthesia*. *Anesth Analg*. 2020;131(3):876-884. [PMID: 31688081].
166. Koch AL, Brown RH, Woo H, Brooker AC, Paulin LM, Schneider H, **Schwartz AR**, Diette GB, Wise RA, Hansel NN, Putcha N. Obstructive sleep apnea and airway dimensions in chronic obstructive pulmonary disease. *Ann Am Thorac Soc*. 2020; 17(1): 116-118 [PMID 31425663].
167. Oliven R, Cohen G, Somri M, **Schwartz AR**, Oliven A. Relationship between the activity of the genioglossus, other peri-pharyngeal muscles and flow mechanics during wakefulness and sleep in patients with OSA and healthy subjects. *Respir Physiol Neurobiol*. 2020 Mar;274:103362. doi: 10.1016/j.resp.2019.103362. Epub 2019 Dec 19. PMID: 31866501; PMCID: PMC7422939.

168. Oliven A, Dotan Y, Golibroda T, Somri M, Oliven R, **Schwartz AR**. Electrical stimulation of the whole hypoglossal nerve in patients with obstructive sleep apnea. *Sleep Breath*. 2020;24(4):1473-1480. [PMID: 31907824].
169. **Schwartz AR**, Sgambati FP, James KJ, Goblish TP, Germany RE, Jackson SE, Samtani N, Berger RD. Novel phrenic nerve stimulation treats Cheyne-Stokes respiration: Polysomnographic insights. *J Clin Sleep Med*. 2020; 16(5):817-820. [PMID: 3202483].
170. Zhang Z, Sowho M, Otvos T, Sperandio LS, East J, Sgambati F, **Schwartz A**, Schneider H. A comparison of automated and manual sleep staging and respiratory event recognition in a portable sleep diagnostic device with in-lab sleep study. *J Clin Sleep Med*. 2020;16(4):563-573. [PMID: 32022670].
171. Berger S, Pho H, Fleury-Curado T, Bevans-Fonti S, Younas H, Shin MK, Jun JC, Anokye-Danso F, Ahima RS, Enquist LW, Mendelowitz D, **Schwartz AR**, Polotsky VY. Intranasal leptin relieves sleep-disordered breathing in mice with diet-induced obesity. *Am J Respir Crit Care Med*. 2019;199(6):773-783. PMID 30309268.
172. Snoring: a source of noise pollution and sleep apnea predictor. Sowho M, Sgambati F, Guzman M, Schneider H, **Schwartz A**. *Sleep*. 2020;43(6):zsz305. Doi:10.1093/sleep/zsz305. PMID:31837267.
173. Oliven R, Cohen G, Somri M, **Schwartz AR**, Oliven A. Relationship between the activity of the genioglossus, other peri-pharyngeal muscles and flow mechanics during wakefulness and sleep in patients with OSA and healthy subjects. *Respir Physiol. & Neurobiology*. 2020;274(3), 103362.
174. Kent DT, Zealear D, **Schwartz AR**. Ansa Cervicalis Stimulation: A new direction in neurostimulation for OSA. *Chest*. 2020:S0012-3692(20)34899-6. Doi:10.1016. PMID:33065104.
175. **Schwartz AR**, Cohen-Zion M, Pham LV, Gal A, Sowho M, Sgambati FP, Klopfer T, Guzman MA, Hawks EM, Etzioni T, Glasner L, Druckman E, Pillar G. Brief digital sleep questionnaire powered by machine learning prediction models identifies common sleep disorders. *Sleep Med*. 2020;71:66-76. PMID:32502852.
176. Seay EG, Keenan BT, **Schwartz AR**, Dedhia RC. Evaluation of therapeutic positive airway pressure as a hypoglossal nerve stimulation predictor in patients with obstructive sleep apnea. *JAMA Otolaryngol head neck Surg*. 2020;146(8)1-8. PMID:32496539.
177. Dalesio NM, Lee CKK, Hendrix CW, Kerns N, Hsu A, Clarke W, Collaco JM, McGrath-Morrow S, Yaster M, Brown RH, **Schwartz AR**. Effects of obstructive sleep apnea and obesity on morphine pharmacokinetics in children. *Anesth. Analg*. 2020;131(3)876-884. PMID 31688-81.
178. Fleury Curado T, Pho H, Freire C, Amorim MR, Bonaventura J, Kim LJ, Lee R, Cabassa ME, Streeter SR, Branco LG, Sennes LU, Fishbein K, Spencer RG, **Schwartz AR**, Brennick MJ, Michaelides M, Fuller DD, Polotsky VY. Designer Receptors Exclusively Activated by Designer Drugs Approach to Treatment of Sleep-disordered Breathing. *Am J Respir Crit Care Med*. 2021 Jan 1;203(1):102-110. doi: 10.1164/rccm.202002-0321OC. PMID: 32673075; PMCID: PMC7781140.
179. Kent DT, **Schwartz AR**, Zealear D. Ultrasound localization and percutaneous electrical

stimulation of the hypoglossal nerve and ansa cervicalis. *Otolaryngol Head Neck Surg.* 2021;164(1):219-225. PMID:33076752.

180. Ju JD, Zhang C, Sgambati FP, Lopez LM, Pham LV, **Schwartz AR**, Accinelli RA. Acute altitude acclimatization in young health volunteers: Nocturnal oxygenation increases over time, whereas periodic breathing persists. *High Alt Med Biol.* 2021;22(1):14-23. PMID:33185483.
181. Kent DT, Zealear D, **Schwartz AR**. Ansa Cervicalis and Hypoglossal Nerve Stimulation in a Patient with Obstructive Sleep Apnea. *Arch Otolaryng Head Neck Surg.* 2021;165(4):602-604. [PMID: 33494663].
182. Costanzo RM, Javaheri S, Ponikowski P, Oldenburg O, Augostini R, Goldberg LR, Fox H, **Schwartz AR**, Gupta S, McKane S, Meyer TE, Abraham WT. Transvenous phrenic nerve stimulation for treatment of central sleep apnea: Five-year safety and efficacy outcomes. *Nat Sci Sleep.* 2021;13:515-26.
183. Pho H, Berger S, Freire C, Kim LJ, Shin MY, Streeter SR, Hosamane N, Cabassa ME, Anokye-Danso F, Dergacheve O, Amorin M, Fleury-Curado T, Jun JC, **Schwartz AR**, Ahma RS, Mendelowitz D, Polotsky VY. Leptin receptor expression in the dorsomedial hypothalamus stimulates breathing during NREM sleep in db/db mice. *Sleep.* 2021;44(6):zsab046. PMID: 33624805.
184. Yu JL, Liu Y, Tangutur A, Arnold M, Seay EG, **Schwartz AR**, Dedhia RC. Influence of apnea vs hypopnea predominance in predicting mean therapeutic positive airway pressures among patients with obstructive sleep apnea. *J Clin Sleep Med.* 2021 Nov 1;17(11):2171-2178. doi: 10.5664/jcsm.9342. PMID: 34666884; PMCID: PMC8636375.
185. **Schwartz AR**, Goldberg L, McCane SM, Morgenthaler T. Transvenous Phrenic Nerve Stimulation improves central sleep apnea, sleep quality and quality of life regardless of prior positive airway pressure-treatment. *Sleep Breath.* 2021;25(4):2053-2063. PMID: 33745107.
186. Kent DT, Scott W, Zealear D, **Schwartz AR**. Ansa Cervicalis Stimulation Increases Pharyngeal Patency in Patients with Obstructive Sleep Apnea. *J Appl Physiol.* 2021;131(2):487-495. PMID: 34197226.
187. Jacobowitz O, Schwartz AR, Lovett EG, Ranuzzi G, Malhotra A. Design and rationale for treating obstructive sleep apnea using targeted hypoglossal neurostimulation (OSPNEY) trial. *Contemp Clin Trials.* 119 (2022) 106804. doi: 10.1016/j.cct.2022.106804. PMID: 35613672.
188. Kent DT, Zealear D, **Schwartz AR**. Ansa cervicalis and hypoglossal nerve stimulation in a patient with obstructive sleep apnea. *Otolaryngol Head Neck Surg.* 2021;165(4):602-604. PMID: 33494663.
189. Sowho M, Jun J, Sgambati F, Potocki M, Schneider H, Smith P, Schwartz A, Dietz H, MacCarrick G, Neptune E. Assessment of pleural pressure during sleep in Marfan syndrome. *J Clin Sleep Med.* 2022 Jun 1;18(6):1583-1592. doi: 10.5664/jcsm.9920. PMID: 35152942; PMCID: PMC9163628.
190. Sowho M, Schneider H, Jun J, MacCarrick G, Schwartz A, Pham L, Sgambati F, Lima J, Smith P, Polotsky V, Neptune E. D-dimer in Marfan syndrome: effect of obstructive sleep

apnea induced blood pressure surges. *Am J Physiol Heart Circ Physiol*. 2022 May 1;322(5):H742-H748. doi: 10.1152/ajpheart.00004.2022. Epub 2022 Mar 11. PMID: 35275761; PMCID: PMC8977140.

191. Yu JL, Thuler E, Seay EG, Schwartz AR, Dedhia RC. The Accuracy and Reliability of Visually Assessed Pharyngeal Opening Pressures During Drug-Induced Sleep Endoscopy. *Otolaryngol Head Neck Surg*. 2022 Aug 30;194:5998221120793. doi: 10.1177/01945998221120793. PMID: 36040822.
192. Fleury TC, Pham LV, Otvos T, Klopfer T, Freire C, Amorim MR, Nishimura Y, Ubirajara LS, Psoter KJ, Abdelwahab M, Huang A, Dedhia RC, Liu S, Capasso R, Oliven A, Polotsky VY, Eisele DW, **Schwartz AR**. Changes in tongue morphology predict responses in pharyngeal patency to selective hypoglossal nerve stimulation. *J Clin Sleep Med*. 2023. <https://doi.org/10.5664/jcsm.10474>. PMID: 36727502.
193. Jacobowitz O, Schwartz AR, Lovett EG, Ranuzzi G, Malhotra A. Design and rationale for the treating Obstructive Sleep Apnea using Targeted Hypoglossal Nerve Stimulation (OSPNEY) trial. *Contemp Clin Trials*. 2022 Aug;119:106804. doi: 10.1016/j.cct.2022.106804. Epub 2022 May 22. PMID: 35613672; PMCID: PMC9420766.
194. Cheong C, Dedhia RC, Seay E, **Schwartz AR**. Enhanced drug-induced sleep endoscopy: Distinguishing central from obstructive apnea. *The Laryngoscope*. 2022;133(3):70-708. <https://doi.org/10.1002/lary.30517>
195. Thuler E, Seay E, Woo J, Lee J, Jafari N, Keenan BT, Dedhia RC, **Schwartz AR**. Transverse maxillary deficiency predicts increased upper airway collapsibility during drug-induced sleep endoscopy. *Otolaryngology-Head and Neck Surgery*. 2023;00(00):1-10. DOI: 10.1002/ohn.258.
196. Li Y, Richard KE, Schwartz AR, Zeale D, Lindsell CJ, Budnick HA, Kent DT. Quantitative Effects of Ansa Cervicalis Stimulation in Obstructive Sleep Apnea. *Am J Respir Crit Care Med*. 2023 Jan 19. doi: 10.1164/rccm.202212-2318LE. Epub ahead of print. PMID: 36656553.
197. Javaheri S, Rapoport DM, **Schwartz AR**. Distinguishing central from obstructive hypopneas on a clinical polysomnogram, *J Clin Sleep Med*. PMID: 36661093. DOI: [10.5664/jcsm.10420](https://doi.org/10.5664/jcsm.10420).
198. **Schwartz AR**, Jacobowitz O, Eisele DW, Mickelson SA, Miller MB, Oliven A, Certal V, Hopp ML, Winslow DH, Huntley TC, Nachlas NE, Pham LV, Gillespie MB, Weeks BH, Lovett EG, Shen J, Malhotra A, Maurer JT. Targeted hypoglossal nerve stimulation for patients with obstructive sleep apnea: A randomized clinical trial. *JAMA Otolaryngol Head Neck Surg*. 2023. doi: 10.1001/jamaoto.2023.0161. PMID: 37022679.
199. Hawks EM, Pho H, Wolfe EM, Guzman MA, Russell C, Polotsky VY, Patil SP, Schneider H, Smith PL, Kirkness JP, **Schwartz AR**. Insulin resistance and upper airway function predict sleep apnea remission with weight loss. *In preparation*.
200. Sgambati FP, Rosenberg R, Dakheel R, Pho H, Arias RS, Wolfe EM, Hawks EM, Guzman MA, Kirkness JP, Smith PL, **Schwartz AR**. Noise pollution in the bedroom: Objective breath-by-breath quantification of snoring intensity and frequency. *In preparation*.

### Not peer-reviewed

1. **Schwartz AR.** Data acquisition and analysis tools simplify research on sleep apnea. *Scientific Computing & Automation.* 1991; 7(10):55-58.
2. Smith PL, **Schwartz AR.** The effect of theophylline on sleep in normal sleep subjects. (Editorial) *Chest.* 1993; 103(1):5-6.
3. Dinges DF, Kribbs NB, **Schwartz AR,** Smith PL, Pack AI. Objective measurement of nasal continuous positive airway pressure use. Ethical considerations. *Am J Respir Crit Care Med.* 1994; 149:291-292.
4. **Schwartz AR,** Rowley JA, O'Donnell C, King ED, Mayor A, Robotham J, Smith PL. Effect of hypertension on upper airway function and sleep apnea. *J Sleep Res.* 1995; 4, Suppl. 1, 83-88.
5. O'Donnell CP, King ED, **Schwartz AR,** Smith PL, Robotham JL. A dog model to investigate the relationship between obstructive sleep apnea and blood pressure regulation. *J Sleep Res.* 1995; 4, Suppl 1, 89-92.
6. **Schwartz AR,** Rowley JA, Thut DC, Permutt S, Smith PL. Structural basis for alterations in upper airway collapsibility. *Sleep.* 1996; 19(10):S184-S188.
7. Smith PL, Eisele DW, Podszus T, Grote L, Hermann P, **Schwartz AR.** Electrical stimulation of upper airway musculature. *Sleep.* 1996; 19(1):S284-S287.
8. Gold AR, **Schwartz AR.** The Pharyngeal Critical Pressure: The Whys and Hows of Using Nasal Continuous Positive Airway Pressure Diagnostically. *Chest.* 1996; 110(4):1077-1088.
9. **Schwartz AR,** Smith PL, Gold AR. Clinical application of quantitative measures of pharyngeal collapsibility. *ASDA News.* 1997; 4(1):11-2.
10. Winakur SJ, Smith PL, **Schwartz AR.** Pathophysiology and risk factors for obstructive sleep apnea. *Seminars in Respiratory Medicine.* 1998; 19(2):99-112.
11. **Schwartz AR,** Eisele DW, Smith PL. Pharyngeal airway obstruction in obstructive sleep apnea pathophysiology and clinical implications. *Otolaryngologic Clinics of North America.* 1998; 31(6):911-918.
12. **Schwartz AR.** Sleep Apnea. *The Johns Hopkins Health Insider.* January 1999; 2(1).
13. Marx JJ, Punjabi N, **Schwartz A.** Letter to the Editor: Preoperative Pulmonary Evaluation. *New Eng J Med.* 1999; 341(8):613.

14. O'Donnell CP, Tankersley CG, Polotsky VY, **Schwartz AR**, Smith PL. Leptin, Obesity, and Respiratory Function. *Respiration Physiology, Special Issue: Sleep and Respiration*, Guest Editors: J.E. Remmers, PM Surratt. *Respir Physiol*. 2000; 119(2-3):163-170.
15. O'Donnell C, **Schwartz AR**, Smith PL. Upper airway collapsibility: The importance of gender and adiposity. *Am J Respir Crit Care Med*. 2000; 162:1606-1607.
16. Smith PL, **Schwartz AR**. Sleep-disordered breathing in adults. *Respiratory Digest*. 2001; Vol. 3, Issue 4:1-9.
17. Boudewyns A, **Schwartz AR**, Van de Heyning PH. Upper airway collapsibility: measurement techniques and therapeutic implications. *Acta Otorhinolaryngol Belg*. 2002; 56(2):121-5.
18. **Schwartz AR**. Sleep Apnea Solutions. *Heart & Health Reports*. 2003; 5(1):1, 4.
19. Eisele DW, **Schwartz AR**, Smith PL. Tongue neuromuscular and direct hypoglossal nerve stimulation for obstructive sleep apnea. *Otolaryngol Clin N Am*. 2003; 36(3):501-510.
20. **Schwartz AR**, Schneider H, Smith PL. Upper airway surface tension: is it a significant cause of airflow obstruction during sleep? *J Appl Physiol*. 2003; 95(5):1759-60.
21. **Schwartz AR**, Kirkness JP, Smith PL. Extraluminal tissue pressure: what does it mean? *J Appl Physiol*. 2006; 5-6.
22. Patil SP, Schneider H, Smith PL. Adult obstructive sleep apnea: pathophysiology and diagnosis. *Chest*. 2007; 132(1):325-37.
23. **Schwartz AR**, Patil SP, Laffan AM, Schneider H, Smith PL. Obesity and obstructive sleep apnea: pathogenic mechanisms and therapeutic approaches. *Proc Am Thorac Soc*. 2008; 15;5(2):185-92.
24. **Schwartz AR**, Patil SP, Schneider H, Smith PL. Modeling pathogenic mechanisms of upper airway dysfunction in the molecular age. *Eur Respir J*. 2008; 32(2):255-8.
25. **Schwartz AR**, Patil SP, Squier S, Schneider H, Kirkness JP, Smith PL. Obesity and upper airway control during sleep. *J Appl Physiol*. 2010; 108(2):430-5.
26. Oliven A, Tov N, Odeh M, Steinfeld U, Oliven R, **Schwartz A**, Gaitini L. Electrical stimulation of the genioglossus to improve pharyngeal patency in obstructive sleep apnea: comparison of results obtained during sleep and anesthesia. *Harefuah*. 2009; 148(5):315-9, 350, 349. Hebrew.
27. Kezirian EJ, Boudewyns A, Eisele DW, **Schwartz AR**, Smith PL, Van de Heyning PH, De Backer WA. Electrical stimulation of the hypoglossal nerve in the treatment of obstructive

- sleep apnea. *Sleep Medicine Reviews*. 2010; 14: 299-305.
28. **Schwartz AR**, Schneider H, Smith PL, McGinley BM, Patil SP, Kirkness JP. Physiologic phenotypes of sleep apnea pathogenesis. *Am J Respir Crit Care Med* 2011; 184(10):1105-6.
  29. **Schwartz AR**, Smith PL, Schneider H, Patil SP, Kirkness JP. Lung Volume and Upper Airway Collapsibility: What Does It Tell Us about Pathogenic Mechanisms? *J Appl Physiol*. 2012;113:689-90.
  30. Esquinas A, Conde B, **Schwartz A**. Monitoring of non-invasive ventilation of home bi-level ventilators: Are bench studies more necessary and familiar? *Chest*. 2012;142(6):1692-3.
  31. Rodríguez AM, Conde B, **Schwartz AR**. Monitoring noninvasive ventilation of home bilevel ventilators: are bench studies more necessary and familiar? *Chest*. 2012 Dec;142(6):1692-3; author reply 1693-4.
  32. **Schwartz AR**, Smith PL. Cross Talk proposal: The upper airway does behave as a Starling resistor. *J. Physiol. (London)*. 2013;591(9): 2229-32.
  33. **Schwartz AR**, Smith PL. Rebuttal from Alan R. Schwartz and Philip L. Smith. *J. Physiol. (London)*. 2013; 591(9): 2235.
  34. **Schwartz AR**, Smith PL, Oliven A. Electrical stimulation of the hypoglossal nerve: a potential therapy. *J. Appl. Physiol*. 2014;116:337-344.
  35. **Schwartz, AR**. Hypoglossal nerve stimulation – Optimizing its therapeutic potential in obstructive sleep apnea. *J Neurological Sciences*. 2014;15;346(1-2):1-3.
  36. Esquinas AM, Papdakos PJ, **Schwartz AR**. Sleep patterns during long-term mechanical ventilation in tracheostomized patients in the ICU: do they matter? *Crit Care Med*. 2014 42(1):e82-3.
  37. Javaheri S, **Schwartz AR**. Leptin and ventilation in heart failure (*letter*). *Chest*. 2015: e197.
  38. Pham L, **Schwartz AR**. The pathogenesis of obstructive sleep apnea. *J. Thoracic Dis*. 2015;7(8):1358-72. PMID:4561284.
  39. Who's Who in the ATS, Alan Schwartz: A focus on sleep leads to new innovation for patients. Mar 4, 2016. <http://news.thoracic.org/alan-schwartz-a-focus-on-sleep-leads-to-new-innovation-for-patients/>
  40. Johns Hopkins Medicine website: Johns Hopkins Healthy Sleep on Snoring and Sleep Apnea. Sari Harrar and Alan R. Schwartz. May, 2016.
  41. Sleep apnoea. Jun JC, Chopra S, **Schwartz AR**. *Eur Respir Rev*. 2016;25(139):12-18. PMID

2692946.

42. Integrating Loop Gain into the Understanding of Obstructive Sleep Apnoea Mechanisms. Pham LV, Polotsky VY, **Schwartz AR**. *Amer J Respir Crit Care Med. J Physiol.* 2018;596(17): 3819-3820.
43. Malhotra A, **Schwartz AR**, Schneider H, Owens RL, DeYoung P, Han MLK, Wetzicha J, Hansel N, Zeidler M, Wilson KC, Badr S on behalf of the Assembly on Sleep and Respiratory Neurobiology. Research priorities in pathophysiology for sleep-disordered breathing in patients with chronic obstructive pulmonary disease. *Amer J Respir Crit Care Med. Am J Respir Crit Care Med.* 2018;197(3):2890299. PMID: 29388824
44. Fleury Curado T, Oliven A, Sennes LU, Polotsky VY, Eisele D, **Schwartz AR**. Neurostimulation treatment in obstructive sleep apnea. *Chest* 2018(18);S0012-3692, PMID: 30222959.
45. If Sleeping During COVID-19 Is Difficult, Here's What You Can Do to Help It. <https://www.doctoroz.com/article/if-sleeping-during-covid-19-difficult-here-s-what-you-can-do-help-it>
46. Nishimura Y, Schwartz AR, Curado TF, Schneider H, Polotsky VY. Review of upper airway physiology in obstructive sleep apnea [in Japanese]. *Japanese J Otolaryng Head Neck Surgery.* 2020;F36(7):811-24.

Dedhia RC, Seay EG, Schwartz AR. Beyond VOTE: The New Frontier of Drug-Induced Sleep Endoscopy. *ORL J Otorhinolaryngol Relat Spec.* 2022;84(4):296-301. doi: 10.1159/000518660. Epub 2021 Sep 27. PMID: 34818232; PMCID: PMC8957630.

### **Book Chapters**

1. **Schwartz AR**, Smith PL. Sleep apnea in the elderly. *In: N. American Clinics in Geriatric Medicine.* 1989; Philadelphia; W.B. Saunders, 5(2):315-29.
2. Smith PL, **Schwartz AR**, Gauda E, Wise R, Brower R, Permutt S. The modulation of upper airway critical pressures during sleep. Section VII: Upper Airway Mechanics and Imaging. *In: Issa FG, Suratt PM, Remmers JE, eds. Sleep and Respiration.* 1990; 253-260.
3. Smith PL, **Schwartz AR**. Medical assessment and management of obstructive sleep apnea in pre- and post-operative setting. *In: Proceedings of Cherry Blossom Conference - American Academy of Otolaryngology - Head and Neck Surgery.* 1992; Clinical Geriatric

Otorhinolaryngology. Decker Publishing. Hamilton, Canada. Chapter 14, 88-91.

4. **Schwartz AR**, Smith PL, Kashima HK, Proctor DF. Respiratory function of the upper airways. In: Murray JF, Nadel JA, eds. *Textbook of Respiratory Medicine*, 2<sup>nd</sup> edition. 1994; Philadelphia: W.B. Saunders Co., 1451-1470.
5. Smith PL, **Schwartz AR**. Control of Breathing. In: Stobo JD, Hellmann DB, Ladenson PW, Petty BG, Traill TA, eds. *The Principles and Practice of Medicine*, 23<sup>rd</sup> edition. 1996; Norwalk, CT: Appleton & Lange Inc.
6. Togias A, Smith PL, Kashima HK, Proctor DF, **Schwartz AR**. Control of Breathing. In: Murray JF, Nadel JA, eds. *Textbook of Respiratory Medicine*, 3<sup>rd</sup> edition. 2000; Philadelphia: W.B. Saunders Co. 1343-1360.
7. Smith PL, **Schwartz AR**. Biomechanics of the upper airway during sleep. In: AI Pack, ed. *Sleep Apnea Pathogenesis, Diagnosis and Treatment*. 2002; New York: Marcel Dekker, pp. 31-56.
8. Boudewyns A, Punjabi N, Van de Heyning PH, De Backer WA, O'Donnell C, Schneider H, Smith PL, **Schwartz AR**. An abbreviated method for assessing upper airway function in obstructive sleep apnea. In: *Snoring and obstructive sleep apnea syndrome*. 2003: 303-305. M. Fabiani, ed. Kugler Publications, The Hague, The Netherlands.
9. Boudewyns A, De Backer WA, **Schwartz AR**, Van de Heyning PH. Functional electrical stimulation of the nervus hypoglossus for obstructive sleep apnea syndrome treatment. In: *Snoring and obstructive sleep apnea syndrome*. 2003: 549-551. M Fabiani, ed. Kugler Publications, The Hague, The Netherlands.
10. **Schwartz AR**, Eisele DW, Oliven A, Rowley JA, Patil S, Schneider H, Boudewyns A, Smith PL. Neuromuscular control of upper airway patency during sleep. In: *La Roncopatia Cronica. XCI Congresso Nazionale, Societa Italiana di Otorinolaringologia e Chirurgia Cervico-facciale*. 2004: 87-106. M De Benedetto, ed. TorGraf Publications, Turin, Italy.
11. Smith PL, Patil SP, Kirkness JP, Schneider H, **Schwartz AR**. Biomechanics of the upper airway during sleep. 2011: 27-52. In: AI Pack, ed. *Sleep Apnea Pathogenesis, Diagnosis and Treatment*. 2<sup>nd</sup> Edition. London: Informa Healthcare, Ltd. (ISBN-13: 9780849396977).

#### **Inventions, Patents, Copyrights:**

“Method and Apparatus for Providing Ventilatory Support to a Patient” (U.S. Patent Filing Date: December 11, 1997, Issued October 1, 2002, U.S. #2002/6457472).

“Therapeutic Diaphragm Stimulation Device and Method” (U.S. Patent Filing Date: October 31, 2007; Issued March 20, 2012, U.S. #2012/8,140,164).

“Disposable Sleep and Breathing Monitor” (U.S. Patent Filing Data: September, 2005; issued

August 16, 2016, U.S. #2016/9,415,182).

“Ventilation and Respiratory Stabilization Device and Method” (U.S. Patent Filing Date: November 7, 2007; Application No. 11/983,240, US8573205B2).

**Extramural Sponsorship:**

**Past Grants:**

NIH – R01 HL37379, PI: Philip L. Smith, M.D. “Critical Pressures in the Human Upper Airway”, 01/20/87- 01/19/90.

NIH – K08 HL02031, PI: Alan R. Schwartz, M.D. "Human Upper Airway Critical Pressures During Sleep", Clinical Investigator Award, 08/01/88 - 07/31/93.

NIH – R01 HL37379, PI: Philip L. Smith, M.D. "Neuromechanical Regulation of Airflow in the Upper Airway", 07/01/90 - 6/30/95.

NIH – M01 RR00052, PI: Hugh Sampson, M.D. "Upper Airway Pressure-Flow Relationship in Children with Obstructive Sleep Apnea", Pediatric Clinical Research Center, 12/1/90 - 11/30/95.

Medtronics, Inc., PI: Alan R. Schwartz, M.D. "Neuromuscular Stimulation of the Human Upper Airway in Sleep Apnea", 9/90 - 08/97.

NIH – R01 HL37379, PI: Philip L. Smith, M.D. "Pharyngeal Collapsibility in Health and Disease", NHLBI, 09/01/95 - 08/31/99.

NIH – U01 HL53937, PI: Javier Nieto, M.D., Ph.D., "Cardiovascular Consequences of Sleep Apnea", NHLBI, 09/30/94 - 08/31/99.

NIH – HL523174, PI: Allan Pack, M.D., Ph.D. "SCOR in Cardiopulmonary Disorders of Sleep", University of Pennsylvania Subcontract, 9/30/93 - 9/30/98.

NIH – R29 HL50381, PI: Alan R. Schwartz, M.D. "The Segmental Control of Pharyngeal Collapsibility", 04/01/94 - 02/29/99.

NIH – R01 HL58585, PI: Carole Marcus, M.D., “Pathophysiology of Childhood Obstructive Sleep Apnea”, 7/1/97 - 6/30/01.

NIH (SBIR) R43 MH60034, PI: Arthur V. Cooke, Ph.D. (Active Signal Technologies), “Advanced At-Home Screening Device for Sleep Apnea”, 7/1/99-12/31/99.

NIH (SBIR) R43 MH59444, PI: Alex Menkes (Baltimore BioMedical Inc.): “Quick Placement EEG Electrode”, 12/01/98 - 12/31/99.

Medizintechnik für Arzt und Patient (MAP), GmbH, PI: Alan R. Schwartz, M.D., “Clinical Testing of a Semi-Automated Device for Critical Pressure Determination in Obstructive Sleep Apnea”, 1/19/99 – 9/30/02.

Itamar Ltd. Evaluation of Peripheral Arterial Tonometry during Obstructive Apnea, 04/01/00 – 09/30/02.

NIH/NHLBI – R01 HL71506-04, PI: Alan R. Schwartz, M.D., "Cardiovascular Stress of Sleep Apnea and Heart Failure", 09/30/02 - 07/31/07.

NIH – R01 HL50381, PI: Alan R. Schwartz, M.D., "Upper Airway Control of Transtracheal Insufflation", 4/01/99 - 03/31/04.

MAP (Medizin-Technologie, GmbH), PI: Hartmut Schneider, M.D., "Clinical Testing of a CPAP Titration-Algorithm for Treating Obstructive Sleep Apnea in the Sleep Laboratory", 07/01/02 - 06/30/04.

Israel-American Binational Grant, Co-PI's: Arie Oliven, M.D and Alan R. Schwartz, M.D. Role of the Genioglossus in the Maintenance of Upper Airway Patency, 8/01 – 7/04.

NIH – R01 HL37379, PI: Philip L. Smith, M.D. "Obesity and Neural Control in Sleep Disordered Breathing", 09/01/99 - 08/31/03.

NIH (SBIR) R43 MH60034, PI: Arthur V. Cooke, Ph.D. (Active Signal Technologies), "Advanced At-Home Screening Device for Sleep Apnea", 9/1/01- 8/31/03.

NIH/NHLBI – R01 HL37379-18, PI: Philip L. Smith, M.D., "Obesity and Neural Control in Sleep Disordered Breathing", 07/1/04-06/30/08.

NIH – R01 HL79554-02, PI: Philip L. Smith, M.D., "Effects of HIV and HAART on Sleep and Daytime Function", 09/30/04-06/30/08.

NIH – R01 HL050381-12, PI: Alan R. Schwartz, M.D., "Mechanisms of Sleep Apnea in Severe Obesity", 01/15/05-11/30/08.

NIH/NHLBI – R01 HL37379-18, PI: Philip L. Smith, M.D., "Obesity and Neural Control in Sleep Disordered Breathing", 07/01/09-06/30/11.

NIH – R01 HL050381-12, PI: Alan R. Schwartz, M.D., "Mechanisms of Sleep Apnea in Severe Obesity", 07/01/09-06/30/13.

NIH – 1P50HL074945-01, PI: Robert A. Wise, M.D., "SCCOR: Mechanisms and Treatment of COPD Progression", Project 3, PI: Alan R. Schwartz, M.D.: "Mechanisms and Impact of Nocturnal Hypoxemia in COPD", 10/01/07 – 11/30/11.

NIH – R01 HL037379-21 PI: PL Smith (Co-investigator, AR Schwartz), Effects of sex and fat distribution on sleep disordered breathing, 07/01/2009 - 06/30/2012.

NIH – U01HL108730 PI: J. Holbrook (Co-investigator, AR Schwartz), Effect of Positive Airway Pressure on Reducing Airways Reactivity in Asthma, 09/01/2011 - 06/30/2014.

NIH/NCRR – UL1 RR025-005, PI: Daniel Ford, M.D. Johns Hopkins Bayview Clinical Research Unit; Center for Interdisciplinary Sleep Research and Education (CISRE), Co-director: Alan R. Schwartz. Institute of Clinical Translational Research, Clinical and Translational Science Award (CTSA), 10/1/07 – 9/30/12. NCE through 9/30/13.

NIH – R01 HL050381-12, PI: Alan R. Schwartz, M.D., "Mechanisms of Sleep Apnea in Severe Obesity", 07/01/09-06/30/13. NCE through 6/30/14.

ResMed Foundation, PI: Vsevolod Polotsky, M.D., "Mechanisms of Steatohepatitis in Intermittent Hypoxia". 7/1/12 – 6/30/14

ResMed Ltd, PI and Co-investigator, “Mechanisms of ventilatory support with high flow nasal therapy.” 11/01/2012 - 10/31/2015.

inSleep Technology, PI: AR Schwartz, Treatment of snoring with low level CPAP and Home-based Usability and Effectiveness of Cloud 9, 09/01/2012 – 02/24/2017.

NIH R01HL105546 PI: H. Schneider (AR Schwartz, Co-investigator), Pathogenesis and Outcomes of Sleep Disordered Breathing in COPD, 07/01/2011 - 05/31/2016.

Respicardia, Inc., PI: R.Berger (AR Schwartz, Co-investigator) Effect of Phrenic Nerve Pacing on Central Sleep Apnea and Cheyne-Stokes Respiration, 08/01/2013 – 07/31/2018.

Binational Science Foundation No. 2009756 (Co-PI: A Oliven and AR Schwartz), Electro-mechanical dissociation of pharyngeal dilator muscles in sleep apnea, 07/15/12 – 07/14/16

Maxis, Inc. PI: AR Schwartz. Polysomnographic scoring and data coordinating center for clinical trials. 06/01/2015 – 12/31/2018

ResMed Corporation JP Kirkness (PI) 11/01/12 - 10/31/15  
Treatment of Nocturnal Hypoventilation and Sleep Nasal High Flow Therapy  
Role: Co-Investigator

NIH R01 HL105546 Schneider (PI) 07/01/11 - 05/31/16  
Pathogenesis and Outcomes of Sleep Disordered Breathing in COPD  
Role: Co-Investigator

Binational Science Foundation (No. 2009756) A Oliven, AR Schwartz (Co-PI) 07/15/12 – 7/14/16  
Electro-mechanical dissociation of pharyngeal dilator muscles in sleep apnea

ImThera, Inc. PI: AR Schwartz. Hypoglossal Stimulation in Obstructive Sleep Apnea: Analysis of Titration Recordings (THN2). 06/01/2015 – 05/31/2016

ImThera Inc., AR Schwartz (Site and Global PI). 10/1/14 – 12/31/18  
Pivotal trial: Targeted hypoglossal nerve stimulation in obstructive sleep apnea (THN3).

Alana Health, PI: Alan R. Schwartz. Pulmonary Function Test Clinical Services Contract.  
06/01/16 – 05/31/18

Under Armour, Inc. PI: Alan R. Schwartz. Deriving and validating sleep phenotypes from wrist activity monitors. 08/1/16 – 07/31/17.

Itamar, Ltd. Co-PI Alan R. Schwartz and Hartmut Schneider. Clinical evaluation of a home testing device for sleep disordered breathing detection. 09/01/16 – 08/31/18

NIH R01 HL128970	Polotsky, Schwartz,(Co-PI)	07/01/15-06/30/20
Treatment of sleep apnea by targeting leptin signaling		
NIH R34 HL12096251	AR Schwartz, W Checkley (Co-PI)	06/01/17-05/31/19
Sleep posture treats disordered breathing and cardiometabolic stress at altitude.		
NIH R01 HL138932	Polotsky (PI)	09/01/17 – 08/31/21
Chemogenetic approach to treat obstructive sleep apnea		
Role: Co-Investigator		
NIH R01HL133100	Polotsky (PI)	07/1/16 – 02/29/20
Leptin signaling in the carotid body: mechanisms and consequences		
Role: Co-investigator		
ImThera Inc., PI: AR Schwartz. Pivotal trial for hypoglossal nerve stimulator in treatment of obstructive sleep apnea (THN3). 02/01/2015 – 05/31/2021		
Maxis Medical, LLC	Schwartz (PI)	01/29/15 – 01/28/20
Polysomnographic scoring and data coordinating center		
Center for Interdisciplinary Sleep Research and Education		06/01/2012 – 2/15/19
Johns Hopkins School of Medicine		
Role: Co-Director		
Itamar, Ltd.	AR Schwartz (PI)	01/01/17 – 12/31/18
Clinical evaluation of a home testing device for sleep disordered breathing detection		
dayZz, Ltd.	AR Schwartz (PI)	04/01/18 – 06/30/19
Prospective study of dayZz survey questionnaire for diagnosing common sleep disorders		
Philips Respiroics Inc.	AR Schwartz (PI)	12/01/19 – 11/30/21
Respiratory effort validation study		
Respimetrix	Schwartz (PI)	07/01/20-6/20/22
A novel biometric device for characterizing inhaled bronchodilator technique and lung function		
Philips Respiroics	Schwartz (PI)	07/01/20-6/30/22
Sparkle / DreamKit Device validation study (vs. polysomnography)		

**Current Grants:**

NIH R01HL144859	AR Schwartz (Co-PI)	12/01/18 – 11/30/2023
Predicting responses in upper airway function and sleep apnea to hypoglossal nerve stimulation		

NIH R01HL161635	DT Kent (PI)	12/01/21 – 11/30/2025
The effect of ansa cervicalis neurostimulation in airway patency in obstructive sleep apnea.		
Apnimed	Schwartz (PI)	03/01/21-02/29/22
Novel medication clinical trial for obstructive sleep apnea		
Periodic Breathing LLC	Schwartz (PI)	12/01/20-11/30/22
Impact of Breathing Maneuvers on CO2RE Device performance		
Signifier Medical	Schwartz (PI)	1/1/22 – 6/30/23
Tongue muscle conditional treatment trial for obstructive sleep apnea		

**Grant Consultant:**

NIH – R01 56876, PI: Ralph F. Fregosi, Ph.D. “Neuromuscular Control of the Pharyngeal Airway.” 1998 – 2003.

NIH/NIDCD R01-DC04324, PI: Paul Flint, M.D., “Gene therapy for laryngeal paralysis”, 1/1/2000 - 12/31/2004.

NIH – R01, PI: Dominique Durand, Ph.D., “Selective Activation of Tongue Muscles for Dilation of the Pharynx in Obstructive Sleep Apnea”, 1/1/2001 – 12/30/2005.

NIH/NIDCD K23 – DC007597, PI: E. Fiona Bailey, Ph.D., “Neuromuscular Control of the Tongue”, 7/1/05 – 6/30/10. (External Advisory Board Member)

**EDUCATIONAL ACTIVITIES**

**Classroom Instruction:**

Tutorial in Sleep Disorders - Conduct weekly tutorial for pulmonary fellows and medical residents covering clinical and research topics on sleep and breathing, Johns Hopkins School of Medicine, 1992-2019.

Instructor, Pathophysiology Course for Second Year Medical Students, Johns Hopkins School of Medicine, 1988 - 2005.

Instructor, Physiology Course for First Year Medical Students, Johns Hopkins School of Medicine, 1988 - 2010.

Lecturer, Basic Medical Clerkship, Johns Hopkins School of Medicine, 1990-1998.

Instructor, Clinical Physiology Tutorial for Pulmonary Fellows, Johns Hopkins School of Medicine, 1988-1997.

Lecturer, Johns Hopkins School of Medicine Pulmonary Pathophysiology Course, 1999-present

Lecturer, Johns Hopkins Bayview Medical Residency Program, Residents’ Conference and Ambulatory Medicine Seminar, 2010 – present.

Lecturer, Johns Hopkins Pulmonary, Critical Care and Sleep Medicine Annual CME Course, 2014, Greenbrier WVA

Lecturer, Johns Hopkins Pulmonary, Critical Care and Sleep Medicine Annual CME Course, 2015, Isle of Palms, SC

**Course Director:**

American Thoracic Society Post-Graduate Course, "Therapy for Sleep Apnea", San Francisco, California, May 15, 1993.

American Physiological Sleep Society Post-Graduate Course, "New Directions in the Therapy of Obstructive Sleep Apnea", Nashville, Tennessee, May 30, 1995.

**Moderator/Symposium Chair:**

American Thoracic Society, Miami Beach, Florida, May 18, 1992, "Principles of Therapy for Sleep Apnea", Meet the Professor Seminar.

American Thoracic Society/American Lung Association International Conference. Seattle, Washington. May 24, 1995. Moderator, Mini-Symposium. "Upper Airway Imaging."

Pulmonary and Critical Care Division, Johns Hopkins School of Medicine. June 26, 2000. Visiting Professor: Nicholas Hill, M.D. Discussions on Non-Invasive Positive Pressure Ventilation in Respiratory Failure.

Mini-Symposium: The Relationship between Obesity, Sleep, Breathing and Cardiovascular Diseases. October 20, 2000. Chair and Moderator, Division of Pulmonary and Critical Care Medicine, Johns Hopkins School of Medicine.

International Symposium on Sleep and Autonomous Function: Mechanisms and Clinical Consequences. Marburg, Germany. March 30, 2001. Moderator: Session on Autonomic Nervous System.

National Heart, Lung, and Blood Institute, Division of Heart and Cardiovascular Diseases and National Center on Sleep Disorders Research. Consensus Conference on "Cardiovascular and Sleep-Related Consequences of Temporomandibular Disorders." December 4, 2001. Discussant.

American Thoracic Society International Conference. Atlanta, Georgia. May 17-22, 2002. Chairman, Poster Discussion Session. "Update on Sleep Apnea."

American Physiological Sleep Society. Seattle, Washington. June 12, 2002. Moderator, Session on "Sleep Apnea: Physiology and Pathophysiology."

American Physiological Sleep Society. Seattle, Washington. June 12, 2002. Moderator: Symposium on "Novel Directions for Treating Obstructive Sleep Apnea."

Topics in Pulmonary and Critical Care Medicine. Santa Rosa, California. August 5, 2004. Symposium Co-Moderator: "Update on Sleep Disorders."

World Association of Sleep Medicine. Berlin, Germany. October 17, 2005. Symposium

Moderator and Speaker: “Beyond the Apnea-Hypopnea Index – New Approaches to Quantifying Sleep Disordered Breathing Severity”.

World Association of Sleep Medicine. Berlin, Germany. October 17, 2005. Symposium Moderator and Speaker: “Beyond the Apnea-Hypopnea Index – New Approaches to Quantifying Sleep Disordered Breathing Severity”.

American Thoracic Society International Conference. San Diego, California. May 20, 2009. Symposium Moderator. “Upper Airway: State of the Art 2009”.

International Sleep and Breathing Conference, Barcelona, Spain. April 7, 2011. Moderator, Symposium on upper airway control during sleep.

American Thoracic Society International Conference, San Francisco, CA. May 20, 2012. Moderator in mini-symposium on: Obstructive sleep apnea: Interventions and new associations”.

American Thoracic Society Convention. May 18, 2015. Symposium Moderator. “Personalized medicine for sleep apnea: State of the art.”

#### **Research Training for Medical Students:**

Darnell Karima	1990 (summer)	Johns Hopkins University
David Thut	1989 (summer) 1990-91 1992 (summer)	University of Pennsylvania
Anil Hari	1992 (summer)	Johns Hopkins University
M. Boyd Gillespie	1993 (summer)	Johns Hopkins University
Andrew McWhorter	1994 (summer)	Johns Hopkins University
Sharyar Dan Samadi	1995 (spring)	Johns Hopkins University
Daniel Alam	1995 (summer)	Johns Hopkins University
Mukesh Prasad	1996 (summer)	Johns Hopkins University
Soo Hang Kim	1997 (summer)	Johns Hopkins University
Shannon Winakur	1997 (summer)	University of Maryland
Marc Bennett	1999 (summer)	Johns Hopkins University

#### **Research Training for Pre-doctoral Trainees:**

Luis Pichard	2003 – 2007	Johns Hopkins University ATS Minority Travel Awardee, 2007
Ahmed Elsayed	2006 – 2009	Johns Hopkins University ATS Travel Awardee, 2009
Michael Polotsky	2008 – 2010	Johns Hopkins University
Samuel Squier	2007 – 2010	Johns Hopkins University

Ian Kidder	2011– 2013	University of Arizona, Masters Thesis committee member
Huy Pho	2012 – 2016	Johns Hopkins University
Francis Sgambati	2015	Johns Hopkins University
Michelle Guzman	2015	Johns Hopkins University
Erin Hawks	2013, 2015	Johns Hopkins University
Jia-Der Ju Wang	2017 – 2019	Universidad Peruana Cayetano Heredia
Cristian Zhang Xu	2017 – 2019	Universidad Peruana Cayetano Heredia
Rafael S. Arias	2012 – 2014	Johns Hopkins University

**Post-Doctoral Research Trainees:**

Iain Gleadhill, M.D.	1986-87	Pulmonary Consultant, Belfast City Hospital, Northern Ireland
Barry Decker, M.D.	1987-89	Pulmonary & Critical Care Clinician, Orlando, Florida
Marc M. Seelagy, M.D.	1991-93	Director, Intensive Care Unit and Sleep Laboratory, St. Francis Hospital, Affiliate of Robert Wood Johnson School of Medicine, Trenton, New Jersey
Earl D. King, M.D.	1991-93	Assistant Professor of Medicine, Fox Chase Cancer Institute, Temple University, Philadelphia, PA
James A. Rowley, M.D.	1993-95	Associate Professor of Medicine, Director of Sleep Laboratory, Wayne State University, Detroit, MI
Hartmut Schneider, M.D.	1996-1999	Instructor of Medicine, Johns Hopkins School of Medicine
Daniel O'Hearn, M.D.	1996-98	Assistant Professor, Pulmonary Division, Oregon Health Sciences School, Portland, Oregon
Naresh Punjabi, M.D.	1997-99	Assistant Professor, Johns Hopkins University School of Medicine, Baltimore, MD
An Boudewyns, M.D.	1997-99	Assistant Professor, University of Antwerp, Department of Otolaryngology, Head and Neck Surgery, Antwerp, Belgium
Yugo Tagaito, M.D.	1997-2000	Assistant Professor, Department of Anesthesiology, Chiba University, Japan
Jason Marx, M.D.	1998-2001	Pulmonary Clinical Attending, Johns Hopkins School of Medicine,

Vsevolod Polotsky, M.D.	1998-2002	Baltimore, MD Assistant Professor of Medicine, Johns Hopkins School of Medicine, Baltimore, MD
Mark Miller, M.D.	1999-2000	Pulmonary Attending, Uniformed Services Med Center, Bethesda, MD
Susheel Patil, M.D.	2000-04	Pulmonary Fellow, Johns Hopkins School of Medicine, Baltimore, MD
Brian McGinley	2003-2007	Pediatric Pulmonary Fellow, Johns Hopkins School of Medicine, Baltimore, MD
Audrey Liu, M.D.	2003-2007	Pulmonary Fellow, Johns Hopkins School of Medicine, Baltimore, MD
Jason Kirkness, Ph.D.	2004-2006	Post-doctoral Research Fellow, Johns Hopkins School of Medicine, Baltimore, MD
Kim Goring, M.D.	2004-2008	Sleep Medicine Fellow, Johns Hopkins School of Medicine, Baltimore, MD
Cindy Brown, M.D.	2005-2008	Pulmonary/Sleep Fellow, Johns Hopkins School of Medicine, Baltimore, MD
Laura Herpel, M.D.	2005-2008	Pulmonary/Sleep Fellow, Johns Hopkins School of Medicine, Baltimore, MD
E. Fiona Bailey, Ph.D.	2005-2010	Associate Professor of Physiology, Univ. Arizona, Tucson AZ
Maria Pallayova, M.D.	2008- 2010	Post-doctoral Research Fellow, Johns Hopkins School of Medicine, Baltimore, MD
Chien Hung Chin, M.D.	2009- 2011	Associate Professor, Chang Gung Memorial Hospital, Taiwan
Adam Hernandez, M.D.	2010- 2013	Pulmonary Fellow, Johns Hopkins School of Medicine, Baltimore, MD
Paulo Biselli, M.D.	2012-2014	Intensivist, International Research Fellow, Universidade de Sao Paulo
Oscar Llanos Ulloa, M.D.	2013-2016	Medical Resident, Cayetano Heredia University, Lima Peru, and University of Arkansas, Little Rock AR
Luu Pham, M.D.	2014-2016	Sleep Medicine Fellow, Johns Hopkins School of Medicine, Baltimore, MD
Tamas Otvos, M.D.	2015-2017	Sleep Medicine Research Fellow, PJ Safarik University, Kosice, Slovakia
Thomaz Fleury Curado, M.D.	2015 - 2019	ENT Sleep Medicine Research

Mudiaga Sowho, M.D.	2018 – present	Fellow, Universidade de Sao Paulo Assistant Professor, Johns Hopkins School of Medicine, Baltimore, MD
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**Faculty Research Training:**

Alex Mayor, M.D.	1995	Professor of Anesthesiology, Bath, England
Arie Oliven, M.D.	1999 (Sabbatical)	Associate Professor of Medicine, Technion University, Haifa, Israel
Brian McGinley, M.D.	2011-2016	Assistant Professor of Pediatrics, Johns Hopkins School of Medicine, University of Utah
Nicholas Dalesio, M.D.	2012-2017	Assistant Professor of Anesthesiology, Johns Hopkins School of Medicine.
Luu Pham, M.D.	2016 – present	Assistant Professor of Medicine, Johns Hopkins School of Medicine
Zhigang Zhang, M.D.	2017 – 2018	Associated Professor of Geriatrics, Peking University First Hospital
David C. Kent, M.D.	2019 – 2022	Assistant Professor of Otolaryngology, Vanderbilt University School of Medicine
Kevin Motz, M.D.	2022 – present	Assistant Professor of Otolaryngology, Head and Neck Surgery, Johns Hopkins School of Medicine
Jason Lee Yu, M.D.	2022 – present	Assistant Professor of Otolaryngology, Head and Neck Surgery, Emory University

**High School / Undergraduate Research Training:**

Chris Harris	2008-2009	Baltimore Polytechnic High School Science Fair- United States Public Health Service Surgeon General’s Award
Branden Etienne	2015-2016	Baltimore Polytechnic High School Ingenuity Program Practicum
Jorge Jimenez	2016-2017	Johns Hopkins University summer research projects
Bradley Parsons	2018	Johns Hopkins University summer research projects



- 1988 Susan Thompson-Gorman “The control of breathing during high frequency ventilation”, Johns Hopkins School of Public Health, Baltimore, Maryland.
- 1999 Hartmut Schneider “Pathogenesis of acute systemic and pulmonary arterial pressure elevations in obstructive sleep apnea”, Philipps-Universitaet Marburg, Marburg, Germany.
- 1999 An Boudewyns “An extended clinical and physiological approach to sleep-related breathing disorders. Universiteit Antwerpen, Antwerp, Belgium.
- 2000 Andreas Klopp “Development of a measurement device for evaluating critical closing pressures in the upper airways”, Fachhochschule Bingen, Munich, Germany.
- 2001 Naresh M. Punjabi “Sleep disordered breathing and daytime sleepiness” Johns Hopkins School of Public Health, Baltimore, Maryland.
- 2003 Jason Kirkness “The role of surface tension in the control of upper airway patency”, Ludwig Engel Institute, University of Sydney, Sydney, Australia.
- 2004 Maria Karaitis “The role of extraluminal tissue pressures in the control of upper airway patency”, University of Sydney, Sydney, Australia.
- 2005 Markus Erlacher “Development and evaluation of algorithms for assessing respiratory phenotypes of obstructive sleep apnea”, Technische Universitaet Muenchen, Munich, Germany.
- 2006 Susheel Patil “Assessment of upper airway function during sleep – Mechanisms of sleep apnea pathogenesis”, Johns Hopkins Bloomberg School of Public Health, Baltimore, Maryland.
- 2009 Rajeev Ratnavadivel “The importance of non-anatomic factors in the pathogenesis of obstructive sleep apnoea”, Flinders University, Adelaide, Australia.
- 2010 Daniel Stadler “Obesity effects on lung volume, transdiaphragmatic pressure, upper airway dilator and inspiratory pump muscle activity in obstructive sleep apnea.” Flinders University, Adelaide, Australia.
- 2010 Jason Amoutory “Mechanical modeling of upper airway patency”, Ludwig Engel Institute, University of Sydney, Sydney, Australia.
- 2011 Luis Pichard “In vivo characterization of carotid body function”, Johns Hopkins Bloomberg School of Public Health, Baltimore, Maryland.

## CLINICAL ACTIVITIES

### Certification:

#### Medical Licensure

1982 New York Medical License  
1985 Maryland Medical License  
2021 Texas Medical License  
2022 Nebraska Medical License  
2022 Tennessee Medical License  
2022 Pennsylvania Medical License

#### Boards

1982 National Board of Medical Examiners  
1985 Diplomate, American Board of Internal Medicine in Internal Medicine  
1987 Diplomate, American Board of Internal Medicine in Pulmonary Medicine  
1990 Diplomate, American Board of Sleep Disorders Medicine  
2007 Diplomate, American Board of Internal Medicine in Sleep Medicine  
2017 Diplomate, American Board of Internal Medicine in Sleep Medicine

### Services Responsibilities (through 2019):

Director, Johns Hopkins Sleep Disorders Center  
Director, Johns Hopkins Clinical Sleep Fellowship Training Program  
Director, Sleep Core Laboratory, General Clinical Research Center at Johns Hopkins Bayview Medical Center  
Member, General Advisory Committee, General Clinical Research Center at Johns Hopkins Bayview Medical Center  
Attending Physician, Inpatient Pulmonary Consult and Medical Intensive Care Services

## ORGANIZATIONAL ACTIVITIES

### Institutional Administrative and Teaching Commitments:

Course Director, 1987 - 1994: Johns Hopkins School of Medicine. A weekly seminar including Topics in Clinical Pulmonary and Critical Care Medicine for pulmonary division fellows and faculty.

Director, Multi-disciplinary Polysomnography Weekly Case Review Conference: 2002 – 2019: Organize weekly case conference for the Johns Hopkins Sleep Disorders Center; discuss clinical and polysomnographic data as well as patient management strategies.

Internal Advisory Committee, T32 Multi-disciplinary Training Grant in Lung Diseases, 2001 - 2019: Johns Hopkins School of Medicine and Bloomberg School of Public Health.

Associate Director - 1987 – 1994, Co-Director - 1994 – 2002, Director 2002 - 2019; Johns Hopkins Sleep Disorders Center: The Sleep Center serves as an institutional resource to the Departments of Medicine, Neurology, Psychiatry, Urology, and Otolaryngology, and as a regional and international referral center for over 2,500 out-patient visits annually. The sleep center has 7 monitored beds and support staff of 13. It provides additional polysomnographic testing and consultative services for in-patients at the Johns Hopkins Hospital and Johns Hopkins Bayview Medical Center. The sleep center is accredited by the American Academy of Sleep Medicine.

Director, Sleep Disorders Training Program, 1992 - 2017: Sleep Disorders Training Program for Clinical Pulmonary Fellows and Internal Medicine Residents. A curriculum was developed to introduce resident and post-doctoral fellow trainees to a broad range of core concepts and clinical issues related to sleep disorders medicine with a particular focus on sleep related breathing disorders.

Director of Johns Hopkins Sleep Disorders Center at Northpoint, 2000 – 2003: Responsible for directing satellite, affiliated clinical sleep laboratory including patient testing protocols, scoring procedures and data management.

Assistant Program Director of General Clinical Research Center, Director of Sleep Core Laboratory, Johns Hopkins Bayview Medical Center, 2001 – present: Responsible for directing the Sleep Laboratory on the GCRC, including review of sleep-related protocols, patient recruitment, testing protocols, analytic procedures and data management.

Director, Johns Hopkins Mobile In-patient Polysomnography Unit (at the Johns Hopkins Bayview Medical Center and Johns Hopkins Hospital), 1994 – present: Responsible for coordinating mobile polysomnographic recordings in each hospital, and interacting with physician staff.

Lecturer and Teaching Instructor, Pulmonary Physiology and Pathophysiology, 1990 – 2017.

Program Advisory Board Member, T32 Training Grant in Pulmonary Medicine, 2002 – 2019.

Director, Sleep Medicine Fellowship Training Program, Johns Hopkins School of Medicine, 2003 – 2019.

Director, Sleep Core Research Laboratory at the Johns Hopkins Bayview General Clinical Research Center (2001- 2010)

Co-Director, Center for Interdisciplinary Sleep Research and Education, Johns Hopkins Bayview Clinical Research Unit (2010-2019)

Medical Director, Johns Hopkins Sleep Center (2002 – 2019)

### **Professional Societies:**

American Thoracic Society	1984-present
Maryland Thoracic Society	1984-present
American Sleep Disorders Association	1991-present

### **Professional Committees:**

Program Committee, Neurobiology and Sleep Section of the American Thoracic Society, 1992-93, 1995-1998.

Scientific Session Planning Committee, Maryland Thoracic Society, 1992.

American Thoracic Society, Representative to the Association of Polysomnographic Technicians 1993.

American Physiologic Sleep Societies, Program Committee, 1997.

ATS Consensus Group, Diaphragm Pacing, 2002.

ATS Respiratory and Neurobiology Section, Planning Committee Member, 2002-2011.

Education Committee, American Academy of Sleep Medicine, 2004 – 2006.

American Thoracic Society, Nominating Committee, 2011.

Maternal Fetal Medicine Units Network: Data, Safety and Monitoring Committee; A randomized trial of continuous positive airway pressure (CPAP) for sleep apnea in pregnancy (SLEEP), 2019 – present.

### **Consultant Appointments:**

Medtronic, Inc., Medical Advisory Panel, Upper Airway Neural Stimulation Program 1991 – 1999, 2002.

Volunteers for Medical Engineering, Inc., Instrumentation for Respiratory Monitoring and Neuromuscular Stimulation, 1992 - 1995.

Fisher and Paykel, Ltd., Medical Advisor, CPAP Delivery Systems, 2000.

Itamar Medical, Inc., Medical Advisor, Screening Devices for Detection of Sleep Disordered Breathing, 2000 – present.

Medizintechnik fuer Patient und Artz (MAP, GmbH), Medical Advisor, Treatment Devices for Sleep Apnea, 1999 – 2002.

St. Jude Medical, Inc., Advisory Panel on Cardiac Pacing in Sleep Apnea, 2003.

Sepracor, Inc., Advisory Panel on Sleep Apnea, Pharmacologic Treatments for Sleep Apnea, 2004, 2007.

Inspiration Medical Inc., Scientific Advisory Panel, A Treatment Device for Obstructive Sleep Apnea, 2005 – 2007.

Seleon GmbH., Scientific Advisor, Sleep Apnea Treatment with Transnasal Insufflation, 2005 – 2009.

Sanofi-Aventis, Scientific Advisor, Weight Loss Treatment in Sleep Apnea, 2006 – 2007.

Apnex Medical Inc., Scientific Advisory Board, A Treatment Device for Obstructive Sleep Apnea, 2005 – 2013.

Respicardia (formerly Cardiac Concepts), Inc., Scientific Advisor, 2009 – present.

inSleep Medical, Chief Scientific Advisor, 2010-present.

Sova Pharmaceuticals, Inc., Scientific Advisor, 2010 – 2015.  
 Cibiem, Inc., 2010-2014.  
 Discover Medical, Inc., 2012 – 2015.  
 Galleon Pharmaceuticals, Inc., Scientific Advisor, 2013.  
 RespEQ, Inc., Scientific Advisor, 2014 – 2018.  
 Cortex Pharmaceuticals, Scientific Advisor, 2016 – 2017.  
 ImThera Medical/LivaNova, Scientific Advisor and PI on pivotal trial, 2014 – 2019.  
 FRESCA Medical, Scientific Advisor, 2018 – 2020.  
 dayZz Sleep, Scientific Advisor, 2017 – present.  
 UnderArmour, Scientific Advisor, 2015 – 2017.  
 Itamar Medical, Scientific advisor, 2018 – present.  
 LivaNova, Scientific advisory board member, 2018 – present.  
 Nyxoah, Scientific advisor, 2019 – present.  
 Onera Medical, Scientific advisor, 2019 – 2020.  
 SHUSH, Scientific advisor, 2019 – present.  
 Airflow (Popitz) Medical, Scientific advisor, 2019 – 2020.  
 Jazz Pharmaceutical, Discussant, 2020.  
 Alfred E. Mann Foundation, Scientific Advisor, 2020 – present.  
 Invicta Medical, Scientific Advisor, 2019 – present.  
 Deerfield Catalyst, Scientific Advisor, 2021 – present.  
 Apnimed, Scientific Advisory Board and consultant, 2020 – present.  
 Philips Respironics, Scientific Advisor, 2020 – 2021.  
 Respimetrix, Scientific Advisor, 2019 – present.  
 Deerfield Catalyst, Scientific Advisor, 2021 – present.  
 Pulmodyne (now Periodic Breathing LLC), Scientific Advisor, 2019 – present.

## RECOGNITION

### Awards, honors:

1976	Phi Beta Kappa
1977	Sigma Xi
1978	Fellow, American Sleep Disorders Association
2001	United States-Israel Binational Science Foundation, The Henry N. Neufeld Memorial Award for 2001 for "Role of Tongue Muscles in Maintaining Upper Airway Patency"
2002	American Federation for Medical Research Foundation, Henry Christian Award to Susheel Patil, M.D. for "Differences in the Control of Upper Airway Collapsibility in Obstructive Sleep Apnea and Normal Subjects"
2003	American Federation for Medical Research Foundation, Henry Christian Award to Susheel Patil, M.D. for "Structural Impact of Obesity and Gender on Upper Airway Collapsibility in Obstructive Sleep Apnea"
2003	American Association of Sleep Medicine, Honorable Mention to Susheel Patil, M.D. for abstract on "Physiologic Determinants of Sleep Apnea Susceptibility"

- 2005 Ludwig Engel Medal, Ludwig Engel Centre for Respiratory Research, Westmeade Millenium Research Centre, University of Sydney for Oration on "Sleep Disordered Breathing: Parsing the Phenotype"
- 2011 David M. Levine Mentoring Award, Johns Hopkins School of Medicine, Baltimore, MD

## **OTHER LECTURES AND SYMPOSIA**

[**Lectures:** Invited (\*), School of Medicine Teaching (+), Peer Reviewed (#)]

\*Research Seminar, Pulmonary Division, Milton S. Hershey Medical Center, October, 1986, "Human Upper Airway PressureFlow Relationships During Sleep".

\*Combined Research Seminar, Pulmonary & Environmental Health Sciences Divisions, Johns Hopkins University, January, 1987, "Human Upper Airway PressureFlow Relationships During Sleep".

#Eastern Thoracic Society Annual Meeting, Providence Rhode Island, October, 1987, "Human Upper Airway Critical Pressures in Normal Snorers and in Patients with Obstructive Hypopnea and Apnea during Sleep".

#American Thoracic Society, Kansas City, Missouri, May, 1988, "Effect of Weight Loss on Upper Airway Collapsibility in Obstructive Sleep Apnea".

\*Pediatric Pulmonary Research Conference, Johns Hopkins University, June, 1988, "Airflow Mechanics in the Upper Airway during Sleep".

+Homewood Hospital Center Housestaff Lecture Series, November, 1988, "The Diagnosis and Management of Sleep Apnea".

+Topics in Pulmonary Medicine, Pulmonary Division, Johns Hopkins University, December, 1988, "Introduction to Polysomnography".

+Anesthesiology Resident Teaching Conference, January, 1989, "The Pathogenesis of Upper Airway Obstruction".

+Clinical Topics of Pulmonary Medicine, Pulmonary Division, Johns Hopkins University, September, 1989, "Pathogenesis of Obstructive Sleep Apnea".

\*Medical Grand Rounds, Carroll County General Hospital, December, 1989, "Approach to the Diagnosis and Management of Obstructive Sleep Apnea".

+ICU Nursing In-service Conference, Johns Hopkins Hospital, December, 1989, "Circadian Rhythm Disorders in Shift Workers".

\*Division of Environmental Health Sciences, School of Hygiene and Public Health, Johns Hopkins University, February, 1990, "Effect of Hypercapnia on Electromyographic and Mechanical Function of the Isolated Canine Upper Airway".

\*Grand Rounds, Department of Otolaryngology, Johns Hopkins University, May, 1990, "Diagnosis and Surgical Management of Obstructive Sleep Apnea".

\*Research Conference, Department of Rehabilitation Medicine, Johns Hopkins University, June 1990, "Respiratory Function of the Upper Airway".

\*Combined Research Seminar, Pulmonary & Environmental Health Sciences Divisions, Johns Hopkins University, March, 1991, "Modulation of Upper Airway Airflow."

\*Contact USA Convention, April 27, 1991, Wilmington, Delaware, "Introduction to Sleep Disorders".

\*Grand Rounds, Department of Otolaryngology, Johns Hopkins University, May 1, 1991, "Effect of Uvulopalatopharyngoplasty on Upper Airway Collapsibility in Obstructive Sleep Apnea: New Therapeutic Strategies to Improve Outcome"

\*American Thoracic Society, Anaheim, California, May 13, 1991, "Effect of Hypoglossal Nerve Stimulation on Airflow Mechanics in the Isolated Upper Airway", In: Symposium on Overview of Upper Airway Patency.

\*Good Samaritan Hospital Lecture for Residents, May 30, 1991, "The Diagnosis and Management of Sleep Apnea".

\*Harford Memorial Hospital Clinical Conference, June 15, 1991, "The Diagnosis and Management of Obstructive Sleep Apnea".

\*Medtronic, Minneapolis, Minnesota, June 5, 1992. "Working Group for Neural Stimulation of Pharyngeal Musculature during Sleep".

\*Primary Care Continuing Medical Education Conference, Francis Scott Key Medical Center, August 7, 1992, "When is a Sleep Study Indicated"

\*Chesapeake Bay Sleep Society Annual Meeting, Baltimore, Maryland, December 11, 1992, "Electrical Stimulation of the Genioglossus Increases Airflow and Attenuates Obstructive Sleep Apnea".

+Johns Hopkins Hospital, Medical Grand Rounds, Case Presentation, April 23, 1993.

\*American Thoracic Society, San Francisco, California, May 15, 1993, Post-Graduate Course, Therapy for Sleep Apnea, "Principles of Therapy for Obstructive Sleep Apnea".

#American Thoracic Society, San Francisco, California, May 17, 1993, Symposium on

Treatment for Obstructive Sleep Apnea, "Electrical Genioglossal Stimulation Increases Airflow and Attenuates Obstructive Apneas During Sleep."

\*American Thoracic Society, San Francisco, California, May 18, 1993, Co-Chairman of the Thematic Poster Session, "Pharyngeal Muscle and Upper Airway Responses."

+Medical Grand Rounds, Johns Hopkins Hospital, November 20, 1993, "Approach to the Sleepy Patient."

\*Osteogenesis Imperfecta Foundation 25th Anniversary Conference, Baltimore, Maryland, July 21-24, 1994, "Respiratory Problems with Osteogenesis Imperfecta."

\*Third International Marburg Symposium. Cardiocirculatory Function during Sleep. Marburg, Germany, August 31 - September 2, 1994. "A Human Model of Obstructive Sleep Apnea."

+Pulmonary Grand Rounds. Johns Hopkins University School of Medicine, October 20, 1994, "Ondine's Curse."

#NIH 25th Neural Prosthesis Workshop. Bethesda, Maryland. October 21, 1994, "Electrical Stimulation of the Genioglossus in Obstructive Sleep Apnea."

\*Baltimore County Dental Association. October 25, 1994, "Obstructive Sleep Apnea."

\*Frontiers in Research and Clinical Management of Asthma and Allergy. Johns Hopkins Asthma and Allergy Center, January 21, 1995, "Respiratory Problems in Sleep."

\*American Thoracic Society/American Lung Association International Conference. Seattle, Washington. May 23, 1995. Speaker, Meet the Professor Seminar. "Obstructive Sleep Apnea: New Therapeutic Approaches."

\*APSS 9th Annual Meeting. Nashville, Tennessee. May 30, 1995, Chairperson, "New Directions in the Therapy of Obstructive Sleep Apnea."

+Johns Hopkins Bayview Housestaff Conference. March 1, 1996. "Approach to Diagnosis and Management of Daytime Somnolence."

+Lectures in Adult and Pediatric Respiratory Care. Johns Hopkins Medical Institutions. March 13, 1996. "Sleep Disordered Breathing".

\*Combined Research Seminar, Pulmonary & Environmental Health Sciences Divisions, Johns Hopkins University, March 14, 1996, "Control of Pharyngeal Collapsibility."

\*Fourth International Sleep & Breathing Conference. March 31, 1996. "The Upper Airway as a Starling Resistor - Part II." Charlottesville, VA.

\*Teaching Conference, Nassau County Medical Center. April 8, 1996. "Sleep Disordered

Breathing in the ICU - A Case Discussion." East Meadow, NY.

\*Pulmonary Grand Rounds, Wayne State Medical Center, Detroit, Michigan. April 29, 1995. "New Approaches to Management in Obstructive Sleep Apnea".

\*Medical Grand Rounds, St. Francis Medical Center. Trenton, New Jersey. May 2, 1996. "Approach to the Sleepy Patient".

#American Thoracic Society/American Lung Association International Conference. New Orleans, Louisiana. May 14, 1996. Mini-Symposium. "Passive Upper Airway Properties in Obstructive Sleep Apnea."

\*American Thoracic Society/American Lung Association International Conference. New Orleans, Louisiana. May 14, 1996. Clinical Topics in Pulmonary Medicine, "Genioglossus Stimulation: Is It the Future"

\*St. Francis Medical Center. Trenton, New Jersey. August 2, 1996. "A Quantitative Approach to Assessment of Sleep Disordered Breathing".

+Pulmonary Grand Rounds, Bayview Medical Center. Baltimore, Maryland. February 6, 1997. "Management of Severe Obstructive Sleep Apnea and Transtracheal Insufflation."

\*New York Hospital Medical Center of Queens. Flushing, New York. February 25, 1997. "Clinical Spectrum of Sleep Apnea."

\*Conference on Obstructive Sleep Apnea - State of the Art - 1997. American Academy of Otolaryngology - Head and Neck Surgery Foundation, Inc. Alexandria, Virginia. March 21, 1997. "The Pathophysiology of Airway Obstruction: An Overview."

\*Conference on Obstructive Sleep Apnea - State of the Art - 1997. American Academy of Otolaryngology - Head and Neck Surgery Foundation, Inc. Alexandria, Virginia. March 22, 1997. "Therapeutic Applications of Airway Physiology, 'The Starling Resistor'."

+Residents' Conference, Bayview Medical Center, Baltimore, MD, June 17, 1997, "Obesity and Breathing".

\*Topics in Ambulatory Medicine VIII, Baltimore, MD, December 11, 1997, "Evaluation of Sleep Disorders".

+Bayview Residents Conference, Baltimore, MD, December 15, 1997, "Evaluating the Sleepy Patient".

\*Physiology Seminar, Department of Environmental Health Sciences, Johns Hopkins School of Public Health. Baltimore, MD, February 12, 1998, "The Upper Airway and Ventilatory Control".

\*Mini-Symposium on Upper Airway Reflexes and Motor Control, FASEB, San Francisco, California, April 21, 1998, "How Tongue Muscles Influence Airway Function".

\*Presentation at Union Memorial Hospital, Resident's Conference, Baltimore, Maryland, May 19, 1998, "Approach to Diagnosis and Management of Sleep Apnea"

#Biomedical Engineering Society Annual Meeting, Cleveland, Ohio, October 13, 1998, Symposium on Electrical Stimulation and Respiratory Function, "Hypoglossal Stimulation for Obstructive Sleep Apnea".

\*Institute for Advanced Science and Technology in Medicine, Johns Hopkins University Applied Physics Laboratory, Laurel, Maryland, December 16, 1998. "To Snore Perchance to Sleep -- Sleep Apnea Symptoms, Causes and Treatment - A Discussion of Transtracheal Insufflation as a New Therapeutic Alternative for Obstructive Sleep Apnea and Respiratory Failure".

+Johns Hopkins School of Medicine Pathophysiology Course, Baltimore, Maryland. January 8, 1999. "Sleep Apnea and the Obesity Hypoventilation Syndrome".

\*Johns Hopkins University School of Medicine and Johns Hopkins Bayview Medical Center, Baltimore, Maryland. Topics in Ambulatory Medicine IX. "Evaluating and Following Patients with Sleep Disorders". December 7, 1998.

+Johns Hopkins University. Pulmonary Grand Rounds. "Obesity: Hypoventilation Syndrome". February 18, 1999. Baltimore, Maryland.

\*Maryland Thoracic Society. Advances in Pulmonary and Critical Care Medicine. Baltimore, Maryland. February 21, 1999. "New Strategies for the Management of Obstructive Sleep Apnea".

\*Montgomery General Hospital. Olney, Maryland. March 4, 1999. "Evaluating the Hypersomnolent Patient".

\*SUNY at Stony Brook, New York. April 14, 1999. "Tracheal Insufflation in Obstructive Sleep Apnea and Respiratory Failure".

\*Select Specialty Hospitals Convention. Baltimore, Maryland. May 21, 1999, "New Approaches to Obstructive Sleep Apnea".

\*Union Memorial Hospital Residents Conference. Baltimore, Maryland. June 15, 1999. "Sleep Apnea and the Pickwickian Syndrome".

\*American Academy of Sleep Medicine Meeting. Orlando, Florida. June 19, 1999. "A Pathophysiologic Approach to Treating Obstructive Sleep Apnea". Post-graduate symposium on Dental Appliance Therapy in Obstructive Sleep Apnea.

\*Department of Anesthesiology. University of Rochester, Rochester, NY. September 27, 1999.

“Assessment and Management of Upper Airway Obstruction”.

+Johns Hopkins School of Medicine. Baltimore, Maryland. Pulmonary Grand Rounds. September 30, 1999. “A Case of Obstructive Sleep Apnea Refractory to Nasal CPAP”.

+Johns Hopkins School of Medicine. Baltimore, Maryland. Internal Medicine Residents Conference. December 8, 1999. “Sleep Apnea and the Pickwickian Syndrome”.

+Johns Hopkins School of Medicine Pathophysiology Course, Baltimore, Maryland. January 20, 2000. “Sleep Apnea and the Obesity Hypoventilation Syndrome”.

\*HortResearch Institute, Hamilton, New Zealand. March 28, 2000. “Ventilatory Support with Transtracheal Insufflation: Physiologic Approach and Early Trials.”

+ Johns Hopkins School of Medicine, Baltimore, Maryland. Grand Rounds, Division of Pulmonary and Critical Care Medicine. April 6, 2000. “Clinical Management of a Patient with Sleep Apnea and Chronic Obstructive Pulmonary Disease.”

\*American Academy of Sleep Medicine Meeting. Las Vegas, Nevada. June 22, 2000. “Pharyngeal Muscle Stimulation in the Treatment of Obstructive Sleep Apnea”. Symposium on Pharyngeal Airway Structure and Function: Implications regarding the Pathogenesis and Treatment of Obstructive Sleep Apnea.

\*2<sup>nd</sup> Annual Update in Pulmonary and Critical Care Medicine. Santa Fe, New Mexico. August 7, 2000. “Updates in Sleep Apnea” and “A Case from the Ward”.

+ Johns Hopkins School of Medicine, Baltimore, Maryland. Pulmonary Fellows’ Lecture, August 15, 2000. “Obstructive Sleep Apnea and Obesity – Hypoventilation Syndrome”.

+Johns Hopkins School of Medicine Pathophysiology Course, Baltimore, Maryland. January, 2001. “Sleep Apnea and the Obesity Hypoventilation Syndrome”.

+Johns Hopkins School of Medicine, Baltimore, Maryland. Pulmonary and Critical Care Medicine Grand Rounds Case Presentation, March 2, 2001. “Cardiovascular Morbidity and Sleep Apnea.”

\*International Symposium on Sleep and Autonomous Function: Mechanisms and Clinical Consequences. Marburg, Germany. March 30, 2001. “The Phasic Modulation of Upper Airway Collapsibility during Sleep in Obstructive Sleep Apnea.”

\*Experimental Biology Meetings (FASEB): Symposium on Respiratory Physiology of the Pharyngeal Airway: Modulation of Skeletal Muscle Activities, Central Nervous System State and Disease. Orlando, Florida. April 3, 2001. “The Modulation of Upper Airway Function during Sleep.”

\*University of Arizona School of Medicine, Department of Physiology Research Seminar,

Tucson, Arizona. April 27, 2001. "Neuromuscular Control of Upper Airway Function."

\*Johns Hopkins School of Medicine, Division of Pediatric Pulmonology, Baltimore, Maryland. May 31, 2001. "The Regulation of Upper Airway Function during Sleep in Obstructive Sleep Apnea: Do Adults Differ from Children?"

\*American Physiologic Sleep Society Convention. Symposium: "Counting 'Microarousals' during Sleep: Is it Worthwhile?" Chicago, Illinois. June 8, 2001. "Relationship between Sleep Disordered Breathing and Daytime Sleepiness as Assessed with Multiple Sleep Latency Testing."

\*American College of Chest Physicians, Symposium on "Nose and Lung". Philadelphia, PA. November 6, 2001. "Obstructive Sleep Apnea: New Strategies for Diagnosis and Management."

+Johns Hopkins School of Medicine Pathophysiology Course, Baltimore, Maryland. November 14, 2001. "Sleep Apnea and the Obesity Hypoventilation Syndrome".

\*National Heart, Lung, and Blood Institute, Division of Heart and Cardiovascular Diseases and National Center on Sleep Disorders Research. Consensus Conference on "Cardiovascular and Sleep-Related Consequences of Temporomandibular Disorders." December 4, 2001. "Upper Airway Neuromuscular Control in Obstructive Sleep Apnea."

\*Johns Hopkins School of Medicine, Continuing Medical Education course on Sleep Disorders, October 4, 2004, "Why the Upper Airway Obstructs".

+Johns Hopkins School of Medicine Pathophysiology Course, Baltimore, Maryland. January 14, 2002. "Sleep Apnea and the Obesity Hypoventilation Syndrome".

+Johns Hopkins Bayview Medical Center, Baltimore, Maryland. Medical Grand Rounds, March 20, 2002. "Sleep Apnea and Cardiovascular Disease."

\*Residents' Conference, Union Memorial Hospital, Baltimore, MD, April 16, 2002, "Sleep Apnea and Cardiovascular Disease."

\*Johns Hopkins School of Medicine, Baltimore, Maryland. Pulmonary and Critical Care Medicine Grand Rounds, January 2, 2003. "The Influence of Gender on Sleep Apnea Pathogenesis."

+Johns Hopkins School of Medicine Pathophysiology Course, Baltimore, Maryland. January 15, 2003. "Sleep Apnea and the Obesity Hypoventilation Syndrome".

\*Johns Hopkins Bayview Medical Center, General Clinical Research Center, Baltimore, Maryland. April 7, 2003. "State of the Art: Sleep."

+Johns Hopkins School of Medicine Pathophysiology Course, Baltimore, Maryland. January 16,

2004. "Sleep Apnea and the Obesity Hypoventilation Syndrome".

+Johns Hopkins School of Medicine, Pulmonary Grand Rounds, Baltimore, Maryland. January 29, 2004. "Sleep Apnea in a Commercial Airline Pilot".

\*General Clinical Research Center National Meetings (AFMR), Associate GCRC Core Laboratories, Chicago, Illinois. April 17, 2004. "GCRC Sleep Core Laboratories: Scientific and Operational Considerations."

\*Sepracor Advisory Panel on Sleep Apnea. Boston, Massachusetts. May 27, 2004. "Human and Murine Models of Upper Airway Control."

\*Update in Pulmonary and Critical Care Medicine. Santa Rosa, California. August 5, 2004. "Cardiovascular Sequelae of Obstructive Sleep Apnea".

\*Update in Pulmonary and Critical Care Medicine. Santa Rosa, California. August 5, 2004. "The Management of Daytime Hypersomnolence in a Commercial Airline Pilot with Sleep Apnea".

#International Sleep and Breathing Conference. Newport, Rhode Island. October 15, 2004. "Obesity and the Control of Upper Airway Patency".

\*Itamar Ltd. Caesaria, Israel. January 4, 2005. "Respiratory phenotyping during sleep".

+Good Samaritan Hospital, Residents Conference. Baltimore, Maryland. February 4, 2005. "The Clinical Evaluation of Patients with Daytime Hypersomnolence".

\*American Thoracic Society Meetings. San Diego, California. May 20, 2005. "Approach to Therapy in Sleep Apnea: Can Electrical Stimulation of the Genioglossus Work?" in post-graduate course, Comprehensive Update on the Management of Obstructive Sleep Apnea.

# American Thoracic Society Meetings. San Diego, California. May 22, 2005. "Effect of Genioglossus Muscle Contraction and Mandibular Advancement on Pharyngeal Patency. "

# New Horizons in Sleep II Symposium. University Specialties Hospital, Baltimore, Maryland. June 10, 2005. "New Approaches to Therapy for Sleep Apnea."

\*Visiting Professor, L. Engel Center for Respiratory Research, Westmead Hospital, Sydney, Australia, September 12-16, 2005. Sleep Disordered Breathing Lecture Series:

"New Therapeutic Approaches for Sleep Apnea (September 14, 2005)"

"What does Pcrit measure?" (September 15, 2005)

"Sleep Disordered Breathing: Parsing the Phenotype" (September 15, 2005)

"Sleeping in an Information Age: New Approaches to Polysomnographic Analysis" (September 15, 2005)

"Genetic Perspectives on Sleep Apnea Phenotypes" (September 16, 2005)

\*Visiting Professor, Sir Charles Gardner Medical Center, Perth, Australia. September 19-22, 2005. “Mechanisms of Upper Airway Obstruction during Sleep” (September 19, 2005)

\*World Association of Sleep Medicine. Berlin, Germany. October 17, 2005. Symposium Moderator and Speaker: “Beyond the Apnea-Hypopnea Index – New Approaches to Quantifying Sleep Disordered Breathing Severity”.

\*Visiting Professor, Division of Geriatrics, University of Maryland, Baltimore, Maryland. December 11, 2005. Grand Rounds on “Sleep Apnea, Obesity and Metabolic Syndrome”.

+Johns Hopkins School of Medicine, Sleep Medicine Lecture Series, Baltimore, Maryland. January 9, 2005. “Novel Therapeutic Approaches for Sleep Apnea”.

\*Sanofi-Aventis Scientific Advisory Board Meeting, New York, New York. February 24, 2006. “Sleep Apnea Pathogenesis and Clinical Consequences”.

#25<sup>th</sup> Anniversary Congress on Sleep Apnea and Autonomic Function. Marburg, Germany. April 8, 2006. “Mechanisms of Upper Airway Obstruction during Sleep”.

+Pulmonary Research Symposium, Johns Hopkins School of Medicine, Pulmonary Division, Baltimore, Maryland. April 28, 2006. “Sleep Disordered Breathing: Research Overview”.

#American Thoracic Society International Conference. San Diego, California. May 21, 2006. Symposium on Sleep Apnea Pathogenesis. “Pathogenesis of Upper Airway Obstruction in Sleep Apnea”.

\*Visiting Professor, Department of Psychiatry, Milton S. Hershey School of Medicine. June 15, 2006. Grand Rounds on “Sleep Apnea Pathogenesis”.

\*Visiting Professor, Department of Psychiatry, Milton S. Hershey School of Medicine. November 3, 2006. CME Course on *Daytime Fatigue and Sleepiness*, Lecture on “Sleep Apnea Pathogenesis”.

+Johns Hopkins Bayview Research Symposium, Dean’s Lecture, Johns Hopkins School of Medicine, Baltimore, Maryland, November 17, 2006. “Sleep Disordered Breathing – A Research Overview”.

\*Invited Lecturer, A Woman’s Health Journey, Johns Hopkins School of Medicine, November 18, 2006. “Fatigue and Sleepless Nights – Sleep Problems in Women”.

+ Sleep Fellowship Conference, Johns Hopkins School of Medicine, Baltimore, Maryland, December 4, 2006. “Sleep Apnea and Commercial Driving Risk”.

\*Visiting Professor, Division of Pulmonary, Critical Care and Sleep Medicine, Mount Sinai Medical School. December 8, 2006, Grand Rounds on “New Approaches to Therapy for Sleep Apnea”.

\*Sepracor, Marlborough, Massachusetts. March 8, 2007. “Sleep Apnea Pathogenesis – Clinical and Murine Approaches to Studying the Control of Upper Airway Patency during Sleep”.

\*Visiting Professor, Department of Psychology, Sleep Unit Research Conference, University of Arizona, Tucson, AZ. March 19, 2007, “Modeling Upper Airway Structural and Neuromuscular Control during Sleep”.

\*Visiting Professor, Division of Pulmonary and Critical Care Medicine, University of Arizona, Tucson, AZ. March 20, 2007, “New Approaches to Therapy for Sleep Apnea”.

+Johns Hopkins School of Medicine, Pulmonary Grand Rounds, Baltimore, Maryland. June 21, 2007. “A Case of Complex Sleep Apnea”.

\*Clinical Nutrition Research Unit (CNRU) of the University of Maryland. September 17, 2007. “Sleep Apnea and Metabolism – An Overview of Current Research at the Johns Hopkins Sleep Disorders Center”.

\*Visiting Professor, Pulmonary Grand Rounds, University of Wisconsin. March 6, 2008. “Obesity, Upper Airway Obstruction and Sleep Apnea Pathogenesis”.

\*Visiting Professor, Sleep Medicine Grand Rounds, University of Toronto. April 11, 2008. “New Approaches to Therapy for Obstructive Sleep Apnea”.

+Union Memorial Hospital, Medical Residents Conference, April 30, 2008. “Evaluation of the Sleepy Patient”.

\*Visiting Professor, Anesthesiology Grand Rounds, University of Rochester. May 8, 2008. “Mechanism of Upper Airway Obstruction during Sleep and Anesthesia”.

\*American Thoracic Society International Conference. Toronto, Ottawa. May 19, 2008. Symposium on the Upper Airway: Models, Imaging and Collapsibility. Featured Speaker: “Upper Airway Collapsibility and Anatomy: Do they correlate?”.

\*Visiting Professor, Internal Medicine Grand Rounds, Howard University. June 3, 2008. “Sleep Apnea Pathogenesis and Clinical Consequences”.

\*Keynote Speaker, Updates on Sleep Apnea, SUNY at Stony Brook. September 24, 2008. “Pathogenesis and Therapeutic Approaches to Obstructive Sleep Apnea”.

+Johns Hopkins School of Medicine Pathophysiology Course, Baltimore, Maryland. December 2, 2008. “Respiratory Complications of Obesity”.

\*Visiting Professor, University of Arizona, Tucson AZ. March 14, 2009. “Modeling Obstructive Sleep Apnea in Mice”.

+Medical Residents Teaching Conference. Union Memorial Hospital, Baltimore, Maryland. March 17, 2009. "Obstructive Sleep Apnea Pathogenesis and Clinical Consequences".

\*Johns Hopkins Bloomberg School of Public Health, Baltimore, MD. April 15, 2009. "Obstructive Sleep Apnea: From Man to Mice".

+Pulmonary Grand Rounds, Johns Hopkins School of Medicine, Baltimore, MD. April 16, 2009. "Sleep Disordered Breathing in COPD".

\*Symposium on Upper Airway Function in Asthma (Does inhaled fluticasone REsult in obstructive sleep Apnea Manifestations, DREAM Pilot Study), Brigham and Women's Hospital Sleep Program, Harvard School of Medicine, Boston, MA. April 29, 2009. "Pcrit Theory and Measurement".

\*American Thoracic Society International Conference. San Diego, California. May 16, 2009. Post-Graduate Course: Comprehensive Update on Sleep Medicine. "Sleep Apnea Pathogenesis – Obstructive, Central and Complex".

+Medical Residents Conference, Good Samaritan Hospital, Baltimore, MD. June 23, 2009. "Mechanical Ventilation: Indications for Invasive vs. Non-Invasive Strategies".

\*4<sup>th</sup> World Equine Airways Symposium 2009, Vet-Suisse University of Berne, Switzerland. August 7, 2009. "Factors Determining Upper Airway Collapsibility".

\*11th International Sleep and Breathing Meeting. Pittsburgh, Pennsylvania. September 11, 2009. Mentor introduction for Susheel Patil. "Effects of obesity on upper airway function".

\*Quarterly Board Meeting, Cardiac Concepts. Minneapolis, Minnesota. October 13, 2009. "Obstructive and central sleep apnea: Pathogenesis and management".

\*Annual Meeting for Look Ahead Cohort Study. Baltimore, Maryland. October 22, 2009. "Obstructive sleep apnea: A patient's perspective".

+ Johns Hopkins School of Medicine, Sleep Medicine Lecture Series, Baltimore, Maryland. November 16, 2009. "Medico-legal risks to physicians due to drowsy driving".

+Johns Hopkins School of Medicine Pathophysiology Course, Baltimore, Maryland. November 30, 2009. "Respiratory complications of obesity".

+ Johns Hopkins Community Physicians Seminar. Baltimore, Maryland. December 16, 2009. "Workup and management of sleep apnea".

+ Johns Hopkins School of Medicine, Sleep Medicine Lecture Series, Baltimore, Maryland. March 1, 2010. "Sleep and medical illness -- Sleep disordered breathing and heart failure".

+Union Memorial Hospital Medical Residents Teaching Conference, Baltimore, Maryland.

April 20, 2010. “Obstructive sleep apnea – Pathogenesis and consequences”.

\* American Thoracic Society International Conference. New Orleans. May 16, 2010. Symposium: When Pulmonary and Critically Ill Patients are Obese. “Bariatric surgery and the respiratory system”.

\* American Thoracic Society International Conference. New Orleans. May 16, 2010. Lead facilitator, Thematic Poster Session on Upper airway and Respiratory Physiology.

\* American Thoracic Society International Conference. New Orleans. May 19, 2010. Mini-symposium co-chair, New Insights into Upper Airway Collapse.

+Johns Hopkins School of Medicine Pre-clinical Pathophysiology Course Lecture, Baltimore, Maryland. September 2, 2010. “Respiratory complications of obesity” (with patient interview and case presentation).

+Johns Hopkins School of Medicine, Pulmonary & Critical Care Grand Rounds, November 11, 2010. “Obesity hypoventilation syndrome”.

\*Harvard Medical School, Sleep Medicine Division, May 26, 2011. “Obesity and upper airway control during sleep”.

\*American Physiologic Sleep Societies conference, Minneapolis, Minnesota. June 14, 2011. Scientific session on Non-PAP Treatment for Sleep Apnea, “Upper airway responses to hypoglossal nerve stimulation during sleep in obstructive sleep apnea”.

+Union Memorial Hospital Medical Residents Teaching Conference, Baltimore, Maryland. June 21, 2011. “A patient with hypercapnic respiratory failure”.

\*Cardiology Research Seminar, Johns Hopkins Bayview Medical Center, Cardiology Division. July 20, 2011. “Sleep apnea and cardiovascular disease – Is it a risk factor?”.

+Johns Hopkins School of Medicine Pre-clinical Pathophysiology Course Lecture, Baltimore, Maryland. September 1, 2011. “Respiratory complications of obesity” (with patient interview and case presentation).

\*WebMD, New York, New York. September 16, 2011. “Obesity and comorbid conditions – Clarifying the referral roadmap”. Panel discussion moderated by Louis Aronne, M.D. with panelists: Caroline M. Apovian, M.D., Francesco Rubino, M.D. and Alan R. Schwartz, M.D.

\*WebTalkRadio.net. “Eat, Exercise, Live – Sweet dreams with NO sleep apnea”. Interview with Shira Litwak. <http://webtalkradio.net/2011/10/10/eat-exercise-live-%e2%80%93-sweet-dreams-with-no-sleep-apnea/>

+ Johns Hopkins School of Medicine, Pulmonary & Critical Care Grand Rounds, October 20, 2011. “New approaches to therapy for obstructive sleep apnea – Electrical stimulation of the

hypoglossal nerve”.

\*Asthma Research Clinical Network, Training Workshop for CPAP Treatment Trial, Tucson, AZ. February 9, 2012. “Continuous positive airway pressure treatment in asthma”.

+Johns Hopkins Bayview Medical Center, Medical Grand Rounds. Johns Hopkins School of Medicine, Baltimore, Maryland. March 20, 2012. “Obesity, Sleep Disordered Breathing and Respiratory Failure”.

\*American Thoracic Society International Conference, San Francisco, CA. May 19, 2012. “Upper airway physiology and hypoglossal nerve stimulation” in post-graduate course: “Current and Emerging Treatments for Sleep Disordered Breathing”.

\*American Thoracic Society International Conference, San Francisco, CA. May 22, 2012. “Electrical stimulation for the upper airway” in Scientific Symposium on “No pain, no gain: Will upper airway exercise training/electrical stimulation work for sleep apnea?”

\*World Congress on Sleep Apnea, Rome, Italy. August 30, 2012. Keynote Address: “Hypoglossal nerve stimulation for treatment of obstructive sleep apnea.”

\*Society of Anesthesia and Sleep Medicine, Washington, DC. October 12, 2012. “Pathogenesis of upper airway obstruction during sleep: Implications for Sedative Management”.

\*XXVIII Congreso Peruano y Latinoamericano de Neumología, Lima, Peru. November 17, 2012. “Obesidad, desordenes respiratorios del sueño e insuficiencia respiratoria [Obesity, sleep disordered breathing and respiratory failure]”; “Trastornos respiratorios del sueño en pacientes con la insuficiencia cardíaca” [Respiratory disorders during sleep in patients with heart failure]; “Manejo del apnea del sueño en un piloto de aerolínea comercial” [Management of sleep apnea in a comercial airline pilot].

\*Asthma Research Clinical Network, Training Workshop for CPAP Treatment Trial, Key West FL. February 28, 2013. “Continuous positive airway pressure treatment adherence in asthma treatment trial – Early findings”.

\*European Respiratory Society and European Sleep Society Conference, Berlin, Germany. April 11-12, 2013. “Pathogenesis of upper airway obstruction during sleep and implications for therapy”, and “Aging, obesity and upper airway obstruction during sleep”.

\*Maryland Sleep Society Fourth Annual Conference. Towson, Maryland. April 19, 2013. “Obesity, Sleep Disordered Breathing and Respiratory Failure”.

\*American Thoracic Society International Conference. Philadelphia, Pennsylvania. May 18, 2013. “If not CPAP, what? Non-CPAP devices”.

\*American Thoracic Society International Conference. Philadelphia, Pennsylvania. May 19, 2013. “Upper airway responses to hypoglossal nerve stimulation during sleep in obstructive

sleep apnea”.

\*American Thoracic Society International Conference. Philadelphia, Pennsylvania. May 20, 2013. Pro-con debate: “The upper airway *does* behave as a Starling resistor”.

+Johns Hopkins Bayview Medical Residents Teaching Conference. Baltimore, Maryland. August 9, 2013. “Respiratory complications in obesity: Sleep apnea, Pickwickian syndrome and respiratory failure”.

+Johns Hopkins School of Medicine Pre-clinical Pathophysiology Course Lecture, Baltimore, Maryland. August 29, 2013. “Respiratory complications of obesity” (with patient interview and case presentation).

\*Visiting Professor, Vúsch Cardiovascular Institute, PJ Safarik University Medical School, Kosice, Slovakia. October 9, 2013. “Cardiovascular sequelae of sleep apnea”.

\*Keynote address, 20<sup>th</sup> Annual Slovak-Czech Sleep Medicine Congress. Konic, Slovakia. October 11, 2013. “Hypoglossal nerve stimulation in the treatment of sleep apnea”.

\*Patient Focus Group, Hilton Hotel, Pikesville MD. December 9, 2013. “The importance of sleep”.

\*University of California San Diego, California. January 30, 2014. “Obesity, leptin and upper airway control” and “Sleep disordered breathing in a Peruvian cohort”.

+Johns Hopkins School of Medicine, Baltimore, Maryland, Pulmonary Grand Rounds. March 20, 2014. “Obesity, sleep disordered breathing and respiratory failure”.

\*Takeda Pharmaceuticals, Philadelphia, PA, Scientific Advisory Board. March 24, 2014. “Therapeutic approach to sleep apnea”.

+Union Memorial Hospital Medical Residents Teaching Conference, Baltimore, Maryland, March 31, 2014. “Obesity, sleep disordered breathing and respiratory failure”.

\*American Physiologic Sleep Societies conference, Minneapolis, Minnesota. June 3, 2014. Scientific session on Hypoglossal Stimulation for Treatment of Obstructive Sleep Apnea, “Hypoglossal nerve stimulation: Feasibility Studies and Mechanism of Action”.

+Updates in Pulmonary, Critical Care and Sleep Medicine, White Sulphur Springs, West Virginia. June 28, 2014. “Updates on sleep apnea – diagnosis and treatment”.

+Johns Hopkins School of Medicine Pre-clinical Pathophysiology Course Lecture, Baltimore, Maryland. August 28, 2014. “Respiratory complications of obesity”.

\*Johns Hopkins School of Medicine, Baltimore, Maryland. Research Seminar, Johns Hopkins Sleep Disorders Center. September 24, 2014. “Obesity, leptin and sleep apnea: From Man to

Mice”.

+Johns Hopkins School of Medicine, Baltimore, Maryland. Fellows Lecture Series, Pulmonary and Critical Care Division. October 24, 2014. “Sleep disordered breathing: pathogenesis, consequences and treatment”.

\*Johns Hopkins School of Medicine, Baltimore, Maryland. Endocrinology Grand Rounds. October 29, 2014. “Leptin, obesity and sleep apnea”.

+Johns Hopkins School of Medicine, Baltimore, Maryland. Morning Report, Johns Hopkins Bayview Medicine Program. October 30, 2014.

\*Universidade de Sao Paulo, Sao Paulo, Brazil. Magna Lecture, Visiting Professor, December 3, 2014. “Obstructive sleep apnea: Pathogenesis and therapeutic approaches”.

\* Universidade de Sao Paulo, Sao Paulo, Brazil. Research Seminar, Visiting Professor, December 4, 2014. “Hypoglossal nerve stimulation for treatment of obstructive sleep apnea”.

+Johns Hopkins School of Medicine, Baltimore, Maryland. Noon Conference, Internal Medicine Residency Program, Johns Hopkins Bayview Medicine Program. December 17, 2014. “The sleepy house officer: Recognition and management”.

\*2<sup>nd</sup> Annual OSAS Surgery International Course, Florida Hospital Nicholson Center, Celebration, Florida. March 1 – 3, 2015. “Obstructive sleep apnea: Diagnostic pitfalls, impact and medical implications”.

\*2<sup>nd</sup> Annual OSAS Surgery International Course, Florida Hospital Nicholson Center, Celebration, Florida. March 1 – 3, 2015. “Therapeutic approach to obstructive sleep apnea: What the sleep surgeon should know...”.

\*Maryland Sleep Society Conference, Shepard Pratt Conference Center, Towson, Maryland. April 24, 2015. Keynote Lecture: “Hypoglossal nerve stimulation for obstructive sleep apnea: Therapeutic potential and challenges”.

\*Puno Symposium, Johns Hopkins School of Medicine. May 8, 2015. “Sleep disordered breathing, altitude and chronic disease: Findings in the Cronicas Cohort”.

+Updates in Pulmonary, Critical Care and Sleep Medicine, Isle of Palms, South Carolina. June 26, 2015. “Updates on sleep apnea – Therapeutic approach to obstructive sleep apnea”.

+Johns Hopkins School of Medicine Pre-clinical Pathophysiology Course Lecture, Baltimore, Maryland. August 27, 2015. “Respiratory complications of obesity”.

+Cortex Pharmaceuticals SAB Meeting, Durham, North Carolina. October 3, 2015. “Approach to therapy for obstructive sleep apnea”.

- +International Sleep and Breathing Conference/Brazilian Sleep Society, Porto de Galinhas, Brazil. October 29, 2015. “Neuromuscular control of upper airway patency”.
- +International Sleep and Breathing Conference/Brazilian Sleep Society, Porto de Galinhas, Brazil. October 30, 2015. “Hypoglossal Nerve Stimulation for Obstructive Sleep Apnea: Therapeutic Potential and Challenges”.
- +International Sleep and Breathing Conference/Brazilian Sleep Society, Porto de Galinhas, Brazil. October 30, 2015. “Inspiratory Airflow Limitation during Sleep – Physiologic Foundations”.
- +Johns Hopkins School of Medicine, Baltimore, Maryland. Noon Conference, Internal Medicine Residency Program, Johns Hopkins Bayview Medicine Program. December 2, 2015. “The sleepy house officer: Recognition and management”.
- + December 10, 2015. Diplomatura a distancia en Medicina del Sueño. Facultad de Ciencias Biomédicas, Universidad Austral. Guest Lecture: “La apnea obstructiva: Mecanismos patógenos y estrategia terapéutica”.
- + January 20, 2016. Somnics Treatment Trial Investigators Meeting. Guest Lecture: “Emerging therapies for obstructive sleep apnea”.
- \* March 6, 2016. 3<sup>rd</sup> Annual OSAS Surgery International Course, Florida Hospital Nicholson Center, Celebration, Florida. “Obstructive sleep apnea: Diagnostic pitfalls, impact and medical implications” and “Rational approach to therapy for obstructive sleep apnea”.
- \*May 2, 2016. Value Committee, Johns Hopkins Hospital. “Hypoglossal nerve stimulation for treating obstructive sleep apnea”.
- +September 1, 2017. Johns Hopkins School of Medicine Pre-clinical Pathophysiology Course Lecture, Baltimore, Maryland. “Respiratory complications of obesity”.
- \*September 19, 2016. Sleep Medicine Fellowship Teaching Conference. Johns Hopkins School of Medicine. “Rational approach to therapy for obstructive sleep apnea”.
- \* August 5, 2016. Under Armour, Connect Fitness Sleep Work Group, Austin, Texas. “Sleep – The Basics”.
- \*October 27, 2016. Under Armour Symposium/Webinar. Austin TX. “Sleep in athletes”.
- +January 9, 2017. Sleep Medicine Fellowship Teaching Conference. Johns Hopkins School of Medicine. “Sleep in athletes”.
- +Updates in Pulmonary, Critical Care and Sleep Medicine, Santa Fe, NM. August 12, 2016. “Updates on sleep apnea – Hypoglossal nerve stimulation therapy”.

+Johns Hopkins Bayview Medical Center. Housestaff Conference. August 19, 2016. “Hypercapneic respiratory failure”.

\*February 27, 2017. 4<sup>th</sup> Annual OSAS Surgery International Course, Florida Hospital Nicholson Center, Celebration, Florida. “Obstructive sleep apnea: Approach to the diagnosis and management”.

+April 24, 2017. Electrophysiology Arrhythmia Conference, Johns Hopkins Hospital. “Impact of recognition and management of sleep disordered breathing in atrial fibrillation”.

\*May 23, 2017. American Thoracic Society Convention, Washington DC. Symposium on Obesity in Lung Disease: “Obesity, Hypoventilation and Sleep Apnea: Neuroventilatory Compensation for Respiratory Loads”.

\*June 3, 2017. Itamar Symposium, SLEEP Society Meetings, Boston MA. “Johns Hopkins Watch-PAT project summary”.

\*June 23, 2017. Actigraph Symposium, Bethesda MD. “Use of actigraphy to recognize sleep-wake disturbances in the general population”.

\*July 18, 2017. International Sleep and Breathing Conference, Madison WI. Moderator for session on “Control of upper airway patency”.

\*Updates in Pulmonary, Critical Care and Sleep Medicine, Napa, CA. August 13, 2017. Johns Hopkins School of Medicine. “Novel approaches to therapy for sleep apnea”.

+Johns Hopkins Bayview Medical Center. Housestaff Teaching Conference. Johns Hopkins School of Medicine. August 18, 2017. “Hypercapneic respiratory failure”.

+April 24, 2017. Electrophysiology Arrhythmia Conference, Johns Hopkins Hospital. “Sleep apnea home testing program – Initial findings in EP referrals”.

\*October 8, 2017. World Sleep Congress, Prague, Czech Republic. Post-graduate course on Modifying the upper airway for sleep apnea management. “Upper airway structural control in the pathogenesis of obstructive sleep apnea”.

\*October 10, 2017. World Sleep Congress, Prague, Czech Republic. Session on Advances in obstructive sleep apnea pathogenesis and non-CPAP therapies. “The role of pharyngeal anatomy and airway collapsibility in the pathogenesis of obstructive sleep apnea”.

\*November 11, 2017. Johns Hopkins Continuing Education Conference, Baltimore, Maryland. A Woman’s Journey 2017. Session on *Sleep Consumer Wear*. Co-moderator and speaker: “Approach to characterizing sleep disturbances across society”.

+January 8, 2018. Sleep Medicine Fellows Teaching Conference, Johns Hopkins School of Medicine. “Pathogenesis of obstructive sleep apnea: Upper airway structural control”.

\*February 21, 2018. Johns Hopkin Tech Ventures, Johns Hopkins School of Medicine. “Modeling digital sleep behavior: dayZz – Johns Hopkins Sleep Center Collaborative Project”.

\*February 28, 2017. 5<sup>th</sup> Annual OSAS Surgery International Course, Florida Hospital Nicholson Center, Celebration, Florida. “Obstructive sleep apnea: Approach to the diagnosis and management”.

+March 17, 2018. Johns Hopkins Electrophysiology Group Conference. “Sleep apnea in atrial fibrillation”.

\*March 27, 2018. ATS ASPIRE Fellows’ Webinar Conference. “Pathogenesis of obstructive sleep apnea: structural control of pharyngeal collapsibility”.

\*June 18, 2018 and August 16, 2018. Center for Medicare Services. “New technology add-on payment discussion – in-patient and out-patient for Respicardia remede system”.

\*July 14, September 7, October 18, November 16, 2018. Workshop training sessions for Key Opinion Leaders in Sleep Medicine designed to teach fundamentals of sleep and cardiorespiratory physiology required to review and interpret Home Sleep Apnea Tests (WatchPAT).

+September 24, 2018. Sleep Medicine Fellows Teaching Conference, Johns Hopkins School of Medicine. “Treatment strategies for obstructive sleep apnea: Personalized approaches”.

\*October 25, 2018. Athletic Department Health Seminar. Johns Hopkins University Homewood Campus. “The importance of sleep in collegiate athletes”.

+November 29, 2018. Pulmonary/Critical Care Medicine Grand Rounds. Johns Hopkins School of Medicine. “Obstructive sleep apnea: What’s the buzz?”.

\*January 7, 2019. Pulmonary/Critical Care Medicine Seminar. Icahn Mt. Sinai School of Medicine. “Obstructive sleep apnea: What’s the buzz?”.

\*February 16 – 18, 2019. Workshop training sessions for European Sleep Medicine physicians in sleep physiology required to review and interpret Home Sleep Apnea Tests (WatchPAT).

\*February 24-26, 2019. 6<sup>th</sup> Annual OSAS Surgery International Course, Florida Hospital Nicholson Center, Celebration, Florida. Talks on “Sleep apnea testing and CPAP treatment – What the sleep surgeon should know”.

\*March 13, 2019. Loma Linda University, Pulmonary, Critical Care and Sleep Division. “New directions in the management of central sleep apnea and Cheyne Stokes respiration.”

\*March 19, 20, 25. Piedmont Sleep Center (Atlanta GA), University of Florida (Tampa FL), MetroHealth (Grand Rapids MI). “New directions in the management of central sleep apnea and

Cheyne Stokes respiration.”

\*April 1, 2019. CRONICAS Field Site, Puno PERU. “Trastornos respiratorios durante el sueño en la altura: efectos and tratamientos nuevos” [Sleep disordered breathing at altitude: Mechanism and therapeutic approaches.]

\*April 5, 2019. Universidad Peruana Cayetano Heredia, Lima PERU. “Trastornos respiratorios durante el sueño en la altura: ¿Dormir o respirar?” [Sleep disordered breathing at altitude: To sleep or to breathe?”].

\*April 9, 2019. Global Non-Communicable Diseases Day. Johns Hopkins School of Public Health. “Sleep disordered breathing at altitude: To sleep or to breathe?”.

\*May 3, 2019, Respicardia field staff. “Pathogenesis and impact of central sleep apnea and Cheyne Stokes respiration”.

\*May 8, 2019. Mt. Sinai Medical Center Sleep Center faculty, NYC. “New tools in the management of central sleep apnea and Cheyne Stokes respiration”.

\*May 10, 2019. International Sleep Surgery Society annual convention, NYC. “How sleep studies can direct therapy.”

\*May 19, 2019. Moderator, Session on: “OSA Pathophysiology and Treatment - Moving Towards Personalized Medicine”. American Thoracic Society, Dallas TX.

\*May 22, 2019. Addison Sleep Center, TX. “New directions in the management of central sleep apnea and Cheyne Stokes respiration.”

\*June 10-12, 2019.

“Role of HST in diagnosing and treating sleep apnea”, Amer. Physiol. Sleep Soc. Conference, San Antonio, TX.

“New directions in management of central sleep apnea and Cheyne Stokes respiration”, Amer. Physiol. Sleep Soc. Conference, San Antonio, TX; Houston TX.

\*September 10, 2019. “Approach to titrating targeted hypoglossal nerve stimulation”. WebEx Field Staff Training Conference, LivaNova.

\*September 11, 2019. “Therapeutic approach to hypoglossal nerve stimulation in obstructive sleep apnea”. Cedar-Sinai Sleep/ENT multi-disciplinary conference, Los Angeles CA.

\*September 12, 2019. “New directions in the management of central sleep apnea and Cheyne Stokes respiration.” La Jolla CA.

\*October 4, 2019. Pulmonary, Critical Care Medicine Grand Rounds. Northwell Medical Center. New Hyde Park NY. “New directions in the management of central sleep apnea and Cheyne Stokes respiration”.

\*October 18, 2019. 8<sup>th</sup> Annual Hackensack Meridian Health National Neuroscience Symposium. “Neurostimulation therapy for sleep apnea”, Eatontown, NJ.

\*October 23, 2019. Sleep Leadership Council Meeting, Franciscan Health System. “New directions in the management of central sleep apnea and Cheyne Stokes respiration.” Tacoma WA.

\*October 24, 2019. Invicta Medical. “Hypoglossal stimulation therapy for obstructive sleep apnea”. Santa Clara, CA.

\*November 1, 2019. Respicardia field staff Webinar. “Pathogenesis and impact of central sleep apnea and Cheyne Stokes respiration”.

\*November, 2019 - present. “New directions in the management of central sleep apnea and Cheyne Stokes respiration.”

November 5: Medical University of South Carolina

November 6: PRISMA Medical System, Pulmonary Critical Care and Sleep Division

November 12: Mercy Medical System, PCCM, Sleep, CHF and EP cardiology

February 19, 2020, Pima Health, Tucson AZ

February 20, 2020, Phoenix AZ

May 14, 2020, Houston City-Wide Sleep Conference, Houston, TX

\*November 7, 2019: Itamar Clinical Support Staff. Workshop on the interpretation of WatchPAT physiology and recordings.

\*November 18, 2019. American Heart Association Convention. “Sleep, Apnea and Cardiovascular Stress”. Philadelphia PA.

\*November 19, 2019. Nyxoah. “Hypoglossal stimulation therapy – Interim Data Analysis and Predictors of Success”. Philadelphia PA.

\*February 19, 2020. University of Arizona, Pulmonary Critical Care Division. “Center for interdisciplinary sleep research and education: An overview”. Tucson, AZ.

\*February 25-27, 2020. 7<sup>th</sup> Annual OSAS Surgery International Course, Florida Hospital Nicholson Center, Celebration, Florida. Talks on “Sleep apnea testing and CPAP treatment – What the sleep surgeon should know”.

\*April 3, 2020. Washington University Sleep Center. Webinar for WatchPAT workshop training

\*April 30, 2020. Webinar on “The role of home sleep apnea testing in diagnosing and managing sleep apnea” and “New approaches to therapy for central sleep apnea and Cheyne Stokes respiration.”

\*May 2, 2020. Webinar for SAHOS-ORL International Group. “Pathogenesis of Obstructive

Sleep Apnea: Structural control of pharyngeal patency”.

\*2018 – present. Multiple training workshops on cardiopulmonary physiology applied to the interpretation of home sleep apnea testing with WatchPAT for physicians and technologists.

\*August 6, 2020. Respicardia webinar. “Transvenous phrenic nerve stimulation in central sleep apnea: Physiologic mechanisms”.

\*August 29, 2020. SLEEP Conference. Session: Phenotyping OSA Based on EDS and Cardiovascular Morbidity: Age and Gender Effects. “Collapsibility of the Upper Airway During Sleep: Age and Gender Effects”.

\*October 23, 2020. ATS SRN Journal Club Panelist. “Effects of Weight Loss on Obstructive Sleep Apnea Severity: 10-year Results of the Sleep AHEAD Study”.

\*November 19, 2020. Peruvian Medical Association. “SAS una vision renovada de un Viejo problema. Nuevos enfoques en fisiopatologia diagnosticos y sus implicaciones en la terapeutica. [Sleep apnea pathogenesis, diagnosis and therapeutic implications].

\*February 28, 2021. 8<sup>th</sup> Annual OSAS Surgery International Course, Florida Hospital Nicholson Center, Celebration, Florida. Panel moderator and speaker “Case studies in polysomnographic analysis – lessons for the sleep surgeon”.

\*March 17, 2021. Brigham and Women’s Sleep Medicine Fellowship Program clinical lecture series. “Approach to home sleep apnea testing with flow- and non-flow based devices”.

\*March 26, 2021. Control of Breathing Airways Defenses (CoBAD seminar). “Genetics and physiology of hypoxic responses: From mountain tops to bench tops to the clinic, Introduction”.

\*March 29, 2021. Johns Hopkins Sleep Disorders Center Clinical Conference. “Upper airway physiologic phenotypes during drug-induced sleep endoscopy”.

\*June 11, 2021. Symposium on central sleep apnea, APSS International Conference. “New approaches to therapy for central sleep apnea and Cheyne Stokes breathing”.

\*June 21, 2021. Sleep Medicine Clinical Case Conference. Sleep Medicine Division, University of Pennsylvania Perelman School of Medicine. “Approach to reading home sleep tests”.

\*August 4, 2021. Panelist/discussant on treatment approaches to Cheyne Stokes respiration. Respicardia panel discussion.

\*September 10, 2021. OSPREY Investigator Meeting. “Target Hypoglossal Nerve Stimulation: Prior investigations”. Houston, TX.

\*October 26, 2021. Panelist, “Exploring the Complexities, Treatment Paradigm, and Overlap of Heart Failure and Sleep Apnea.” Zoll Medical.

\*November 5, 2021. Otolaryngology Grand Rounds. “Ansa Cervicalis Stimulation: A possible novel OSA therapy”. Vanderbilt University School of Medicine (joint presentation with David T. Kent MD).

\*December 9, 2021. Symposium on Drug Induced Sleep Endoscopy. “Upper airway flow dynamics during DISE: Assessing patients, one breath at a time...”. University of Pennsylvania Perelman School of Medicine (joint presentation with David T. Kent MD).

\*February 27 – March 1, 2022. 9<sup>th</sup> Annual International OSAS Surgery Course, Celebration FL. “Quick Take on Sleep Studies: What the sleep surgeon should know”, “Sleep study interpretation workshop”, “CPAP therapy and diagnostics insights”. and “What does the future hold for OSAS (with Eric Thuler, MD PhD)”.

#May 17, 2022. American Thoracic Society Conference. Sleep apnea phenotyping and endotyping. “THN3: A Randomized, Controlled Trial of Targeted Hypoglossal Nerve Stimulation for Obstructive Sleep Apnea (OSA)”.

\*May 19, 2022. Richard Goode Invited Lecture. “Treating obstructive sleep apnea...one breath at a time”. Stanford University Department of Otolaryngology, Head and Neck Surgery – Sleep Surgery division.

\*May 25, 2022. Boston area clinical teaching conference. “Approach to home sleep apnea testing: WatchPAT Overview”.

#June 8, 2022. SLEEP 2022 Conference. Non-PAP Treatment for Sleep Apnea.

“Stage-dependent differences in central sleep apnea predominate in remede system pivotal trial participants”. Group trajectories demonstrate robust effects of targeted hypoglossal nerve stimulation in THN3 randomized controlled trial”.

“Enhanced response to targeted hypoglossal nerve stimulation in patients with normal sleep efficiency: A THN3 post-hoc analysis.”

\*September 9, 2022. International Sleep Surgery Society Conference.

Pathophysiology of OSA and Physiologic Consequences. “Sleep Study Interpretation (beyond AHI): Unpacking pathogenic risks and clinical consequences”.

Role of the sleep surgeon. “Upper airway phenotypes: Treating obstructive sleep apnea, one breath at a time”.

\*November 4, 2022. Virginia Sleep Academy conference. Richmond, VA. Keynote address: “Central sleep apnea and Cheyne Stokes respiration: Pathogenic mechanisms, clinical impact, polysomnographic recognition and therapeutic approaches.

\*November 10, 2022. University of Miami. Pulmonary, Critical Medicine and Sleep Research Seminar: “Physiologic approach to developing neurostimulation therapy: Past lessons and future directions”.

\*November 15, 2022. University Hospitals, Case Western Reserve University. Sleep Medicine Grand Rounds. “Treating sleep apnea...one breath at a time”.

\*January 3, 2023. Mancomunidad Regional de los Andes Webinar Series. Lima, Peru. Moderator: Dr. Roberto Accinelli. “Trastornos respiratorios durante el sueño: Respirar o dormir”.

\*February 17, 2023. 28th Annual Advances in Diagnosis and Treatment of Sleep Apnea and Snoring. Orlando, FL. Keynote address: “Treating obstructive sleep apnea...one breath at a time”.

\*February 26, 2023. 10th Annual OSAS Sleep Surgery Conference. Celebration, FL. “Pre-operative evaluation: Polysomnography”.

\*February 28, 2023. 10th Annual OSAS Sleep Surgery Conference. Celebration, FL. “Panel on non-surgical treatment: CPAP”.

\*February 28, 2023. 10th Annual OSAS Sleep Surgery Conference. Celebration, FL. “Sleep study interpretation lab”.

\*March 2, 2023. Webinar: “WatchPAT workshop: Central sleep apnea and Cheyne Stokes Respiration.”

\*May 11, 2023. Sleep Medicine Grand Rounds: “Central sleep apnea and Cheyne Stokes Respiration: Pathogenic mechanisms, clinical impact, polysomnography and therapeutic approaches”.

**Lectures:** Invited (\*), School of Medicine Teaching (+), Peer Reviewed (#)

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