出國報告（出國類別：進修）

聽力障礙之基礎研究發展
及
耳科臨床手術觀摩

服務機關：國防醫學院醫學系耳鼻喉科

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赴派國家：美國

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摘要

有鑑於世界人口老化，聽力障礙人口數越來越多，同時在軍中服役的官士兵也可能會面臨到聽力受損的可能性，因此積極發展預防及治療聽障的方法是刻不容緩。而感音神經性聽力障礙常見於年齡老化、耳毒性藥物或環境噪音傷害的族群，一旦聽覺接受器的毛細胞或傳遞訊息的神經元遭受傷害或退化，再加上哺乳類動物的耳蝸神經上皮無法使受傷或凋亡的毛細胞及神經元重新再生，因此常造成永久不可回復的聽力損失。為了回復或是再生這些退化及死亡的耳蝸細胞及神經元，目前可使用藥物、病毒載體、成體細胞或前驅細胞利用各種不同的手術方式輸送到耳蝸。

因此本人有幸於美國哈佛醫學院麻州眼耳醫院進修，這一年研究的主要內容為將幹細胞植入內耳耳蝸中，首先我做出聽神經退化的模式，穩定培養胚胎幹細胞，並將這些細胞利用微注射器經枕骨方式植入聽神經幹，且結果顯示在於小鼠某些音頻看到明顯進步的聽力回復，同時免疫組織染色也發現有額外神經元的表現於細胞移植的實驗組中，此一結果於回到國內將延續相關實驗。除了基礎實驗外本人也觀摩神經耳科手術及相關耳科手術，進一步增加對於神經耳科學及顱底手術醫學學習的經驗與認知，同時在這一年參加全美耳鼻喉頭頸外科學會及美國耳科研究學會之大型醫學會，增加相關大型會議之經驗，於研究之餘也參加進修醫院的臨床研討會及內視鏡耳科大體解剖研習會，於美國也與三總醫師相互交流，最後要感謝軍醫局局長於美國軍陣醫學交流之際慰問進修人員。

出國進修一年不僅僅是個人的研究所得，更是報告有關如何在當地生活或與實驗室人員交往或臨床教學及手術觀摩等經驗，可提供給爾後要出國進修人員的參考。

目次

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壹、進修目的

有鑑於世界人口老化，聽力障礙人口數越來越多，同時在軍中服役的官士兵也可能會面臨到聽力受損的可能性，因此積極發展預防及治療聽障的方法是刻不容緩。 而感音神經性聽力障礙目前治療方式不外乎助聽器及人工電子耳，但此兩種輔助治療方式皆須有殘存的感音細胞及神經元，但當這些細胞都消失時，就需要其他治療方式，而現在藥物、小分子基因及幹細胞使毛細胞或是神經元再生醫學屬於新興醫學，可對未來感音神經性聽力障礙提供更符合生理之另一種治療策略。 藉由上述的治療方式，須將基因及幹細胞植入內耳耳蝸中，可進一步增加對於神經耳科學及顱底手術醫學學習的經驗與認知，同時對於耳科聽神經瘤及顱底腫瘤增加手術學習機會。

目前國內並無此種技術及治療方式，為學習新知並走在國內先導，需藉此進修機會將最新技術及發展引進國內，以提升國軍醫療之地位及最新進展。

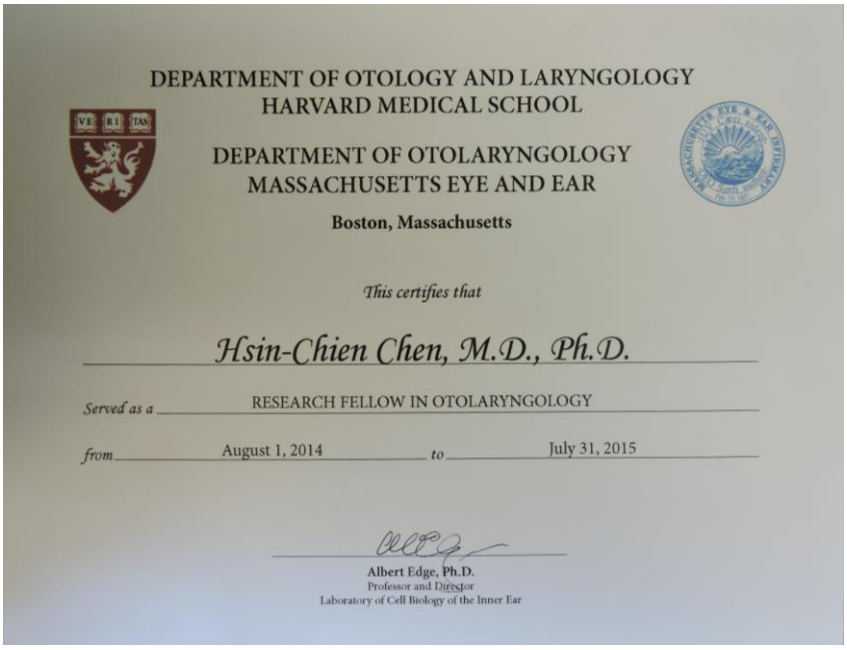
貳、進修過程

一、實驗室基礎研究內容

本實驗室屬於哈佛大學哈佛醫學院附屬麻州眼耳醫院的Eaton-Peabody Laboratory，而實驗室負責人為Albert Edge教授，主要研究內容為聽覺回復、探討關於毛細胞再生及聽神經神經元再生的研究，在毛細胞再生這一領域佔有一席之地，尤其對於研發毛細胞再生的機轉進而發展相關藥物，在此學習到毛細胞再生完整的模式，從實驗的設計開始，轉殖基因鼠的配置，於體外或體內模式用藥物刺激毛細胞增生，或是經由傷害後使用藥物或相關方式來探討毛細胞再生現象，也讓我吸收不少新知。

而Albert給我的題目為使用一個聽神經退化動物小鼠模式，從體外植入幹細胞後觀察是否能讓聽覺回復的可能性，因此首先我必須能做出聽神經退化的模式，接下來能穩定培養胚胎幹細胞，而將這些細胞植入聽神經幹，然而植入聽神經幹的

手術技巧非常困難，植入的方式雖有很多種，但我們希望不要損害耳蝸，因此從枕骨下移除部份小腦，直接看到聽神經後，再利用微注射器，將這些細胞精準的打入聽神經幹內。然而實驗的過程並非都是順利的，是否能完成實驗目的還是得重複不斷的實驗，光是穩定維持細胞的量及品質，就須連假日的時間都得到實驗室，才能確保細胞的存活，再來就是手術的技巧，如何將細胞打入聽神經幹，之前提到從枕骨下進入方式，這樣所遭遇的問題是小腦組織會擋住聽神經幹，因此須將小腦部份移除，但這樣的結果會造成出血及小鼠甦醒會步態不穩和眩暈，但為了能精準將細胞打進聽神經幹並清楚的確定其位置，這是無法避免，經過無數次的實驗及手術技巧的精進，終於將細胞打入聽神經幹中，同時降低小鼠死亡率及併發症，而且在聽力回復上於小鼠某些音頻看到明顯進步的結果，同時免疫組織染色也發現有額外神經元的表現於細胞移植的實驗組中，目前中這些神經元是移植進去的幹細胞直接分化而成或是間接促成內生性細胞轉分化成神經元，還未能證明，這一年有這樣的成績是本人進修最大的收穫，希望藉由這些技術回台後可發展更多的方法及實驗結果。



DEPARTMENT OF OTOLOGY AND LARYNGOLOGY
HARVARD MEDICAL SCHOOL

DEPARTMENT OF OTOLARYNGOLOGY
MASSACHUSETTS EYE AND EAR

Boston, Massachusetts

This certifies that

Hsin-Chien Chen, M.D., Ph.D.

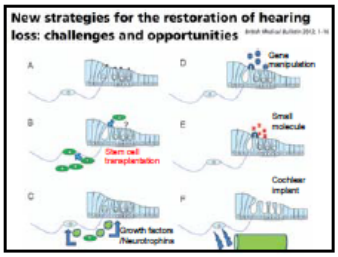
Served as a RESEARCH FELLOW IN OTOLARYNGOLOGY

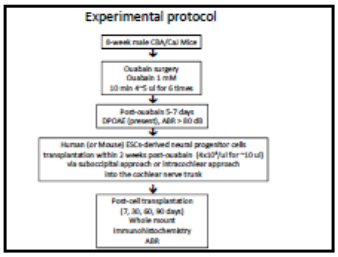
from August 1, 2014 *to* July 31, 2015

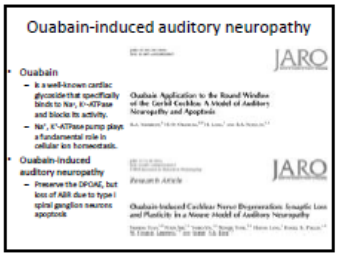
Albert Edge, Ph.D.
Professor and Director
Laboratory of Cell Biology of the Inner Ear

Neural progenitor cells transplantation for restoring of hearing in an ouabain-induced auditory neuropathy mouse model

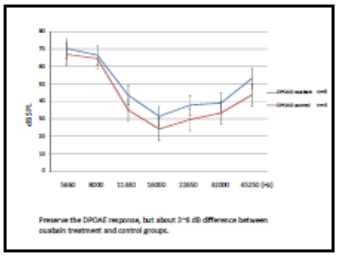
Hsin-Chien Chen
Albert Edge
2014/12/12

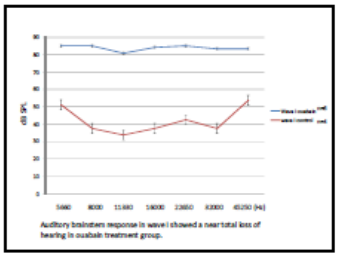


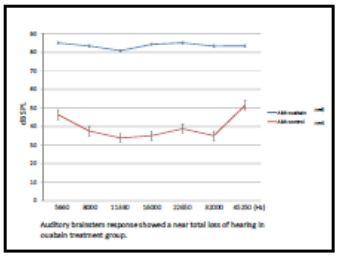


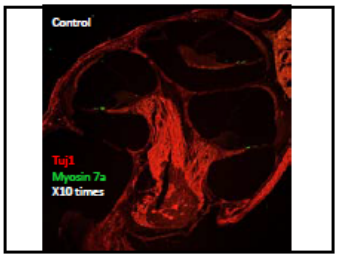


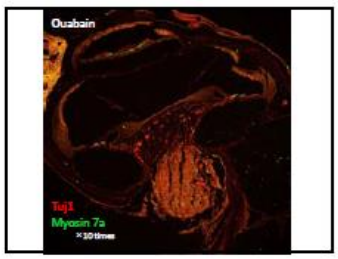
Experimental results

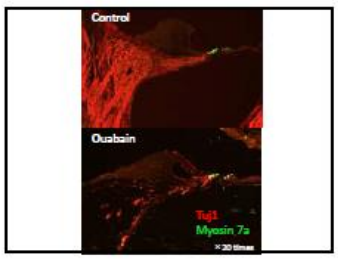


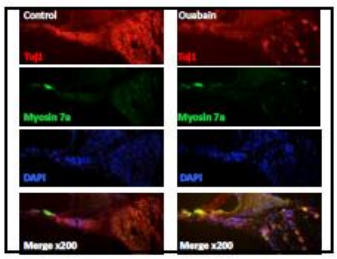


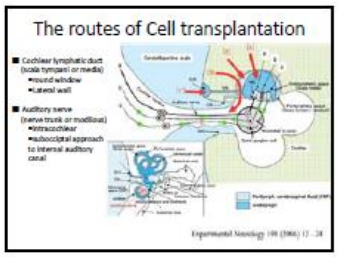


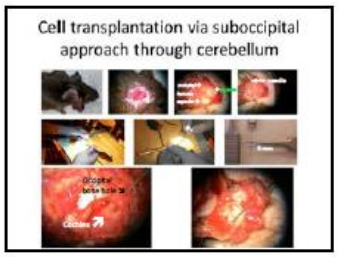


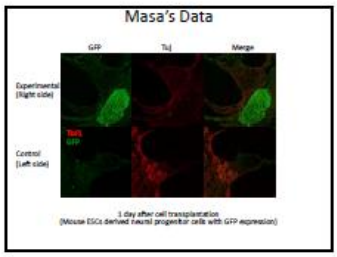

Ouabain
Tuj1
Myosin 7a

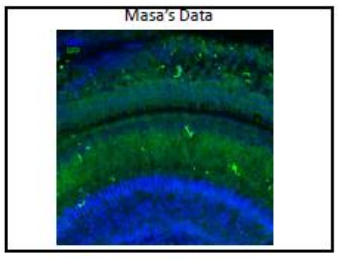

Control
Ouabain
Tuj1
Myosin 7a

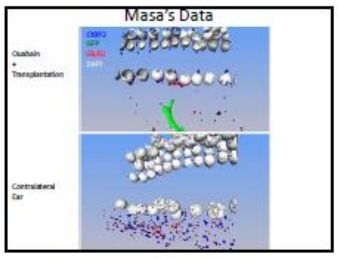

Control
Ouabain
Tuj1
Myosin 7a
DAPI
Merge x200

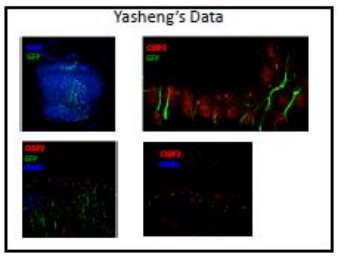

The routes of Cell transplantation
Cochlear lymphatic duct (scala tympani or media)
round window
Lateral wall
Auditory nerve (nerve trunk or modiolus)
intracochlear
suboccipital approach to internal auditory canal

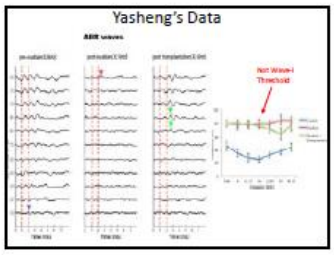

Cell transplantation via suboccipital approach through cerebellum

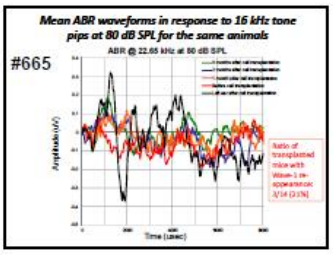

Masa's Data
GFP
Tuj
Merge
Experimental (Right side)
Control (Left side)

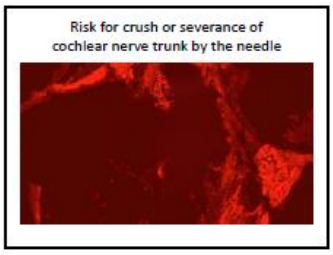

Masa's Data

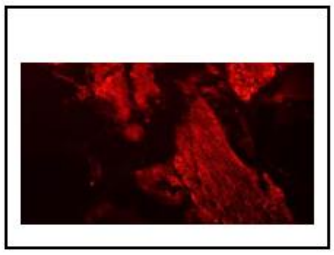

Masa's Data
Ouabain + Transplantation
Contralateral Ear

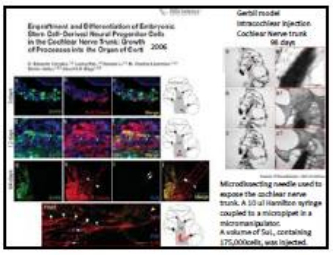

Yasheng's Data


Yasheng's Data
ABR waves
Post-transplant 6 Wk
Post-transplant 12 Wk
Post-transplant 24 Wk
Wave-I Threshold
Time (ms)

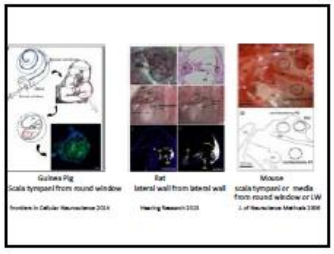

Mean ABR waveforms in response to 16 kHz tone pips at 80 dB SPL for the same animals
#665
ABR @ 22.65 kHz at 80 dB SPL
Amplitude(uV)
Time (usec)
Ratio of transplanted mice with Wave-1 re-appearance: 4/14 (31%)

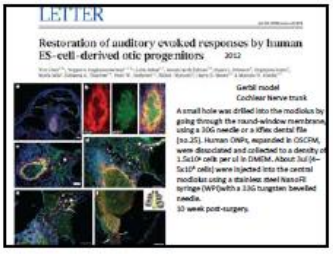

Risk for crush or severance of cochlear nerve trunk by the needle

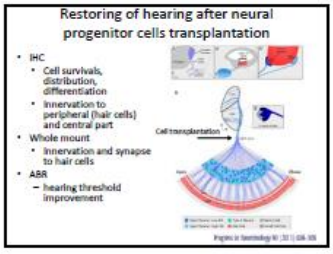



Engraftment and Differentiation of Embryonic Stem Cell-Derived Neural Progenitor Cells in the Cochlear Nerve Trunk: Growth of Processes into the Organ of Corti 2006
Gerbil model
Intracochlear injection
Cochlear Nerve trunk
90 days
Microdissecting needle used to expose the cochlear nerve trunk. A 10 ul Hamilton syringe coupled to a micropipet in a micromanipulator.
A volume of 5ul, containing 175,000cells, was injected.


Thank you for your attention!


Guinea Pig
Scala tympani from round window
Rat
lateral wall from lateral wall
Mouse
scala tympani or media from round window or LW

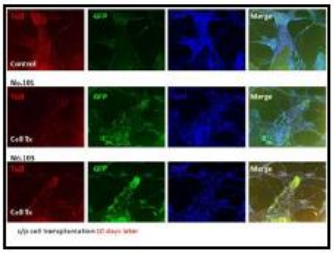

LETTER
Restoration of auditory evoked responses by human ES-cell-derived otic progenitors 2012
Gerbil model
Cochlear Nerve trunk
A small hole was drilled into the modiolus by going through the round-window membrane, using a 30G needle or a Kiffes dental file (no.25). Human ONPs, expanded in OSCFM, were dissociated and collected to a density of 1.5x10⁴ cells per ul in DMEM. About 3ul (4–5x10⁴ cells) were injected into the central modiolus using a stainless steel Hamilton syringe (WPI with a 33G tungsten bevelled needle.
10 week post-surgery.


Restoring of hearing after neural progenitor cells transplantation
IHC
Cell survivals, distribution, differentiation
Innervation to peripheral (hair cells) and central part
Whole mount
Innervation and synapse to hair cells
ABR
hearing threshold improvement
Cell transplantation

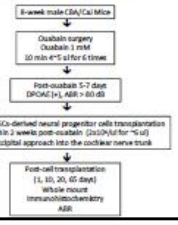
An occipital approach into cochlear nerve for cells transplantation with hearing restoring in a mouse model of auditory neuropathy

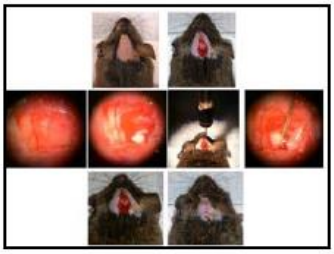
Hsin-Chien Chen
Albert Edge
2015/06/18

Cell transplantation into cochlear nerve trunk via occipital craniotomy through cerebellum



Experimental protocol

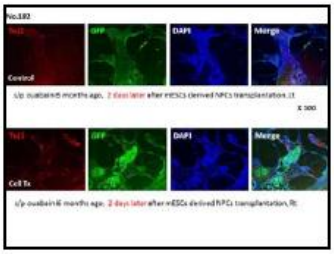




The fate of transplanted GFP cells

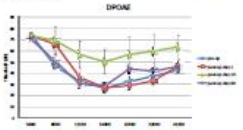
- Strong GFP expression in the modiolus after 2 days transplantation
  - Auto-GFP
- Decreased GFP expression were noted in the loose modiolus after 10 days transplantation
  - 1st anti-GFP Ab

Experimental results



DPOAE of post-surgery procedure

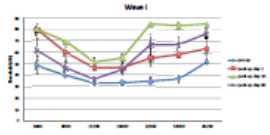
- Control group : removal of partial cerebellum with injected medium in normal mice (n=5)



1.No change of DPOAE was noted immediately in both pre-op and post-op day 1.
2.Obvious elevation of DPOAE was noted on post-op day 10.
3. DPOAE was recovered on post-op day 60.

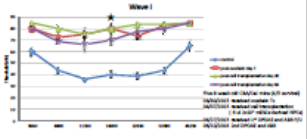
Wave I of post-surgery procedure

- Control group : removal of partial cerebellum with injected medium in normal mice (n=3)



1. Obvious elevation of wave I threshold was noted immediately on post-op day 1.
2. The wave I threshold deteriorated gradually obviously on post-op day 10.
3. Obvious recovery of wave I was noted on post-op day 60 except high frequency.

Post-cell transplantation Wave I ABR



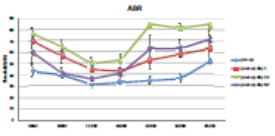
1. Obvious elevation of wave I was noted after ouabain treatment.
2. No obvious improvement of wave I was noted 20-day follow-up after cell transplantation.
3. Mild improvement over 11.33k and 16 k after post-cell transplantation day 65. There was a statistic significance in the 16 k.

Cell transplantation to cochlear nerve trunk through occipital craniotomy via cerebellum approach

- Advantage
  - More precisely injected
  - More deep and parallel to the modiolus and auditory nerve trunk

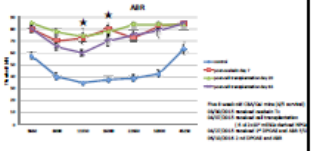
ABR of post-surgery procedure

- Control group : removal of partial cerebellum with injected medium in normal mice (n=3)



1. Obvious elevation of wave I threshold was noted immediately on post-op day 1.
2. The wave I threshold deteriorated gradually obviously on post-op day 10.
3. Obvious recovery of ABR was noted on post-op day 60 except high frequencies.

Post-cell transplantation ABR

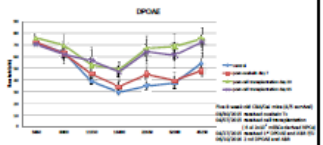


1. Obvious elevation of wave I was noted after ouabain treatment.
2. No obvious improvement of wave I was noted 20-day follow-up after cell transplantation.
3. Mild improvement over 11.33k and 16 k after post-cell transplantation day 65. There were statistic significances in the 11.33 k and 16 k.

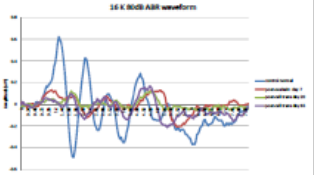
Conclusions

- The hearing impairment (DPOAE and ABR) could be recovered after 2 months in this new approach for cell transplantation.
- There was some hearing recovery in 11.3k and 16 K compatible with the cell transplanted site (more apex and middle modiolus).
- It might be a new route for delivery of cells, small molecule or other drugs by this approach in a mouse animal model.

Post-cell transplantation DPOAE



1.No obvious change of DPOAE was noted after ouabain treatment.
2.Obvious elevation of DPOAE was noted 20-day follow-up after cell transplantation. 3. No recovery of DPOAE after cell transplantation day 65. (May be damaged by ouabain)

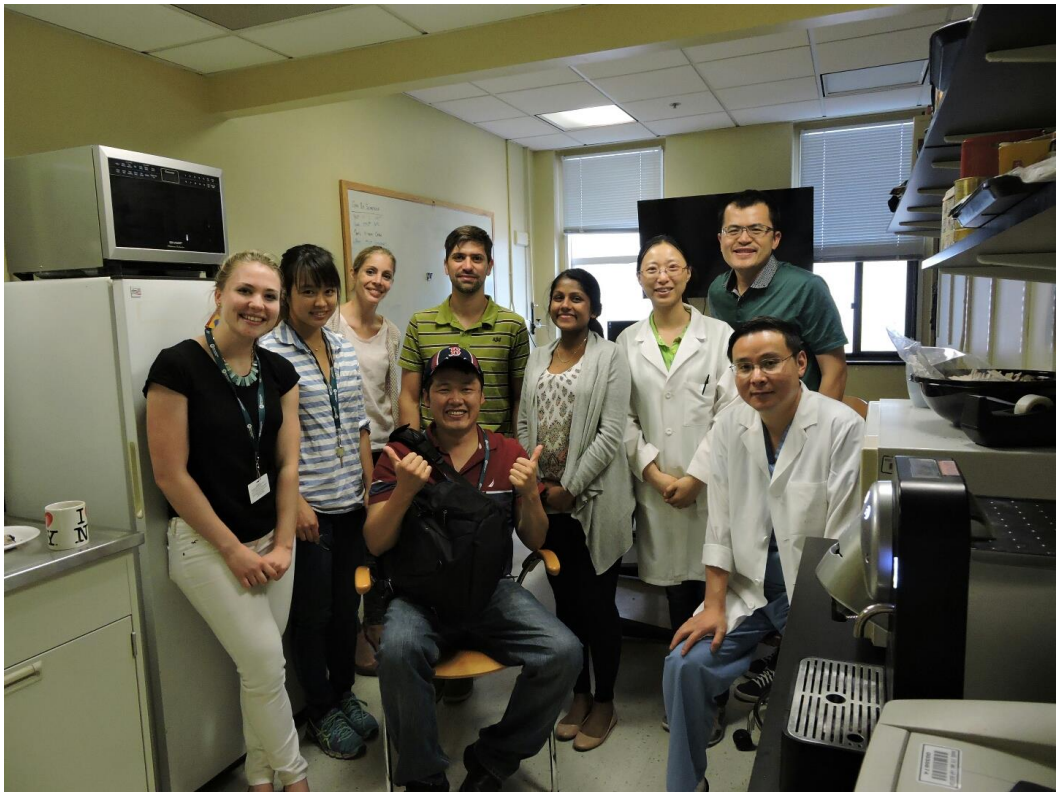


Delay latency and small amplitude in post-ouabain and post-cell transplantation mice. It is difficult to explain what these waveforms present.

Future works

- The four mice were sacrificed, and I would do whole mount (2 mice) and IHC (2 mice) in next week.
- or any suggestions ?

Albert Edge晉升為哈佛醫學院終身職教授(Tenure Professor) 於20150213Harvard Club舉辦之晚宴



實驗室歡送本人波士頓紅襪隊隊帽

實驗室歡送本人之聚餐

實驗室Harvard University and MIT博士生畢業慶祝遊艇餐會

二、SHBT inner ear biology修課及基礎研究討論會

（一）、SHBT inner ear biology修課

EPL部主任Charles Liberman有負責SHBT (Speech and Hearing Biology and Technology) 隸屬哈佛醫學院，開了一門Inner Ear Biology，我也去旁聽了大部份課程，內容涵蓋聽覺傳遞的生理物理學，雖然深奧難懂，但有機會與這些高材生上課，也是非常難得的經驗。

SHBT201/HST 721 2014 Edition

SEPTEMBER

Tuesday	Thursday	Friday
2 Lecture 1: Course Overview	**4 Lecture 2: Inner Ear Anatomy**	**5 OPEN**
9 Tutorial: Molecular Biology	**11 Lecture 3: Inner Ear Development**	**12 Lab: Inner Ear Anatomy**
16 Discussion 1: Development & Regeneration	**18 Lecture 4: Hair Cells**	**19 OPEN**
23 Discussion 2: Hair Cells & Transduction	**25 Lecture 5: Stria & EP**	**26 Recitation: PS#1 -Anatomy, Development & Regeneration**
30 Discussion 3: Stria & EP		

OCTOBER

Tuesday	Thursday	Friday
	2 Lecture 6: Motility & Mechanics	**3 OPEN**
7 Review Session	**9 Lecture 7: Afferent Transmission**	**10 Recitation: PS#2 – Stria and Hair Cells**
14 Lecture 8: Intro to Mouse Lab	**16 Discussion 4: Motility & Mechanics**	**17 Lab: Mouse Hearing in vivo**
21 Discussion 5: Afferent Transmission	**23 Lecture 9: Auditory Nerve Response**	**24 Recitation: PS#3- Motility, Mechanics, & OAEs**
28 Discussion 6: Aud. Nerve Response	**30 OPEN**	**31 OPEN**

NOVEMBER

Tuesday	Thursday	Friday
4 Lecture: 10: Efferent Control	**6 Review Session**	**7 Recitation: PS#4- Afferent Transmission and AN Response**
11 Discussion 7: Efferent Control	**13 Lecture 11: Trauma & Protection**	**14 OPEN**
18 Discussion 8: Trauma & Protection	**20 Lab Discussion: Mouse Hearing in Vivo**	**21 Recitation: PS#5- Efferent Control, Trauma & Protection**
25 Lecture 12: Sensorineural Hearing Loss	**27 HOLIDAY**	**28 HOLIDAY**

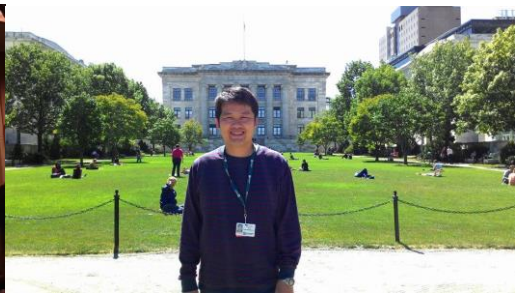
DECEMBER

Tuesday	Thursday	Friday
2 Discussion 9: Sensorineural Hearing Loss	**4 Review Session**	**5 Recitation: PS#6- Sensorineural Hearing Loss**
9 Review Session		
16 FINAL EXAM		

(二)、基礎研究討論會 （Molecular Biology of the Inner Ear Seminar Series 2014-2015）

在Eaton-Peabody Laboratory(EPL)此有定期的基礎耳科學演講，可以獲得新的知識，只是內容太廣，無法一一理解。

Olivia Bermingham-McDonogh, Ph.D. Associate Professor, University of Washington, Seattle
Notch and FGF in inner ear development
Fri, Sep 2, 2014,12 pm, Harvard Medical School, Longwood area, Goldenson 122



Ross Williamson, Ph.D. MEEI/HMS
Thalamic encoding of dynamic audiovisual signals in the actively foraging mouse
Host: Daniel_Polley@MEEI.HARVARD.EDU
Thursday, September 11th at 4 pm, Meltzer Auditorium, MEEI, 3rd floor

Barbara Shinn-Cunningham, Ph.D. Boston University
Title: Hidden hearing loss and cortical networks: Understanding individual differences in communication ability
Host: christopher_shera@meei.harvard.edu
Thursday, September 25th, 4 pm, Meltzer Auditorium, MEEI, 3rd floor

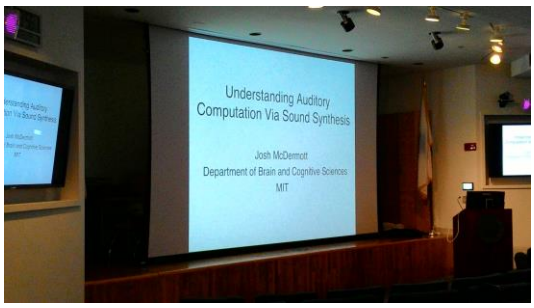
Evan Remington, Ph.D., McGovern Institute, Department of Brain and Cognitive Sciences, MIT
Title: Representing the full spatial field in primate auditory cortex
Host: Daniel_Polley@MEEI.HARVARD.EDU
Thursday, October 2nd, 4 pm, Meltzer Auditorium, MEEI, 3rd floor

Tony Ricci, Ph.D, Stanford University
A look at hair cell synaptic transmission from the pre and postsynaptic sides
Host: Charles_Liberman@meei.harvard.edu
Thursday, October 9th, 4 pm, Meltzer Auditorium, MEEI, 3rd floor

Larry Benowitz, PhD, Harvard Medical School
Optic Nerve Regeneration
Host: William Sewell wfs@epl.meei.harvard.edu
Thursday, October 16th, 4 pm, Meltzer Auditorium, MEEI, 3rd floor

Alan Cheng, PhD, Stanford University
Direct transdifferentiation and mitotic regeneration: a balancing act
Host: Lisa_Goodrich@hms.harvard.edu
Thursday, October 23rd 5 pm, Harvard Medical School, Longwood area, auditorium

Thursday, October 30th, 4 pm, Meltzer Auditorium, MEEI, 3rd floor
Josh McDermott, PhD
Massachusetts Institute of Technology
Understanding Auditory Computation via Sound Synthesis
Host: Mitch_Day@MEEI.HARVARD.EDU



Thursday, November 6th, 4 pm, Meltzer Auditorium, MEEI, 3rd floor
Michelle Valero, Ph.D.
Massachusetts Eye and Ear infirmary/ Harvard Medical School
Can the Middle Ear Muscle and Medial Olivocochlear Reflexes aid in the Diagnosis of Cochlear Neuropathy?
Host: Charles_Liberman@meei.harvard.edu

Thursday, November 13th, 4 pm, Meltzer Auditorium, MEEI, 3rd floor
Jyrki Ahveninen, Ph.D.

Massachusetts General Hospital/ Harvard Medical School
Spatiotemporal brain imaging of human auditory attention and perception
Host: Bertrand_Delgutte@MEEI.HARVARD.EDU

Thursday, November 20th, 4 pm, Meltzer Auditorium, MEEI, 3rd floor
Nace Golding, Ph.D.,University of Texas at Austin
Computing by coincidence: cells and circuits for binaural coding in the medial superior olive
Host: Chris_Brown@meei.harvard.edu

Thursday, December 4th, 4 pm, Meltzer Auditorium, MEEI, 3rd floor
Richard Mooney, Ph.D.
Duke University
Motor-auditory interactions for listening and learning
Host: Daniel_Polley@MEEI.HARVARD.EDU

Tuesday, December 9th, 10 am, Meltzer Auditorium, MEEI, 3rd floor
Anna Chambers, Ph.D. Candidate (thesis defense)
Massachusetts Eye and Ear infirmary/ Harvard Medical School
Progressive recovery of cortical and midbrain sound feature encoding following profound cochlear neuropathy
Host: Daniel_Polley@meei.harvard.edu

Thursday, December 11th, 4 pm, Meltzer Auditorium, MEEI, 3rd floor
Peter Cariani, Ph.D.
Boston University
Subharmonics, interspike intervals, and musical pitch: Current thinking, conundrums, and cognitive dissonances
Host: Christopher_Shera@meei.harvard.edu

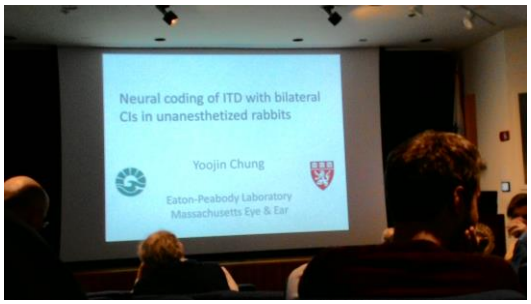
Thursday, December 18th, 4 pm, Meltzer Auditorium, MEEI, 3rd floor
Jeffrey Tao Cheng, Ph.D.

Massachusetts Eye and Ear infirmary/ Harvard Medical School
The Mechanics of the Tympanic Membrane for Hearing
Host: John_Rosowski@meei.harvard.edu

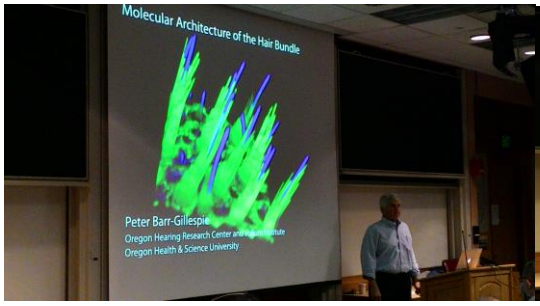
Thursday, January 8th, 4 pm, Meltzer Auditorium, MEEI, 3rd floor
Gabrielle Merchant, Ph.D.
Massachusetts Eye and Ear infirmary/ Harvard Medical School
Exploring the Utility of Reflectance, High-Frequency Reflectance, and Time Domain Reflectance as a Diagnostic Tool
Host: Heidi_Nakajima@meei.harvard.edu

Thursday, January 15th, 4 pm, Meltzer Auditorium, MEEI, 3rd floor
Steven Colburn, Ph.D.
Boston University
Modeling the Cocktail Party Effect
Host: Heidi_Nakajima@meei.harvard.edu

Thursday, January 22nd, 4 pm, Meltzer Auditorium, MEEI, 3rd floor
Yoojin Chung, PhD,Massachusetts Eye and Ear infirmary/ Harvard Medical School
Neural coding of ITD with bilateral cochlear implants in unanesthetized rabbits
Host: Bertrand_Delgutte@meei.harvard.edu



Thursday, January 29th, 2 pm, Harvard Medical School, Longwood area, Goldenson 122
Peter G. Barr-Gillespie, PhD
Oregon Health & Science University; Vollum Institute
Molecular Architecture of the Hair Bundle
Host: Lisa_Goodrich@hms.harvard.edu



Thursday, February 5th, 4 pm, Meltzer Auditorium, MEEI, 3rd floor
Michael Young , Ph. D.
Massachusetts Eye and Ear infirmary/ Harvard Medical School
Stem Cell For Retinal Repair
Host: Albert_Edge@meei.harvard.edu

Thursday, February 26th, 11 a.m., Sloane Auditorium, MEEI, 3rd floor
Andrew Dykstra, Ph.D.,University Hospital Heidelberg, Department of Neurology
Electrophysiological markers of auditory perceptual awareness
Host: Jennifer_Melcher@MEEI.HARVARD.EDU

Piotr Majdak,Ph.D.
Acoustics Research Institute, Austrian Academy of Sciences, Vienna
Sensitivity to Interaural Time Differences in Electric Multi-Electrode Stimulation
Host: Bertrand_Delgutte@MEEI.HARVARD.EDU

Friday, February 27th, 2015 1:00 p.m.; 4th floor Conference room
Shefin George, Ph.D. candidate, Bionics Institute and The University of Melbourne
Focused Multipolar Stimulation for Cochlear Implants: Preclinical Studies
Host: Bertrand_Delgutte@MEEI.HARVARD.EDU

Thursday, March 5th, 4 pm, Meltzer Auditorium, MEEI, 3rd floor
Peter Cariani, Ph.D., Boston University
Subharmonics, interspike intervals, and musical pitch: Current thinking, conundrums, and cognitive dissonances
Host: Christopher_Shera@meei.harvard.edu

Monday March 9, 2014, 4 pm, Sloane Room, MEEI, 3rd floor
W. Michael King,Ph.D. University of Michigan, Ann Arbor
Voluntary Gaze Shifts: Active Gaze Stabilization (AGS) and/or Vestibulo-Ocular Reflex (VOR)?

Host: Faisal_Karmali@MEEI.HARVARD.EDU

Thursday, March 12th, 4 pm, Meltzer Auditorium, MEEI, 3rd floor
Richard Lewis, MD, Massachusetts Eye and Ear infirmary/ Harvard Medical School
Central vestibular processing investigated with electrical stimulation of the labyrinth
Host: Charles_Liberman@meei.harvard.edu

Thursday, March 19th, 4 pm, Meltzer Auditorium, MEEI, 3rd floor
Dong Feng Chen. M.D., Ph.D.
Massachusetts Eye and Ear infirmary/ Harvard Medical School
A regenerative approach of neural repair for reversing vision loss
Host: Zheng-Yi_Chen@meei.harvard.edu

Thursday, March 26th, 4 pm, Meltzer Auditorium, MEEI, 3rd floor
Albert Edge, Ph.D.
Massachusetts Eye and Ear infirmary/ Harvard Medical School
Wnt in the Cochlea: Activation of a Stem Cell Signaling Pathway Regenerates Hair Cells
Host: Charles_Liberman@meei.harvard.edu

Thursday, April 2nd, 4 pm, Meltzer Auditorium, MEEI, 3rd floor
Sean Megason, Ph.D. Harvard Medical School
The role of pressure in inner ear development, physiology, and disease based on in toto imaging of zebrafish
Host: Lavinia_Sheets@meei.harvard.edu

Thursday, April 9th, 4 pm, Meltzer Auditorium, MEEI, 3rd floor
Faisal Karmali, Ph.D.
Massachusetts Eye and Ear infirmary/ Harvard Medical School
Age-related changes in vestibular function: A Bayesian response to hair cell death?
Host: Lavinia_Sheets@meei.harvard.edu

Thursday, April 23rd, 4 pm, Meltzer Auditorium, MEEI, 3rd floor
Vishal Tandon, Ph.D.
Draper Laboratory
Title: Microfluidics-Based Platform for Intracochlear Drug Delivery
Host: William Sewell wfs@epl.meei.harvard.edu

Thursday, April 30th, 4 pm, Meltzer Auditorium, MEEI, 3rd floor
Ross Maddox, Ph.D. University of Washington
Active listening in humans
Host: Charles_Liberman@meei.harvard.edu

Thursday, April 30th, 4 pm, Meltzer Auditorium, MEEI, 3rd floor
Lavinia Sheets, Ph.D. Massachusetts Eye and Ear infirmary/ Harvard Medical School
Death of a Hair Cell: Using zebrafish to uncover cellular mechanisms of
noise-induced hair cell damage
Host: Albena_Kantardzhieva@meei.harvard.edu

Rescheduled:
Thursday, May 7th, 4 pm, Meltzer Auditorium, MEEI, 3rd floor
Charles Liberman, Ph.D.
Massachusetts Eye and Ear infirmary/ Harvard Medical School
Title: Defining molecular mechanisms in the SLC26 family of proteins
Host: Chris_Brown@meei.harvard.edu

Thursday, May 14th, 4 pm, Meltzer Auditorium, MEEI, 3rd floor
Maria Lehtinen,Ph.D. Harvard Medical School
Title: Instructive cues for neural stem cells in the cerebrospinal fluid
Host: Konstantina_Stankovic@meei.harvard.edu

Thursday, May 21st, 4 pm, Meltzer Auditorium, MEEI, 3rd floor
Ulrich Mueller, Ph.D., The Scripps Research Institute
Mechanotransduction, auditory perception and the molecular pathogenesis of
deafness.
Host: Charles_Liberman@meei.harvard.edu

Thursday, May 28th, 4 pm, Meltzer Auditorium, MEEI, 3rd floor
Eri Hashino,Ph.D.
Indiana University School of Medicine
Generation of Inner Ear Organoids from Pluripotent Stem Cells
Host: Albert_Edge@meei.harvard.edu

Thursday, June 4th, 4 pm, Meltzer Auditorium, MEEI, 3rd floor
Sunil Puria, Ph.D. Stanford University
A Photonic Hearing Aid and the Biomechanics of High-Frequency Hearing

Host: Charles_Liberman@meei.harvard.edu

Thursday, June 11th, 4 pm, Meltzer Auditorium, MEEI, 3rd floor
Matt McGinley, Ph.D. Yale School of Medicine
Cortical Membrane Potential Signature of Optimal States for Auditory Signal Detection
Host: Charles_Liberman@meei.harvard.edu

Thursday, June 11th, 4 pm, Harvard Medical School, Longwood area
Gerry Shadel , Ph.D. Yale University
Mitochondrial Stress Signaling in Disease, Aging and Immunity
Host: lisa_goodrich@hms.harvard.edu

Thursday, June 25th 4 pm, 4th floor conference room, MEEI, 3rd floor
Vidhya Munnamalai, Ph.D. Purdue University
Signaling molecules that regulate radial patterning of the cochlea.
Host: Charles_Liberman@meei.harvard.edu

Thursday, July 2nd 4 pm, Meltzer Auditorium, MEEI, 3rd floor
Nace Golding, Ph.D. University of Texas at Austin
The plastic auditory brain in development and maturity
Host: Charles_Liberman@meei.harvard.edu

三、參加2014 American Academy of Otolarnyngology-Head and Neck Surgery (AAOHNS) 及 2015 Association for research in Otolaryngology (ARO) 大會

(一) 2014 AAOHNS meeting

到美國進修剛好有機會參加全美最大的耳鼻喉科醫學會，今年的大會20140921~0924於佛羅里達州奧蘭多城舉辦，因此從波士頓搭機到南方，這是本人第一次參加美國耳鼻喉科醫學會，見識到大型國際會議的經驗，但卻發現此大會類似大拜拜般，不見得都是很棒的報告，但相對也是與大家各醫院醫師一起認識，另外有很多需繳錢的教學課程，早上早一點來拿剩餘的票不用錢，會中的儀器廠商實境人體解剖秀令人印象深刻，臺灣來的醫師還不少（北榮長庚來很多）但卻沒有國軍醫院醫師參加真是可惜，因此回國後應鼓勵年輕主治醫師或住院醫師可前來多多參加，AAOHNS meeting是值得參加的大會，同時我也利用這個機會申請入會，成為AAOHNS member之一。


CERTIFICATE OF ATTENDANCE

AAO-HNSF 2014 ANNUAL MEETING & OTO EXPO℠

The American Academy of Otolaryngology—Head and Neck Surgery Foundation certifies that

HSIN-CHIEN CHEN, MD

attended this education activity

AMERICAN ACADEMY OF OTOLARYNGOLOGY–HEAD AND NECK SURGERY FOUNDATION

David R. Nielsen, MD, FACS
Executive Vice President and CEO

AAO-HNSF ANNUAL MEETING & OTO EXPO 2014 SEPTEMBER 21-24 ORLANDO, FL

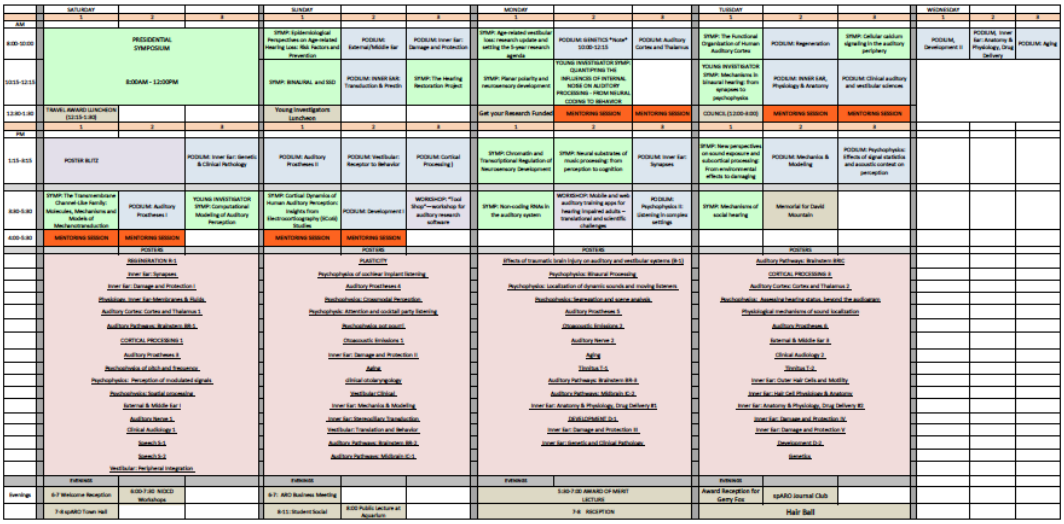
會議中心環境很棒但太大距離太遠

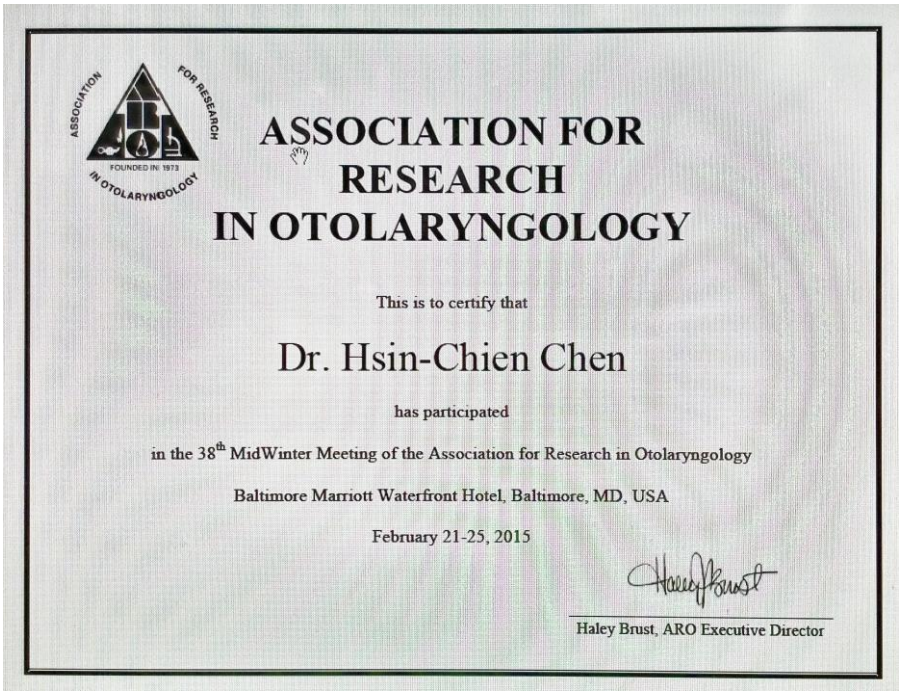
有幸與臺灣唯一應邀上台演講的侯勝博教授合影主講鼻咽癌之臺灣經驗

(二) 2015ARO midwinter meeting in Baltimore

今年的基礎耳科大會正好在美東的巴爾狄摩內港舉行，職為第一次參與此一盛會，才讓我大開眼界號稱最大的基礎耳科研討會，本人對於耳科相關的研究在連續五天的會議中全程參與，從耳科的周邊耳蝸研究到中樞腦區研究應有盡有，各式動物模式的設計，有蟾蜍、蝙蝠、果蠅、知更鳥、斑馬魚、雞、貓、鼠、鯨魚至人類的都有，才知道自己所學及所作的狹小，分為好幾大類例如Presidential Symposium: Diverse Ears serving Diverse Tasks: Communicating, Moving, Learning, Deciding、Podium: Inner Ear: Genetics & Clinical Pathology、Symposium: The Transmembrane Channel-Like Family: Molecules, Mechanisms and Models of Mechanotransduction、Podium: Auditory Prostheses、Young Investigator Symposium: Computational Modeling of Auditory Perception 、Symposium: Epidemiological Perspectives on Age-Related Hearing Loss: Risk Factors and Prevention、Podium: External & Middle Ear、Podium: Inner Ear: Damage and Protection、Symposium: Binaural Processing and Spatial Unmasking for Bilateral, Bimodal and Single-Sided Deafness Cochlear-Implant Users、Podium: Inner Ear: Transduction & Prestin、Symposium: The Hearing Restoration Project、Podium: Vestibular: Receptors to Behavior、Podium: Cortical Processing、Symposium: Cortical Dynamics of Human Auditory Perception: Insights from Electrocorticography (Ecog) Studies、Podium: Development、Symposium: Age-Related Vestibular Loss: Research Update and Setting the 5-Year Research Agenda、Podium: Genetics、Podium: Auditory Cortex and Thalamus、Symposium: Planar Polarity and Neurosensory Development、Young Investigator Symposium: Quantifying the Influences of Internal Noise on Auditory Processing - from Neural Coding to Behavior 、Symposium: Chromatin and Transcriptional Regulation of Neurosensory Development、Symposium: Neural Substrates of Music Processing: From Perception to Cognition、Podium: Inner Ear:

Synapses、Symposium: Non-Coding RNAs in the Auditory System、Workshop: Mobile and Web Auditory Training Apps for Hearing Impaired Adults – Translational and Scientific Challenges、Podium: Psychophysics: Listening in Complex Settings?、Symposium: The Functional Organization of Human Auditory Cortex、Podium: Regeneration、Symposium: Cellular Calcium Signaling in the Auditory System、Young Investigator Symposium: Mechanisms in Binaural Hearing: from Synapses to Psychophysics、Podium: Inner Ear: Hair Cell Anatomy & Physiology、Podium: Clinical Auditory and Vestibular Sciences、Symposium: New Perspectives on Sound Exposure and Subcortical Processing: from Environmental Effects to Damaging Sounds、Podium: Inner Ear: Mechanics & Modeling、Podium: Psychophysics: Effects of Signal Statistics and Acoustic Context on Perception、Symposium: Mechanisms of Social Hearing、Podium: Inner Ear: Anatomy & Physiology, Drug Delivery、Podium: Aging（如下附表），研究項目實在太多了，但經過這樣的研討會真是讓我大開眼界了，接觸了更多的範圍，學術界太浩瀚了，還有很多東西值得去探討。





ASSOCIATION FOR RESEARCH IN OTOLARYNGOLOGY

This is to certify that

Dr. Hsin-Chien Chen

has participated

in the 38th MidWinter Meeting of the Association for Research in Otolaryngology

Baltimore Marriott Waterfront Hotel, Baltimore, MD, USA

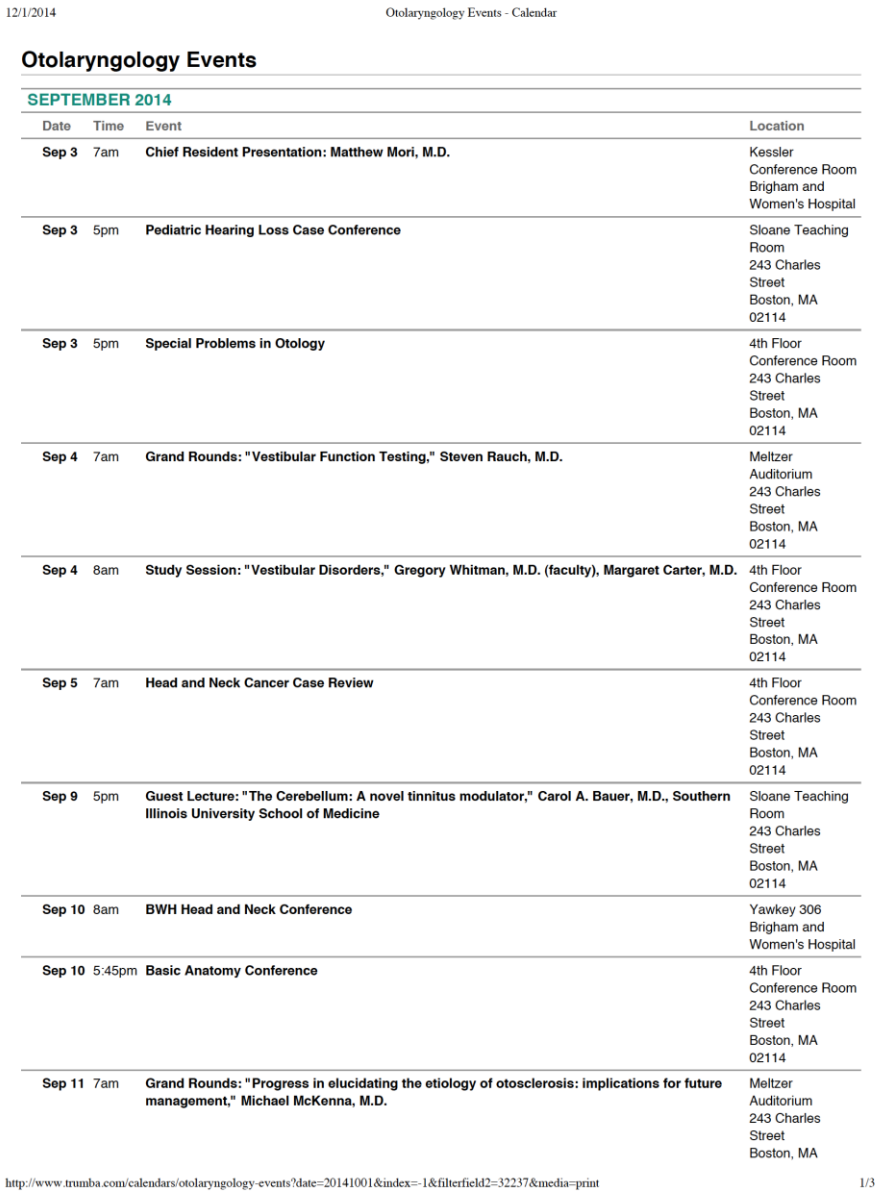
February 21-25, 2015

Haley Brust, ARO Executive Director

四、參加臨床會議及手術觀摩

(一) 臨床會議

每星期四早上七點耳鼻喉部的teaching seminar（如附件單月），從家裡就得六點出發，在冬天低溫及下雪是最痛苦的時候，頂著寒風等著地鐵到來，終於感受到攝氏零下20度的情景，每季都會由某個科負責那三個月的seminar，其中有文章發表的研究，有些是病例討論，手術心得分享，事實上跟臺灣的模式差不多，只是因醫師群較廣，所以大家準備的資料較齊全，另外所收到的案例較特殊，值得學習。



12/1/2014 Otolaryngology Events - Calendar

Otolaryngology Events

SEPTEMBER 2014

Date	Time	Event	Location
Sep 3	7am	Chief Resident Presentation: Matthew Mori, M.D.	Kessler Conference Room Brigham and Women's Hospital
Sep 3	5pm	Pediatric Hearing Loss Case Conference	Sloane Teaching Room 243 Charles Street Boston, MA 02114
Sep 3	5pm	Special Problems in Otology	4th Floor Conference Room 243 Charles Street Boston, MA 02114
Sep 4	7am	Grand Rounds: "Vestibular Function Testing," Steven Rauch, M.D.	Meltzer Auditorium 243 Charles Street Boston, MA 02114
Sep 4	8am	Study Session: "Vestibular Disorders," Gregory Whitman, M.D. (faculty), Margaret Carter, M.D.	4th Floor Conference Room 243 Charles Street Boston, MA 02114
Sep 5	7am	Head and Neck Cancer Case Review	4th Floor Conference Room 243 Charles Street Boston, MA 02114
Sep 9	5pm	Guest Lecture: "The Cerebellum: A novel tinnitus modulator," Carol A. Bauer, M.D., Southern Illinois University School of Medicine	Sloane Teaching Room 243 Charles Street Boston, MA 02114
Sep 10	8am	BWH Head and Neck Conference	Yawkey 306 Brigham and Women's Hospital
Sep 10	5:45pm	Basic Anatomy Conference	4th Floor Conference Room 243 Charles Street Boston, MA 02114
Sep 11	7am	Grand Rounds: "Progress in elucidating the etiology of otosclerosis: implications for future management," Michael McKenna, M.D.	Meltzer Auditorium 243 Charles Street Boston, MA

http://www.trumba.com/calendars/otolaryngology-events?date=20141001&index=-1&filterfield2=32237&media=print 1/3

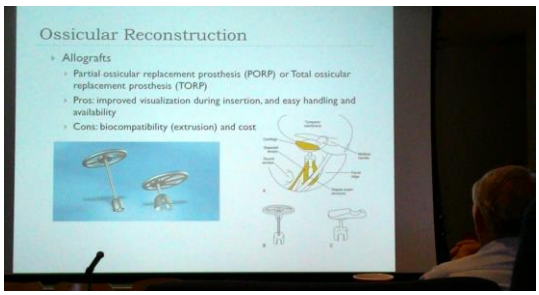
Sep 11	8am	**Chief Rounds: TBD, Aaron Remenschneider, M.D.**	4th Floor Conference Room 243 Charles Street Boston, MA 02114
Sep 12	7am	**Head and Neck Cancer Case Review**	4th Floor Conference Room 243 Charles Street Boston, MA 02114
Sep 12	12pm	**Research Seminar: "Notch and FGF in inner ear development," Olivia Bermingham-McDonogh, Ph.D., University of Washington, Seattle**	Goldenson 122 Harvard Medical School 220 Longwood Avenue Boston, MA 02116
Sep 16	5:30pm	**Issues in Research**	4th Floor Conference Room 243 Charles Street Boston, MA 02114
Sep 17	7am	**BWH/DFCI Research Conference**	Yawkey 308 Brigham and Women's Hospital
Sep 17	8am	**BWH Head and Neck Conference**	Yawkey 306 Brigham and Women's Hospital
Sep 18	7am	**Grand Rounds: "Comprehensive management of tinnitus: the neuropsychiatric perspective," Zeina El-Chemali, M.D.**	Meltzer Auditorium 243 Charles Street Boston, MA 02114
Sep 18	7am	**Study Session: "Migraine-associated vertigo," Adrian Priesol, M.D., George Scangas, M.D.**	4th Floor Conference Room 243 Charles Street Boston, MA 02114
Sep 19	7am	**Head and Neck Cancer Case Review**	4th Floor Conference Room 243 Charles Street Boston, MA 02114
Sep 21	4 Days	**AAO-HNS Annual Meeting**	Orange County Convention Center 9860 Universal Blvd Orlando, FL 32819
Sep 24	7am	**BWH M&M Conference**	Kessler Conference Room Brigham and

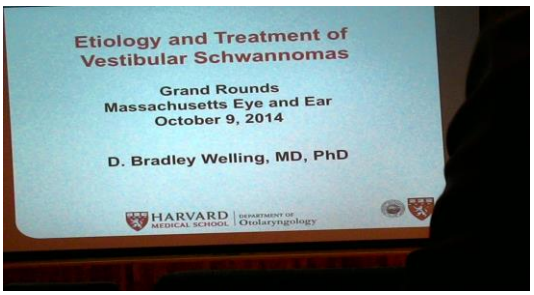
			Women's Hospital
Sep 24	8am	**BWH Head and Neck Conference**	Yawkey 306 Brigham and Women's Hospital
Sep 25	7am	**QHP Lecture/Schwartz Center Rounds: "NCR patient experience survey from a physician perspective," Tessa Hadlock, M.D., Ula Jurkunas, M.D.**	Meltzer Auditorium 243 Charles Street Boston, MA 02114
Sep 25	8am	**M&M Rounds/Quality Assurance**	Meltzer Auditorium 243 Charles Street Boston, MA 02114
Sep 25	4pm	**EPL Seminar: "Hidden hearing loss and cortical networks: Understanding individual differences in communication ability," Barbara Shinn-Cunningham, Ph.D., Boston University**	Meltzer Auditorium 243 Charles Street Boston, MA 02114
Sep 26	7am	**Head and Neck Cancer Case Review**	4th Floor Conference Room 243 Charles Street Boston, MA 02114
Sep 27	8am	**Course: "Performing Voice Update," Voice and Speech Laboratory**	Meltzer Auditorium 243 Charles Street Boston, MA 02114

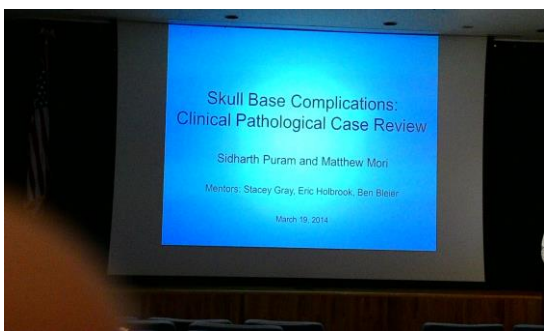
Events calendar powered by Trumba

Printed: Monday, December 01, 2014 at 12:25 PM PST

Calendar events displayed in Eastern Daylight Time



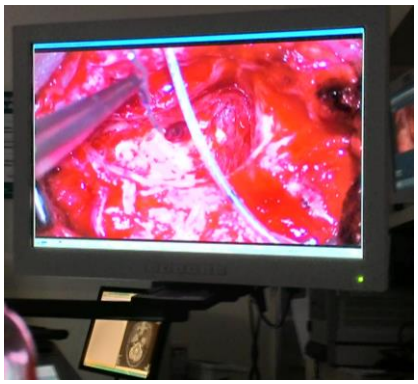




(二) 觀摩臨床手術

趁進修最後三個月進到MEEI surgery room，手術房不算新，但該有的儀器及設備非常齊全，尤其是手術影像系統十分令人驚訝，其中一支手術燈就配有影像系統，可即時觀看手術台上過程，另外兩至三台影像系統分別給醫師助手及護理人員，而內試鏡系統及顯微鏡系統非常齊全，雖然耳科手術流程跟國內很像，但常規使用神經刺激器，還有中顱窩手術（半規管縫隙修補）令我印象深刻，同時人工電子耳也是門診手術開完當天就回家，一些耗材也應有竟有，強調拋棄式用完就丟，我最覺得不可思議的是為何能當天就回家的手術（病人能OPD出院一定有特別之處，如保險、麻醉方式等)，另外也到門診觀摩。


Dr. Denis Poe執行耳咽管成型術

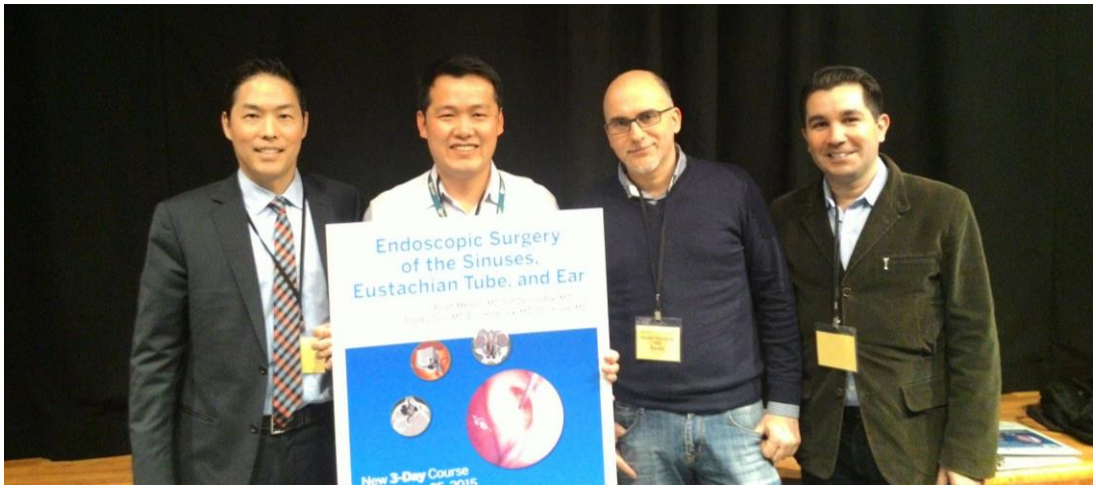



Dr. Daniel Lee 執行內視鏡耳科手術情形

五、參加2015 Endoscopic Surgery of the Sinuses, Eustachian Tube, and Ear研討會併大體實際操作及Harvard Catalyst-Advanced Imaging in Clinical/Translational Neuroscience Research研討會

(一) 參加20150323~25 Endoscopic Surgery of the Sinuses, Eustachian Tube, and Ear研討會併大體實際操作

於三月參加Harvard Continuing Medical Education於本院MEEI舉辦的耳內試鏡手術，第一次使用內試鏡做大體耳科手術，經驗難得，同時觀摩顳骨手術室設置也是令人印象深刻，影像系統及手術器械，同時大體頭顱隨你用，這些設備與環境才能不斷培養一流的醫師，雖然所費不貲，但能持續去做才會有進步，在三總王智弘主任的努力下終於成立顳骨研究室，每年提供住院醫師研磨的機會，期待也能成立相關規模的研究室。



國外知名耳內試鏡大師分別為Daniel J. Lee (USA), me, Daniele Marchioni (Italy) and Joao Flavio Nogueira (Brazil)

(二) 參加20150413~15Harvard Catalyst-Advanced Imaging in Clinical/Translational Neuroscience Research研討會

六、三總醫師及進修人員交流

耳鼻喉頭頸外科部M103林鴻哲醫師

神經外科部M100林柏君醫師

麻醉科部M98陳佳琳醫師及心臟血管外科部M97許博順醫師

參、進修心得與建議

一、進修心得

其實到國外進修的感覺第一個心得就是幹麼出國啊，這些東西在國內也多有呀，實驗室也沒比國防醫學院的好也沒有比較大，實驗動物房也沒有比國防醫學院的高級動物室好，那為什麼國外會做的比我們好呢，文章也發的比我們我多且impact factor也高，因此我就想看看我到底能獲得甚麼！若別人問我出國到底有什麼收穫啊，我能講出那些呢！

說真的，差別就在我們在臺灣也可以這麼做，但是卻不知可以這麼做，我們就是不知或不知嘗試做，這是我感受最深的心得。難怪要提倡垮領域合作才能讓方法學及議題增加，同時激盪出不一樣的火花。

從各方面探討我的進修心得：

學習、主動、積極方面：須加強英文聽及講的能力，才有辦法與國外學者有良好的溝通，才能有後續的進展，國外學者大部分都蠻好的，得要主動發問才行，別人才知道你的需求，本人就是個性過於內向無法打入同仁中，不要怕問人。同時需要積極點，老闆也是會暗中觀察的，態度會決定一切，要呈現真實的數據最重要，不要讓老闆認為你的數據是假的，這樣爾後所作的都是做白工了。

專業性：本實驗室雖然是關於探討聽力再生的研究，但卻恨多的議題參與其中，舉例來說實驗所需用的轉殖鼠，從轉殖鼠的配種繁殖及條件性誘導，誘導完如何使用都是學問，而本實驗室人員幾乎每位都要處理轉殖鼠，算一算整個實驗室有貳拾幾種轉殖鼠，單基因、雙基因、甚至叁基因轉殖鼠，這也讓我了解到想做出大實驗，transgenic mice是不可或缺的。同時對於再生研究也需要對於胚胎發育有所了解，另外對於基因的表現時機也須清楚，進而在新生鼠的處理上更需要藥物的注射，在此也學會了新生鼠耳蝸注射技術，可於回國內進一步做研究。

展現自己的強項：但自己並不是都沒有強項，因為是外科醫師，所以在動物手術方面的操作及解剖實驗的瞭解程度都比其他人員好，因此老闆在這一塊就非常需要我的技術，雖然沒有得到完整的結果，但是在實驗技術上是一大突破了，

除此之外，也因為手術方面多結交了幾個朋友（奧地利、日本、奧大利亞、臺灣），這也是我在此另一種心得，善用自己的強項優點。

在這裡的實驗室動物房說實在的蠻臭的，換料人員更換次數太少，這是我最想念國防動物室的地方，而且出入的無菌或清潔度都比較差，但相對來說非常簡便進出動物房，卻也方便了我們這些辛苦的實驗人員，同時動物手術室雖然老舊，但在各種手術耗材因應盡全，都不用煩惱缺東缺西的，做起實驗雖然類但卻非常舒服，不用擔心沒有耗材可用，而且都有相關人員管理補充耗材，這是值得學習跟進的地方，當然要有相當的經費支持才行。

進修的地點：我蠻感謝我的指導老師王智弘處長，建議我直接申請哈佛大學相關的實驗室，能來到美國學術最頂尖的殿堂–波士頓擁有全世界最出名的Harvard University and Massachusetts Institute of Technology (MIT)，這裡真是充滿全世界頂尖一流的師生與研究人員，但在這樣的環境下競爭相對激烈，雖然常看到每個人在草坪上野餐曬太陽，看似悠閒的生活下也是壓力很大，而我在王處長的建議下選擇進修博士後研究員，這樣收穫才多，同時也可以觀看臨床，果然這樣的進修讓我獲得不少東西。波士頓位於美國東北部，四季分明，但冬季卻是低溫及下雪的地方，且高達四～五個月，雖然對我們而言是新鮮的生活體驗，但今年的大雪卻是破紀錄的多，也對交通產生很大的不便，相對影響到進修的進度，因此雖然擁有高學府的加持，但是環境氣候也須考慮，但總而言之，波士頓還真是一個進修的好地方。

老闆及題目選擇：雖然要來之前就知道哪位老師，但卻也不認識且不知道他的個性及習慣，剛來的時候，真是無法適應，Albert跟我講完題目後就再也沒跟我講過話了，可能是我的英文太差不想跟我講，還是博士後研究員應該可以把事情做好做完，不用人家去盯呢，或者是我太過於被動，沒有主動與老闆討論實驗進度，其實這樣有好有壞，壞處就是感情不夠好，好處卻是非常自由的可以安排實驗計畫，個人認為老闆真的是有點過度輕鬆與自由，或許這就是美國PI的特性之一，完全由你去發揮，最後再來討論結果，這不外也是值得學習的地方。

二、建議事項

回想本人當初要能獲的出國進修的機會真是困難，除了得預劃派職外，意思是服務年限要夠才能報考，就因為如此本人多位同學連報的機會都沒有，喪失出國進修機會，建議該限制應該放寬，讓有意願出國進修人數能提高，有鑒於進修期間碰到多位中國學者，相較於臺灣進修人數較少，凸顯出臺灣出國進修機會越來越少之現象。

再來得通過體能考試，雖是好意的限制，但讓天天忙於臨床工作的醫療人員卻也是各無形的壓力，建議將體能考試適用於替代項目即可。

另一個困難的就是托福或是國軍英文能力考試，慚愧的是我考了第四次的托福ITP才過基本標準，這樣的結果的確是出國最痛苦的對待，英文能力不佳造成與人溝通上的問題，尤其是在實驗室與同仁相處，沒有人會主動幫你，加上聽說能力差就有可能被排擠，本人就有如此的感覺，但這也是自己造的果，如何讓自己的能力增加是要靠自己的努力下苦功，因此建議增加國軍人員英文聽語能力，例如聘請外籍老師與同仁對話，增加英文報告的討論會，加強基本對話生活口語英文，才不會遇到像我這樣的窘境。

最後提到一點是，不知是不是只有我這麼擔心出國生活，因為是全家都出去到人生地不熟的地方，非常的緊張，四處去問人有關食衣住行育樂各方面問題。也在網路上尋找別人幫忙，但最後還是自己扛著大包小包行李到飯店，此時只覺得孤苦零仃，後來發現其他醫院有海外校友會幫忙打點，此時想說國防海外校友會在哪啊，建議每年出國進修人員可以與海外校友會聯繫，幫助進修人員渡過新環境適應期，這些是我個人看法。

還有一點是經費問題，我知道軍中經費很難籌措，建議要來進修的人員，準備好一筆錢，這樣才不會糧食短缺彈盡糧絕的問題，進修才不會有後顧之憂。另外在家人的安排上，還是建議與家人一起出國進修，有家人的扶持相對也比較能互相照應，同時小孩也能在國外學校上課，學習不同的語言與環境上的適應，只要家人都在一起就是最快樂的事。

肆、回單位後報告情形

將於進修歸建後於本部作專題演講，在科部報告進修成果及在當地生活狀況，使耳鼻喉科同好對於本人的基礎研究過程及出國進修有更進一步的認識。出國進修一年不僅僅是個人的研究所得，更是報告有關如何在當地生活或與實驗室人員交往或臨床教學及手術觀摩等經驗，也將報告個人參加哪些耳鼻喉科的相關大會可提供給大家作為日後參考並可口頭報告的經驗，雖然進修過程也充滿不少挫折與不好的經驗，但畢竟在外地生活一年其經驗是值得與大家分享，期待此次報告能獲得與會同仁的熱烈回應及指教。

伍、國外進修對單位的貢獻

職當初在本科部主任王智弘指導下攻讀博士班，進修耳蝸幹細胞分子生物醫學知識，希望藉由所學之基礎醫學知識及實驗設計方法能在國內發展聽覺再生這個領域，而此次能在博士完成三年後有機會再出國進修一年，讓自己對於幹細胞用於毛細胞再生的最新分子生物醫學的基礎研究及轉譯醫學有更進一步的認識，藉由對耳蝸幹細胞的基礎研究與具潛力治療藥物的探討，對於目前臨床的病人提供另一個治療的選擇；同時在此地除了基礎研究也觀摩當地醫院的臨床手術，這些的心得及所學，可增進科內同仁的研究風氣及進修意願，將本科部與世界同潮流，最後更希望能將這些所學回饋到臨床病人增益療效及國軍人員醫療保健上，這樣才能真正對科部有所貢獻。

陸、致謝

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