



From CSVP to ACVP Diplomate: Career Path in Comparative and Laboratory Animal Pathology

Shanny H. Kuo

DVM, MS, PhD, DACVP (Anatomic)

Director, Histology and Imaging Core (HIC)

Director, Comparative Pathology Program

Comparative Pathologist

Department of Comparative Medicine, School of Medicine

University of Washington



My Background



Education:



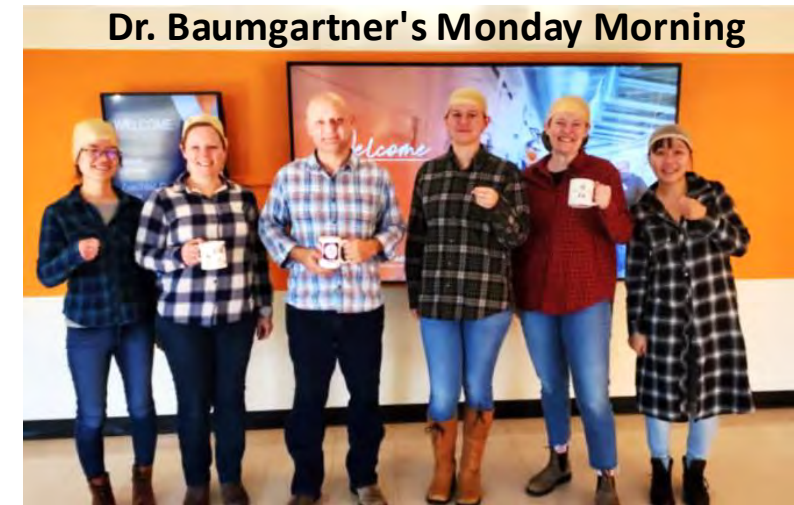
- **DVM**, National Chung Hsing University, Taiwan | **2009–2014** 5-year DVM program (**VM98!**)
- **M.S. in Veterinary Anatomic Pathology**, National Taiwan University | **2014–2017** 3-year Anatomic Pathology Residency + M.S. program
- **Ph.D. in Pathobiology**, University of Illinois Urbana-Champaign | **2019–2024** Combined Veterinary Anatomic Pathology Residency + Ph.D. Program
- **Residency in Veterinary Anatomic Pathology**, University of Illinois Urbana-Champaign | **2021–2024**
- **Comparative Pathology Fellowship**, Department of Comparative Medicine, University of Washington | **2024–Apr 2026**

Qualification:

- Taiwan Veterinary Licensure Examination | 2014
- Taiwan Civil Service Examination – Veterinary Medical Officer | 2015
- Diplomate, Chinese Society of Veterinary Pathologists (DCSVP) | 2016
- **Government Fellowship for Studying Abroad (full-ride)**, Ministry of Education, Taiwan | **2019** 108年公費留學考試
- **Taiwan Key Field Fellowship (full-ride)**, Ministry of Education, Taiwan | **2019** 108年台灣重點領域獎學金
- **Diplomate, American College of Veterinary Pathologists (DACVP), Anatomic Pathology** | **2024**



I My Background



W

My Background

Lab Animal Residents at DCM, UW — Seattle!



Dr. Jessica Snyder and Dubs II
(the Husky mascot) ❤️



W UNIVERSITY of WASHINGTON



What is ACVP?

American College of Veterinary Pathologists (ACVP)

- The specialty board for veterinary pathology in North America
- Board certification in:
 - **Anatomic Pathology (AP)**
 - **Clinical Pathology (CP)**
- ACVP-certified veterinarians are **Diplomates (DACVP)**
- Certification demonstrates competency as an entry-level veterinary pathologist
- Training typically occurs through a **veterinary pathology residency program**
- Certification requires successful completion of the **ACVP Certifying Examination (Phase I + Phase II)**
- **Phase I**
 - General veterinary pathology
 - 100 multiple-choice questions
 - 2 hours
 - Must pass before Phase II
- **Phase II**
 - **Anatomic Pathology or Clinical Pathology**
 - 300 multiple-choice questions
 - 3 sections / 7.5 hours total
 - Taken after completion of required pathology training



How to Apply for a U.S. Veterinary Pathology Residency

CV

- Education
- Pathology experience
- Research
- Publications
- Presentations
- Awards

Personal Statement

- Why veterinary pathology?
- Why this program?
- Career goals
- Research interests

Letters of Recommendation (3)

- Pathologists (2 from DACVP)
- Research mentors
- Faculty who know your work and performance well

Identify programs

- ACVP Training Programs Directory
- Anatomic Pathology vs Clinical Pathology
- Research interests & species expertise
- University / government / industry
- Traditional separate vs combined PhD programs

<https://acvp.org/training/training-programs/>

US-Based Training Programs	
State	Institution
Alabama	Auburn University ↗, Program Overview
Arizona	Midwestern University ↗, Program Overview
California	University of California at Davis - Anatomic ↗ University of California at Davis - Clinical ↗ University of California at Davis - Comparative Pathology Fellowship ↗ University of California at Davis - Lab Animal ↗ University of California at Davis - Standard ↗ Program Overview
California	Zoological Society of San Diego ↗
Colorado	Colorado State University ↗, Program Overview
Connecticut	University of Connecticut ↗
Florida	University of Florida - Clinical ↗ University of Florida - Anatomic ↗, Program Overview ↗
Georgia	University of Georgia - Anatomic ↗ University of Georgia - Clinical ↗ Program Overview, Video ↗
Illinois	University of Illinois at Urbana-Champaign - Anatomic ↗ University of Illinois at Urbana-Champaign - Clinical ↗ University of Illinois, Zoological Pathology Program - Anatomic ↗ Program Overview

W

Resources



台灣獸醫海外工作留學資訊站

私密社團 · 2,674 位成員



+ 邀請

分享

已加入



關於 討論區 精選 成員 活動 影音內容 檔案

Q

...



Min Chun Chen

5月17日 · 公開

Anatomic Pathology Residency 申請心得分享

大家好 我是晏均

今年七月即將在Cornell university 開始anatomic pathology residency- forensic specific track的住院醫師訓練

從來沒有想過自己有機會可以在美國做病理訓練的還能接觸法醫的領域 這一路上真的受到好多好心人的幫忙。版上小修學姐 [Hsiou Chlorine](#)之前的心得文真對我的申請有極極大的幫助

所以想要在這裡分享自己走過的路希望可以幫助到有需要的人

顯示更多

159 14



Ming Lo 在台灣獸醫海外工作留學資訊站社團中編輯了一份文件。

2019年7月5日 · 公開

美國Veterinary Anatomic Pathology Residency申請經驗分享

大家好, 我是台大獸醫b93的羅敏。去年非常幸運的申請上University of Florida的Anatomic Pathology Residency, 即將在2019七月開始為期三年的住院醫師訓練。在這裡跟大家分享我的申請經驗, 希望能夠對有興趣的人提供一些參考價值。我是針對美國地區的解剖病理住院醫師訓練計畫做申請, 因此加拿大以及歐洲其他解剖病理住院醫師計畫不在我分享的範疇。以下是我

[查看更多](#)



138



17



Hsiou Chlorine

2024年3月8日 · 公開

Anatomic Pathology Residency 申請心得分享

大家好, 我是小修

今年7月即將在Cornell University開始解剖病理住院醫師訓練
申請前去了一些學校做externship, 所以主要想分享相關的事
希望能幫助到像我一樣、剛開始想去externship但不知道怎麼實際開始的人們 (文長注意)

【背景】

2019 台大獸醫系畢業

[顯示更多](#)



188



30





Routes to Veterinary Pathology Residency

1. **Externship / Visiting Experience** <https://acvp.org/training/intern-externship-opportunities/>

- Take a **gap year (1-3 years)** to gain intensive, on-site experience
- **2–4 week externships** at U.S. veterinary pathology residency programs
- Build professional connections and demonstrate your interest before applying

2. **PhD → Residency Route**

- Complete a **Ph.D. in the U.S. first**
- Apply for a **3-year Anatomic Pathology Residency** afterward
- **Seek DACVP faculty mentorship and committee membership**
- Use an appropriate immigration/work authorization pathway to transition into residency, depending on your individual situation: OPT after F-1 graduate training, J-1, H-1B

3. **Government-Sponsored Training**

- Seek **government scholarship sponsorship** for U.S. graduate training
- Consider **combined Ph.D. + residency programs**
- Example: Iowa State University

*****Build Strong Letters of Recommendation**

- Typically **3 letters of recommendation**
- Aim for **≥2 letters from DACVPs**
- Ideally, recommenders should know your **pathology skills, work ethic, research potential, and commitment to veterinary pathology**

W

Routes to Veterinary Pathology Residency

1. Externship / Visiting Experience

<https://acvp.org/training/intern-externship-opportunities/>

- Take a **gap year (1-3 years)** to gain intensive, on-site experience
- **2–4 week externships** at U.S. veterinary pathology residency programs
- Build professional connections and demonstrate your interest before applying

2. PhD → Residency Route

- Complete a **Ph.D. in the U.S. first**
- Apply for a **3-year Anatomic Pathology**
- **Seek DACVP faculty mentorship and c**
- Use an appropriate immigration/work transition into residency, depending on OPT after F-1 graduate training, J-1, H-

3. Government-Sponsored Training

- Seek **government scholarship sponsor** training
- Consider **combined Ph.D. + residency**
- Example: Iowa State University

Forensic

Institution	Location	Discipline/Field of Study
University of Florida	Gainesville, FL	Forensic

Government

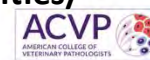
Institution	Location	Anatomic or Clinical
Friedrich-Loeffler-Institute (FLI), Federal Research Institute for Animal Health	Mecklenburg-Western Pomerania, Germany, Europe	Anatomic
National Cancer Institute, National Institutes of Health	Bethesda, MD	Anatomic
The Joint Pathology Center	Silver Spring, MD	Anatomic

Industrial

Institution	Multiple Locations	Anatomic or Clinical
Abbvie	North Chicago, IL	Toxicologic & Lab Animal
Inotiv	Multiple Locations	Anatomic & Toxicologic
Regeneron	Tarrytown, NY	Anatomic
Charles River Laboratories	Multiple Locations	Anatomic & Clinical

Zoo / Wildlife

Institution	Location	Anatomic or Clinical
The Marine Mammal Center	Sausalito, CA	Anatomic



[Donate](#)
[Career Center](#)
[MyPath Account](#)
 Search ...

[Certification](#)
[Careers](#)
[Education](#)
[Annual Meeting](#)
[Membership](#)
[About ACVP](#)
[Awards](#)

Intern/Externship Opportunities



Attention Veterinary Students Interested in Pathology!!

Pathology externships are great opportunities to work with pathologists outside of your own college. Externships help forge professional relationships, educate students in new ways, and (hopefully) instill confidence in students applying to pathology residencies. A number of opportunities are listed below for informational purposes only.

Academic

Institution	Location	Anatomic or Clinical
Colorado State University	Fort Collins, CO	Anatomic
Colorado State University	Fort Collins, CO	Clinical

pathology skills, work ethic, research potential, and commitment to veterinary pathology



Back in 2018...

- **3-Year Veterinary Anatomic Pathology Residency, National Taiwan University (NTU) TW**
 - Built a strong foundation in anatomic pathology (>1100 necropsy & biopsy cases)
- 1 Year Diagnostic Pathology Experience as **Veterinary Pathologist/ Veterinary Medical Officer** at Animal Disease Diagnostic Center, National Pingtung University of Science and Technology
 - Gained independent diagnostic pathology experience
- **Diplomate, Chinese Society of Veterinary Pathologists (DCSVP) | 2016**
- **No externship or visiting experience at U.S. veterinary pathology residency programs**
- Professional Presentations
 - Multiple oral & poster presentations
 - ACVP & CSVP & CSCP conferences
- Research & Publications
 - 5 peer-reviewed publications
- GPA: 3.99/4.0
- **Letters of Recommendation** 

W

Back in 2018...

Skype interview for our 2019 residency position



Inbox x

Ingeborg Langohr

to me

Wed, Oct 17, 2018, 6:39 AM



Dear Shanny,

I am happy to inform that you were included in the short list of the applicants for our 2019 residency position. We would like to schedule a 30-minute Skype interview to get to know you a bit better and to provide you with the opportunity to learn more about our training program.

In order to schedule this interview, please indicate your availability through the following Doodle: <https://doodle.com/poll/8nrmfqwnhb92g49x>. The indicated times should be in your time zone. Should you not be available on any of the indicated days and times, please provide me with some alternate times. Please also provide me with your Skype name.

We are looking forward to 'meeting' you!

Best regards,
Inge Langohr

LSU

Ingeborg M. Langohr, BS, DVM, PhD, DACVP
Professor, Veterinary Pathology

University of Minnesota anatomic pathology residency program



Inbox x

Gerard O'Sullivan

to me

Mon, Nov 5, 2018, 2:17 AM



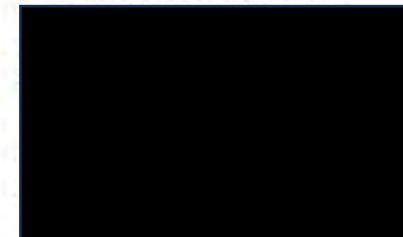
Dear Dr. Kuo,

By any chance are you at the ACVP meeting, so that we can meet? I am interviewing some of the applicants that are on our current shortlist, and it would be great to meet up if possible

Sincerely,
Gerard O'Sullivan

--

M. Gerard O'Sullivan MVB, MSc, PhD, MACVSc,
Diplomate ACVP & ECVF
Professor, Department of Veterinary Population Medicine
Director, Comparative Pathology Shared Resource
University of Minnesota Masonic Cancer Center



- Post-Doctoral Associate in Comparative and Experimental Pathology (Alternate Training Route)
- Anticipated start date in Feb 2019

W

Plan B, C, D...



ILLINOIS

COLLEGE OF VETERINARY MEDICINE

Department of Pathobiology
2522 Veterinary Medicine Basic Sciences Building, MC-002
2001 S. Lincoln Ave.
Urbana, IL 61802-6178

February 26, 2019

SENT VIA EMAIL TO:

Dear Shanny,

Congratulations! I am pleased to inform you that the Department of Pathobiology recommended to the Graduate College that you be admitted for graduate study in our PhD program at the University of Illinois at Urbana-Champaign, beginning with the Fall 2019 semester. If approved, the Graduate College will issue your official notice of admission to the University.

Your application made a favorable impression on our Admission Committee. We believe that you are an outstanding candidate for our graduate program and that our department and campus will provide you with an excellent environment in which to pursue your scholarly and research interests.

You will receive a 50% assistantship for the upcoming academic year (9 months). Your assistantship will include a monthly stipend of \$[REDACTED]. Graduate assistantships are renewable, contingent upon meeting financial support and employment requirements as outlined below. The assistantship includes a tuition and partial fee waiver and health services including vision insurance, dental insurance and partial payment of the health insurance fee. Students are responsible for paying other assessed fees. Students are eligible for awarded financial support from University funded sources, contingent upon maintaining good academic standing and satisfactory progress toward completing degree requirements, as well as satisfactory employment performance, the availability of funding for the position, and continued enrollment in the academic program. All employment at the University of Illinois is contingent upon the successful completion of a criminal background check in accordance with the University of Illinois Background Check Policy. Please visit the following link to learn more:
<https://nessie.uihr.uillinois.edu/pdf/Policy/UniversityBackgroundCheckPolicy.pdf/>.



教育部108年公費留學考試錄取名單

一、一般公費留學99名

1081173002

美國

農林漁牧

禽病學/動物疫苗學

教育部108年臺灣重點領域獎學金試辦計畫 錄取名單

研究領域：生醫產業

准考證號	姓名	備註
1080010	郭 ○	錄取
1080017	林○希	錄取
1080030	余○毅	錄取

以上合計：3名



Government Scholarship

項目	公費留學考試	臺灣重點領域獎學金 (停辦)	留學獎學金	世界百大合作獎學金	Fulbright
核心概念	考試錄取 → 政府公費留學	國家重點領域 → 培養博士人才	優秀學生部分補助	教育部 + 指定世界名校共同培養博士	台美教育／文化交流
主要學位	博士為主；部分類別例外	博士	碩士／博士	博士	碩士／博士
學校限制	依當年度學門／國家規定	世界百大等	知名國外大學	指定合作學校	廣，但由 Fulbright/IIE 協助 placement
申請方式	考試／書審 + 面試	書審 + 面試	資格審查 + 書審	先申請合作學校 + 教育部甄選	Fulbright Taiwan 甄選 + 美國學校錄取
資助程度	★★★★★	★★★★★	★★★	★★★★★~★★★★★	★★★★★
學費	有	有	通常是定額補助	有，依校而異	通常不是全面支付
生活費	有	有	有	有	US\$2,831-4,300/月
年限	3-4年	4年	2-3 年	3-4年	12 個月，可依條件續 1 年
是否有返國服務	有	有	通常沒有	通常沒有	有
美國簽證最注意事項	J-1/212(e) 要特別確認	J-1/212(e) 要特別確認	依實際簽證身分(F-1)	依實際簽證身分(F-1)	J-1/212(e) 要特別確認
最大優勢	最完整、資助高	資助高 + 重點領域	彈性較高	名校 + 博士 + 資助	國際辨識度、IIE 幫你申請美國學校
最大缺點	考試、返國義務	領域限制、返國義務	金額較有限	只能申請指定學校	返國義務

目前教育部列出的百大合作學校包括：

- Cambridge
- Oxford
- Washington University in St. Louis
- USC
- Caltech
- Columbia
- UIUC
- UC Berkeley
- ANU
- University of Sydney
- Paris-Saclay
- KU Leuven
- EPFL
- KAIST



Post-residency Fellowship

- What Can You Specialize in After Residency? **1-2 years** specialized training

Career Path	Example Training Sites
 Laboratory Animal / Comparative Pathology	UC Davis (CPL/CNPRC) · Stanford · Penn Vet CPC, UW
 Toxicologic Pathology	Pharmaceutical & biotech companies, e.g., Moderna
 Zoo & Wildlife Pathology	San Diego Zoo Wildlife Alliance · UW–Madison / Milwaukee County Zoo
 Veterinary Forensic Pathology	Cornell University · University of Florida
 Organ-System Specialization	Dermatopathology · Ocular Pathology · Neuropathology

Typical Eligibility

- **DVM or equivalent veterinary degree**
- **2 to 3+ years of formal Anatomic Pathology residency training**
- **ACVP board eligibility** generally required
- **ACVP-certified/board-eligible applicants** are highly competitive and commonly welcomed



Post-residency Fellowship

- What Can You Specialize in After Residency? **1-2 years** specialized training

Career Path	Example Training Sites
 Laboratory Animal / Comparative Pathology	UC Davis (CPL/CNPRC) · Stanford · Penn Vet CPC, UW Comparative Pathology Fellowship Starting Date: August or September 1, 2027 Closing Date for Applications: September 7, 2026 Compensation: Senior Resident Step 3 Benefits include: Medical, dental, vision, and life insurances, vacation and sick pay. The Comparative Pathology Laboratory (CPL) and the California National Primate Research Center (CNPRC) at UC Davis offer a one-year Fellowship or Senior Residency in laboratory animal and comparative pathology for trainees who seek to specialize in this area of high demand. During this year, the trainee will spend 6 months at the CNPRC and 6 months at the CPL.
 Toxicologic Pathology	
 Zoo & Wildlife Pathology	
 Veterinary Forensic Pathology	
 Organ-System Specialization	

Typical Eligibility

- DVM or equivalent veterinary degree**
- 2 to 3+ years of formal Anatomic Pathology residency training**
- ACVP board eligibility** generally required
- ACVP-certified/board-eligible applicants** are highly competitive and commonly welcomed

W Careers in Veterinary Pathology

Career Path	Core Mission	Main Environment
 Academia/VDL	Diagnose + Teach +/- Research	Veterinary schools / VDLs
 Comparative Pathology	Animal models → Human disease	Medical schools / Research institutes (cancer centers)
 Toxicologic Pathology	Drug safety & development	Pharma / Biotech / CRO
 Diagnostic Pathology	Clinical diagnosis	Diagnostic laboratories (IDEXX, Antech)
 NIH Research Pathologist	Biomedical & translational research	NIH / Federal research institutes
 Zoo Pathologist	Wildlife health & conservation	Zoos / Aquariums / Universities

Academia → teaching + diagnosis + publications + (grants) + (Research)

Comparative Pathology → Experimental animal models + research + collaboration

Toxicology Pathology → Toxicologic pathology + GLP + preclinical studies

Diagnostic / IDEXX → High-volume diagnostic experience + broad species/cases

NIH Research → Research + animal models + translational science + collaboration

Zoo → Exotic species + wildlife + infectious disease + conservation

Same degree. Different career.

W Careers in Veterinary Pathology

Career Path	Core Mission	Main Environment
Ask Yourself... Do you enjoy teaching? → 🎓 Academia Do you love animal models & disease mechanisms? → 🔬 Comparative Pathology Are you interested in drugs & safety? → 💊 Toxicologic Pathology Do you love solving clinical cases (surgical biopsy)? → 🔬 Diagnostic Pathology / IDEXX Do you want to work in collaborative biomedical research? → 🧬 NIH Research Pathology Do you prefer unusual species & conservation? → 🐯 Zoo Pathology		
Dog Pathologist	Wildlife conservation	Aquariums / Universities

Academia → teaching + diagnosis + publications + (grants) + (Research)

Comparative Pathology → Experimental animal models + research + collaboration

Toxicology Pathology → Toxicologic pathology + GLP + preclinical studies

Diagnostic / IDEXX → High-volume diagnostic experience + broad species/cases

NIH Research → Research + animal models + translational science + collaboration

Zoo → Exotic species + wildlife + infectious disease + conservation

Same degree. Different career.

W Careers in Veterinary Pathology

Career Path	Approx. US Salary*
 Academia/VDL	\$100–200K+
 Comparative Pathology	\$145–220K+
 Toxicologic Pathology	\$180–260K+
 IDEXX / Diagnostic	\$130–180K+
 NIH / Federal Research	\$120–180K+
 Zoo Pathology	\$100–180K+

ACVP 2023 Salary Survey :

Toxicologic Pathologist: median \$225,000

- 25th percentile : ~ \$192,300
- 75th percentile : ~ \$258,800

Veterinary pathologist / pathologist / diagnostician (VDL, vet school) :

- median \$150,000
- 25th percentile : ~ \$134,300
- 75th percentile : ~ \$175,500

Typical Earning Potential



Higher salary ≠ better career

Choose based on what you want to do every day.

The Many Hats of a Comparative Pathologist in Academia: Advancing Science and Beyond

- **Research Hat**
- **Pathology Hat**
- **Teaching & Mentorship Hat**
- **Core Leadership & Collaboration Hat**



W



Deciphering the molecular mechanism and immunopathogenesis of *Pseudomonas aeruginosa*-derived volatile organic compounds on airway mucus hypersecretion

Shanny Hsuan Kuo

Department of Pathobiology
University of Illinois at Urbana-Champaign

Microbiologist
Respiratory scientist

Ph.D Thesis Committee:

Dr. Gee W. Lau, BS, MS, PhD (Doctoral Advisor)

Dr. Som Nanjappa, DVM, PhD, DABT

Dr. William Witola, BVM, MS, PhD

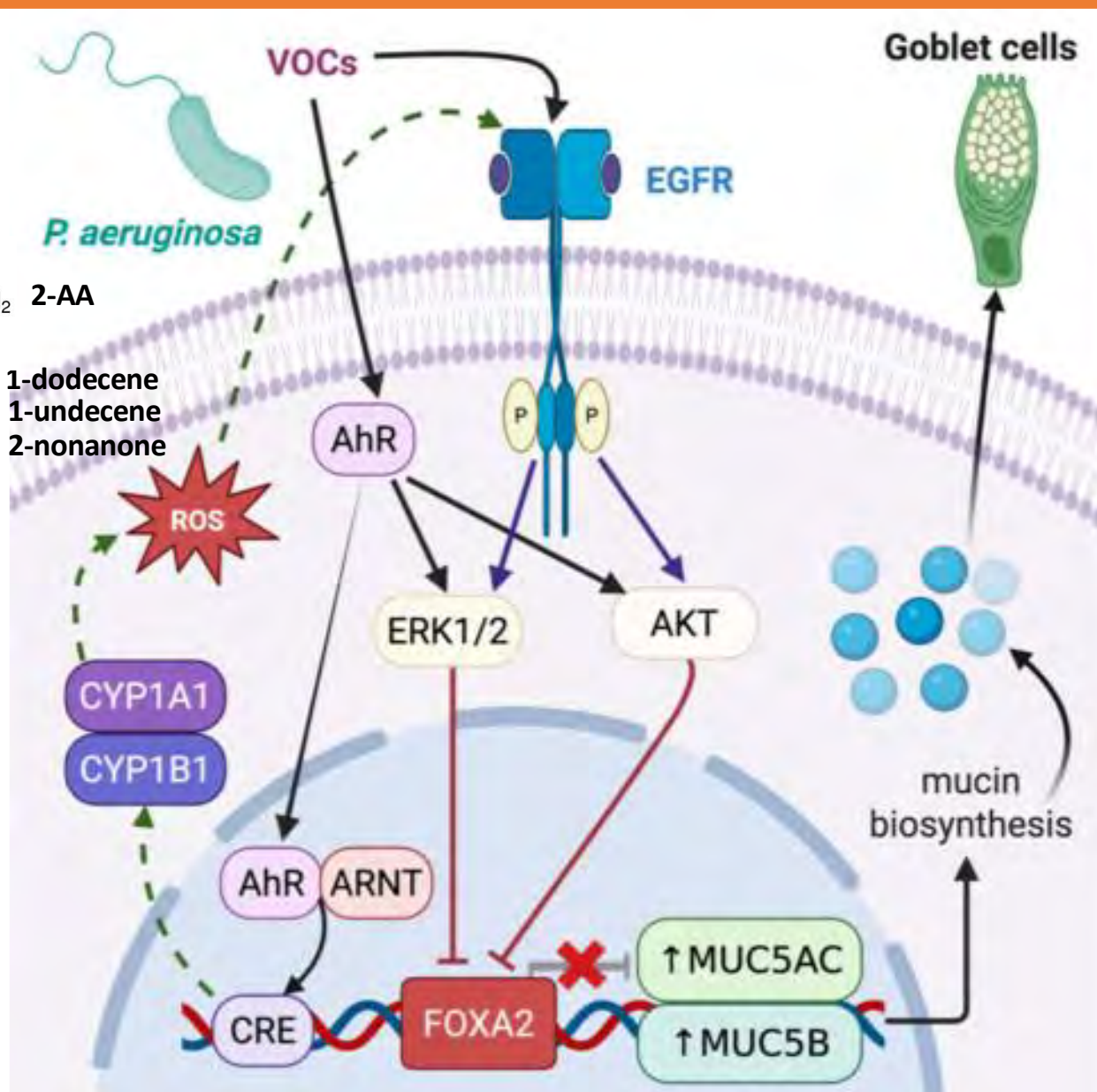
Dr. Miranda Vieson, DVM, PhD, DACVP (Pathology Training Mentor)



**College of
Veterinary Medicine**

UNIVERSITY OF ILLINOIS URBANA-CHAMPAIGN

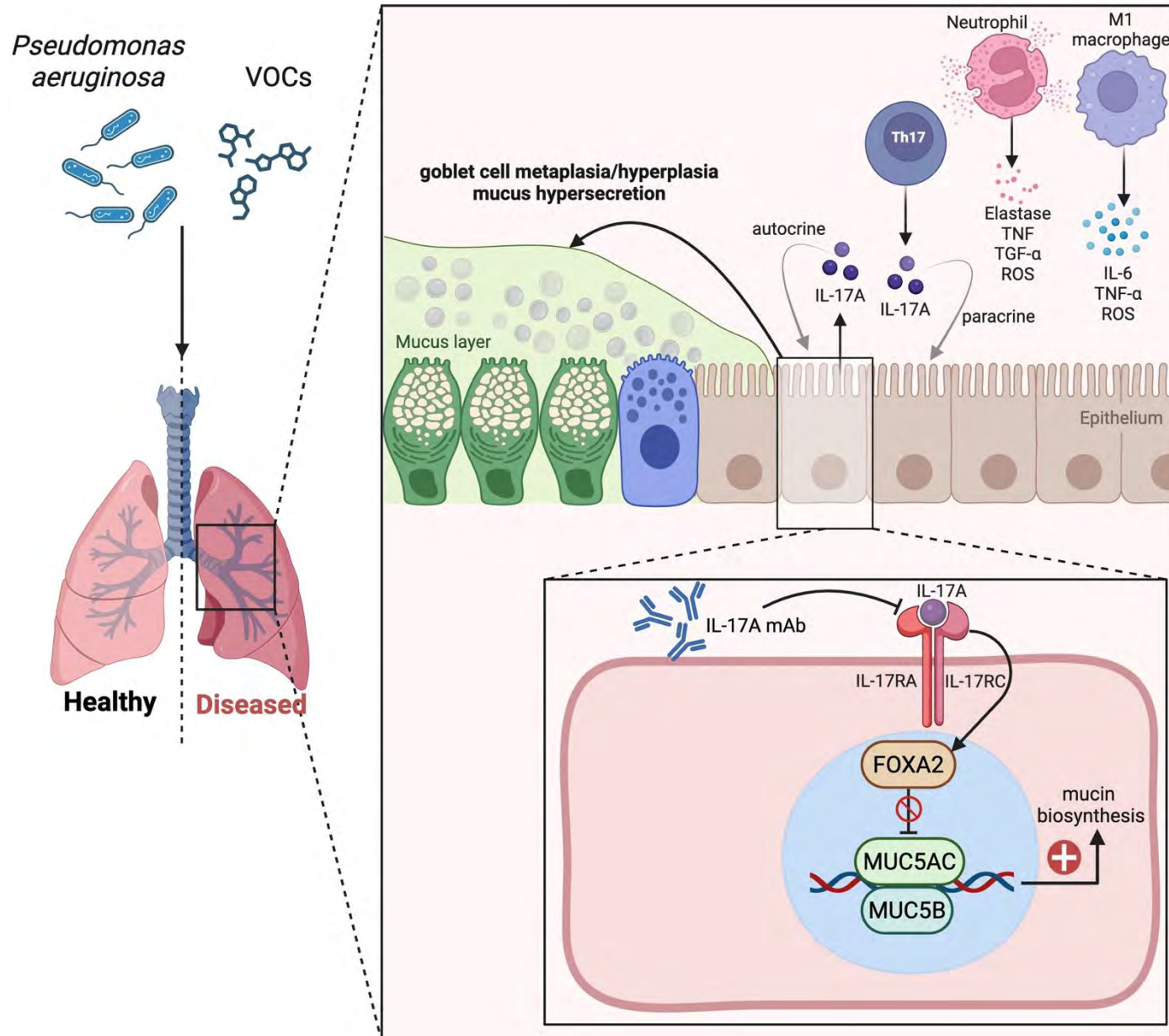
Summary: aim 1



- P. aeruginosa*-derived VOCs activate **EGFR-AKT-ERK1/2** and **AhR-CYP1A1/CYP1B1-mitochondrial ROS-EGFR-ERK** cascades that antagonize FOXA2, leading to increased mucin biosynthesis and goblet cell hyperplasia/metaplasia.

Kuo SH, Lew S, Chong SY, Wu C, Williams AB, Kosmider B, Randell SH, Rahme LG, and Lau GW. *Pseudomonas aeruginosa*-derived volatile organic compounds modulate AhR signaling to dysregulate airway mucus homeostasis. *Nature communications* (2026).

Summary: aim 2



- *P. aeruginosa*-derived VOCs activate EGFR-AKT-ERK1/2 and AhR-CYP1A1/CYP1B1-mitochondrial ROS-EGFR-ERK cascades that antagonize FOXA2, leading to increased mucin biosynthesis and goblet cell hyperplasia/metaplasia.
- PA-derived VOCs induce mucus overproduction through a shift toward a proinflammatory pulmonary environment, characterized by **elevated IL-17A expression**, activation of **M1 macrophages**, and **enhanced infiltration of neutrophils**. Epithelial-derived IL-17A acts in an autocrine manner, alongside paracrine signaling from IL-17A-producing type 17 lymphocytes, to suppress FOXA2 expression and regulate mucin hypersecretion

Kuo SH, Sharma J, Wu C, Vieson MD, Kosmider B, Randell SH, Nanjappa SG, and Lau GW. *Pseudomonas aeruginosa*-Derived Volatile Organic Compounds Modulate Immune Signaling to Dysregulate Airway Mucus Homeostasis. *Frontiers in Immunology*. Vol. 17, (2026) 1823251.

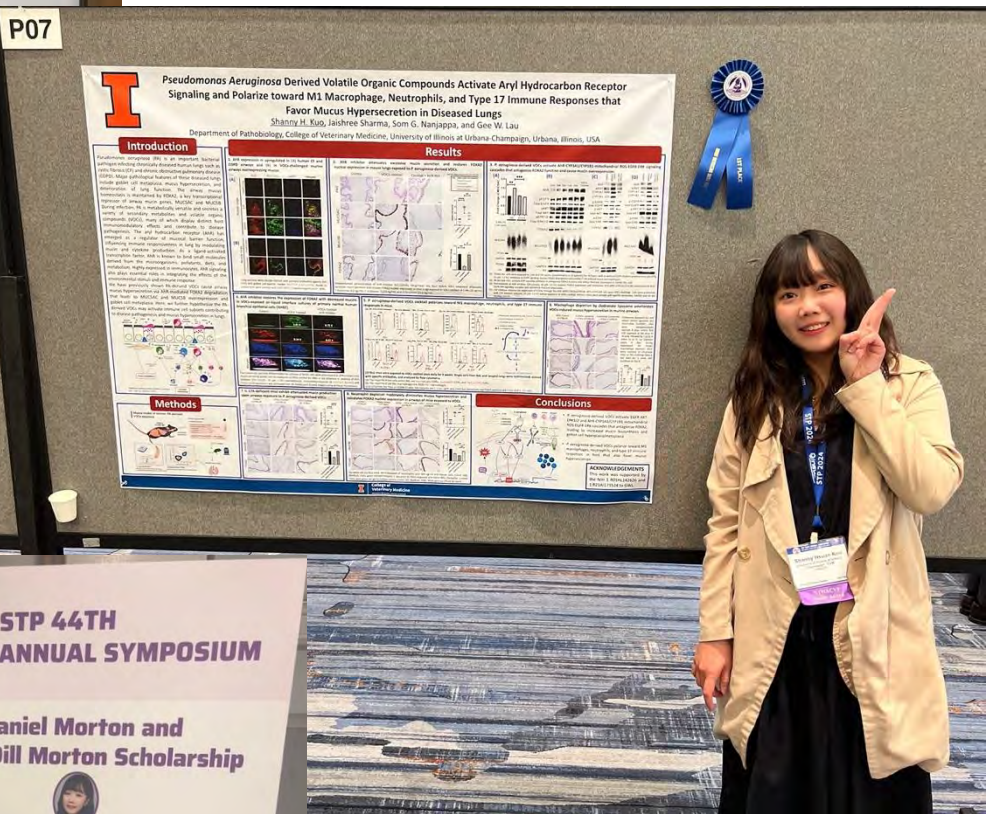


University of Illinois College of Veterinary Medicine
4,483 followers
2yr •

Dr. Shanny Kuo, a graduate research assistant in the department of Pathobiology who is pictured (left) with Professor Emerita Dr. Wanda Haschek-Hock, was honored in late October during the American College of Veterinary Pathologists Annual Meeting with two awards – the ACVP Young Investigator Award and the **Society of Toxicologic Pathology (STP)/ACVP Resident and Student Poster Award**. 🏆

Learn more about our students and their exciting work: vetmed.illinois.edu/path

#IllinoisVetMed #Pathobiology #GradStudent #ACVP2023



2023 ACVP Young Investigator Award
(Industrial and Toxicologic Pathology, First Place), ACVP/ASVCP Annual Meeting, Chicago, USA
2024 Society of Toxicologic Pathology/ACVP Student Poster Award
(First Place)
2024 STP Young Investigator Award
(First Place), STP Annual Symposium, Baltimore, USA
[Aim 2 of the thesis](#)

The Daniel Morton and Laura Dill Morton Scholarship



SOCIETY OF
TOXICOLOGIC PATHOLOGY

[Past Award Recipients](#)

2025 The Daniel Morton and Laura Dill Morton Scholarship Recipient



Shanny Hsuan Kuo

University of Illinois Urbana-Champaign

Dr. Shanny Hsuan Kuo is an ACVP board-certified anatomic pathologist and dedicated research scientist committed to advancing human and animal health through innovative animal research. Originally from Taiwan, she earned her DVM and MS degrees in veterinary anatomic pathology before starting a combined residency and PhD program at the University of Illinois Urbana-Champaign in 2019. Dr. Kuo's research focuses on investigating the effects of *Pseudomonas aeruginosa*-derived metabolites on lung mucus homeostasis. Her doctoral work has garnered multiple accolades, including several Young Investigator Awards from the Society of Toxicologic Pathology and the American College of Veterinary Pathologists. During her PhD training, she developed a passion for comparative and toxicologic pathology, where she worked as a veterinary pathologist and collaborated with diverse principal investigators, resulting in 16 co-authored publications in prestigious journals like Nature and Science Advances. Currently, Dr. Kuo is furthering her expertise through a comparative pathology fellowship at the University of Washington's Department of Comparative Medicine and envisions a career dedicated to drug discovery, gene therapy, and the pursuit of cures for devastating diseases. Outside of work, she enjoys watching delightful goldendoodle reels on social media and exploring outdoor activities in Seattle.

Past The Daniel Morton and Laura Dill Morton Scholarship Recipients



2024

Andressa Varella Gonsioroski
Michigan State University



2023

Jonathan Nagel
University of North Carolina at Chapel Hill



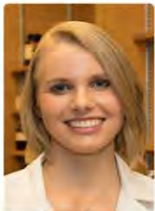
2022

Jessica Kendziorski
Michigan State University



2021

Alexandra Armstrong
University of Minnesota



2020

Alexandra (Alix) Dieterly
Purdue University



2019

Timothy Helms
The Ohio State University



2018

Gregory A. Krane
North Carolina State University



2017

Elizabeth S. Clark
The Ohio State University

University of Illinois COLLEGE OF VETERINARY MEDICINE

Presents this certificate of recognition to

Shanny Hsuan Kuo

Selected by the college to receive the

Dr. Victor E. O. (Ted) and Carroll J. Valli Award

for outstanding performance in research and diagnostic medicine

April 17, 2024

**College of
Veterinary Medicine**
UNIVERSITY OF ILLINOIS URBANA-CHAMPAIGN

Peter D. Constable
Dean, College of Veterinary Medicine



**Pathology/ACVP Student Poster Award
(First Place)**

**2024 STP Young Investigator Award
(First Place), STP Annual Symposium,
Baltimore, USA**

[Aim 2 of the thesis](#)



Pseudomonas aeruginosa-derived volatile organic compounds modulate AhR signaling to dysregulate airway mucus homeostasis

Received: 10 May 2025

Accepted: 22 July 2026

Published online: 10 August 2026

Check for updates

Shanny Hsuan Kuo^{1,2}, Shi Qian Lew¹, Sook Yin Chong¹, Cong Wu¹,
Allison B. Williams³, Beata Kosmider⁴, Scott H. Randell⁵,
Laurence G. Rahme⁶ & Gee W. Lau^{1*}

Pseudomonas aeruginosa frequently infects chronically diseased lungs and exacerbates airway mucus hypersecretion and failure in clearance. *P. aeruginosa* is metabolically versatile and secretes multiple volatile organic compounds (VOCs), which have been scrutinized as potential biomarkers for diagnosing acute exacerbation in diseased lungs. However, the pathogenic roles of VOCs in mucus dysregulation are unknown. By using air-liquid interface cultures of normal and diseased human bronchial epithelial cells and a mouse model of chronic VOCs exposure, we report that dominant species of *P. aeruginosa* VOCs in concentrations found in both the breath of cystic fibrosis patients and in the headspace of bacterial cultures significantly elevated the expression of the mucin MUC5AC. VOCs activate the AhR signaling to inhibit FOXA2, a key regulator of airway mucus homeostasis. AhR inhibitor restored FOXA2 expression to attenuate excessive mucin expression. Mechanistic studies revealed that *P. aeruginosa* VOCs activate the AhR-ARNT-CYP1B1-ROS signaling cascade, which in turn induces the EGFR-AKT/ERK signaling pathways to disrupt airway mucus homeostasis. Taken together, these findings highlight the critical role of *P. aeruginosa* VOCs in disrupting airway mucus homeostasis and implicate the pathogenic role of AhR signaling in chronic lung diseases.

Check for updates

OPEN ACCESS

EDITED BY
Rúbia Marília De Medeiros,
Federal University of Rio Grande do Sul,
BrazilREVIEWED BY
Zhenyu Cheng,
Dalhousie University, Canada
Indiwari Gopallawa,
AstraZeneca (United States), United States*CORRESPONDENCE
Som G. Nanjappa
✉ nanjappa@illinois.edu
Gee W. Lau
✉ geelau@illinois.eduRECEIVED 04 March 2026
REVISED 26 June 2026
ACCEPTED 10 August 2026
PUBLISHED 26 August 2026CITATION
Kuo SH, Sharma J, Wu C, Vieson MD,
Kosmider B, Randell SH, Nanjappa SG
and Lau GW (2026) *Pseudomonas*

Pseudomonas aeruginosa-derived volatile organic compounds modulate host immunity to disrupt airway mucus homeostasis

Shanny Hsuan Kuo^{1,2}, Jaishree Sharma^{1,3}, Cong Wu¹,
Miranda D. Vieson^{1,4}, Beata Kosmider⁵, Scott H. Randell⁶,
Som G. Nanjappa^{1*} and Gee W. Lau^{1*}

¹Department of Pathobiology, College of Veterinary Medicine, University of Illinois Urbana-Champaign, Urbana, IL, United States, ²Department of Comparative Medicine, School of Medicine, University of Washington, Seattle, WA, United States, ³Fred Hutchinson Cancer Center, Seattle, WA, United States, ⁴Veterinary Diagnostic Laboratory, College of Veterinary Medicine, University of Illinois Urbana-Champaign, Urbana, IL, United States, ⁵Center for Inflammation and Lung Research, Department of Microbiology, Immunology and Inflammation, Lewis Katz School of Medicine, Temple University, Philadelphia, PA, United States, ⁶Marsico Lung Institute/Cystic Fibrosis Center, School of Medicine, University of North Carolina at Chapel Hill, Chapel Hill, NC, United States

Lau Lab - UIUC @LauUiuc · Sep 21, 2023

R21 "Our R21 grant on the impact of *P. aeruginosa* volatile organic compounds on airway mucus biology has been funded by NIH (September 2023)!"





ACVP Award & Scholarship Opportunities



As a Veterinary Student

- **ACVP Student Poster Awards** → Research & presentation experience
- **Pathology Club Travel Award** → Attend ACVP Annual Meeting
- **Student Excellence Award** → Recognition in pathology
- **William Inskeep II Scholarship** → Scholarship + leadership
- **Student Externship Scholarship** → Externship & pathology experiences

ACVP Young Investigator Awards

Award Categories:

- Diagnostic Pathology
- Experimental Disease
- Industrial and Toxicologic Pathology
- Natural Disease

Each of these categories will offer up to three awards:

- First Place: \$750
- Second Place: \$500
- Third Place: \$300



As a Resident / Graduate Student

- **ACVP Young Investigator Awards** → Poster research (Diagnostic Pathology, Natural Disease, Experimental Disease, Industrial & Toxicologic Pathology)
- **ACVP/AAVLD Diagnostic Pathology Travel Award** → Diagnostic pathology
- **Casey Scholarship** → Trainee support
- **Capen Scholarship** → PhD / experimental pathology research
- **Society of Toxicologic Pathology Resident and Student Poster Award** → Toxicologic Pathology research
- **ACVP Pathology of Wildlife and Zoo Animals Award** → Wildlife pathology research

→ **Don't just attend meetings—submit, present, compete, and build your CV!**

<https://acvp.org/training/annual-meeting-abstract-awards/>



ACVP Award & Scholarship Opportunities

Abstract Awards Criteria

Award	Eligibility	Focused Scientific Area	Presentation Type	Judged On
ACVP/AALVD Diagnostic Pathology Travel Award ¹	Residents, Graduate Students	Diagnostic Pathology	Oral	Abstract & Oral
ACVP Pathology of Wildlife and Zoo Animals Award	Residents, Graduate Students, and Veterinary Students	Natural Disease	Oral or Poster	Abstract
ACVP Young Investigator Award ²	Residents, Graduate Students	Diagnostic Pathology, Experimental Disease, Industrial & Toxicologic Pathology, Natural Disease	Poster	Poster
ASVCP Young Investigator Award	Residents, Graduate Students	Clinical Pathology	Oral	Oral
Latin Comparative Pathology Group Travel Award ³	Trainees, Postdocs, Graduate Students, Junior Faculty	Any	Oral or Poster	Abstract & Application
STP Resident and Student Poster Award ⁴	Residents and Veterinary Students	Industrial & Toxicologic Pathology	Poster	Poster

- **ACVP Pathology of Wildlife and Zoo Animals Award** → Wildlife pathology research
→ **Don't just attend meetings—submit, present, compete, and build your CV!**

<https://acvp.org/training/annual-meeting-abstract-awards/>



STP Award & Scholarship Opportunities

- **Daniel Morton & Laura Dill Morton Scholarship Award**
 - \$7,500 award + engraved plaque
 - Presented at the **STP Annual Symposium Awards Ceremony**
 - Award recognition on the **STP website** and in *Toxicologic Pathology*
- **Student Travel Grant**
 - ~\$1,000 travel stipend
 - Complimentary meeting registration
 - Complimentary student membership for the following year
- **Young Investigator Award**
 - 1st: \$750 | 2nd: \$500 | 3rd: \$250
 - Based on outstanding student poster abstracts and presentation
- **STP Student Externship Scholarships (\$1,000)**
- **IATP/STP Charles Capen Trainee Poster Award**
 - \$750 award
 - For veterinary/medical students, graduate students, residents & postdocs
- **Environmental Toxicologic Pathology Student Research Award**
 - Open to undergraduate, veterinary & graduate students, residents, and postdocs
 - Recognition + toxicologic pathology textbook



STP Award & Scholarship Opportunities

- **Daniel Morton & Laura Dill Morton Scholarin Award**

- **\$7,500 award + engraved plaque**
- Presented at the **STP Annual Symposium**
- Award recognition on the **STP website**



- **Student Travel Grant**

- **~\$1,000 travel stipend**
- Complimentary meeting registration
- Complimentary student membership

- **Young Investigator Award**

- **1st: \$750 | 2nd: \$500 | 3rd: \$250**
- Based on outstanding student poster

- **STP Student Externship Scholarships**

- **IATP/STP Charles Capen Trainee Poster Award**

- **\$750 award**
- For veterinary/medical students,

- **Environmental Toxicologic Pathology**

- Open to undergraduate, veterinary & graduate students, residents, and postdocs
- Recognition + toxicologic pathology textbook

STP Student Awards



The Daniel Morton and Laura Dill Morton Scholarship

[Award Procedures](#)

[Recipients](#)



Other Scholarship and Support Opportunities

[View more](#)



Young Investigator Awards

[Award Procedures](#)

[Recipients](#)



STP Environmental Toxicologic Pathology SIG Student Research Award

[Award Procedures](#)

[Recipients](#)



IATP/STP Charles Capen Trainee Poster Award

[Award Procedures](#)

[Recipients](#)



Student Travel Grant

[Grant Procedures](#)

[Recipients](#)



STP/CTPVSS Student Award

[Award Procedures](#)

[Recipients](#)



STP/ACVP Student Poster Award

[Award Procedures](#)

[Recipients](#)



Other Award & Scholarship Opportunities

AAVLD AWARD OPPORTUNITIES

[American Association of Veterinary Laboratory Diagnosticians \(AAVLD\)](#)

- College of Veterinary Medicine
- International Organization for Mycoplasmatology
- American Association of Immunologists/ Virologists/ Parasitologists
- Many more..

[Trainee Travel Awards](#) | [Pathology Awards](#) | [Bacteriology Awards](#) | [Virology Awards](#) | [JVDI Awards](#) | [Molecular Diagnostics & Bioinformatics Presentations](#)



<https://sot.toxicology.org/award?categories=16871>

<https://aavco.memberclicks.net/award-opportunities-article>

The Many Hats of a Pathologist in Academia: Advancing Science and Beyond

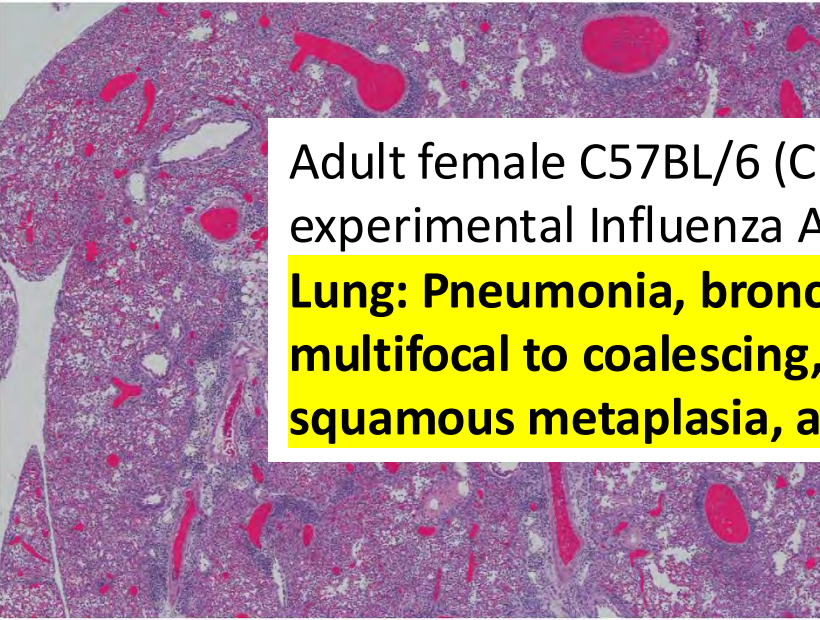
- Research Hat
- **Pathology Hat**
- Teaching & Mentorship Hat
- Core Leadership & Collaboration Hat



W

Diagnostic Pathology Experience : 2014 to 2026

- **Anatomic Pathology Resident:** National Taiwan University, Taipei, Taiwan, 2014 to 2017.
 - Diagnostic pathology training: **small companion animal** (85%), **exotic/zoo animal** (10%), **farm animal** (5%)
 - Laboratory animal pathology model (< 5%) : **pig**
- **Veterinary Anatomic Pathologist and Veterinary Medical Officer:** National Pingtung University of Science and Technology, Pingtung, Taiwan 2017 to 2021. (Unpaid leave for PhD study from 2019 to 2021)
 - Diagnostic pathology service: **small companion animal**, **exotic/zoo animal**, **farm animal**
 - Disease surveillance: rabies in wildlife animals, tuberculosis in farm animal, avian influenza/ Newcastle disease in flocks
 - Laboratory animal pathology interpretation (**ICR mice**, **hamster**, **SD rats**, **broiler chicken**)
- **Anatomic Pathology Resident :** University of Illinois at Urbana-Champaign, IL, USA, 2021 to 2024.
 - Diagnostic pathology training: **small animal** (45%), **large animal** (35%), **wildlife animal** (15%), **lab animal** (5%)
 - Laboratory animal pathology evaluation for preclinical **rodent** research studies
- **Comparative Pathology Fellow and Veterinary Pathologist:** University of Washington, WA, USA, 2024 to 2026.
 - Comparative pathology across laboratory animal species, including **rodents (mice, rats, guinea pigs)**, **amphibians (zebrafish, frogs)**, **avian species**, and **large animals (rabbits, ferrets, pigs, and dogs)**.
 - Pathology consultation for NIH-funded preclinical research (**rodents**, **pig**, **non-human primates**).
 - Histology, IHC, and imaging expertise through the Histology Imaging Core



Adult female C57BL/6 (CD45 congenic) mice (*Mus musculus*) with experimental Influenza A/Puerto Rico/8/34 (PR8) (H1N1) virus inoculation.

Lung: Pneumonia, broncho-interstitial, necrotizing, subacute to chronic, multifocal to coalescing, moderate to severe, with epithelial regeneration, squamous metaplasia, and hyaline membrane formation

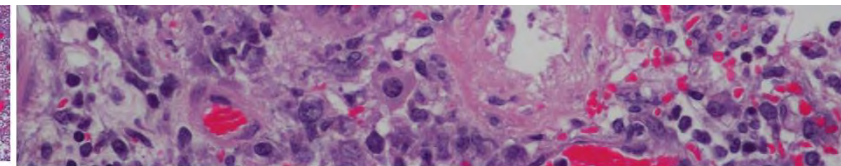


Figure 1-5. Lung, mouse. Intra-alveolar accumulation of homogeneous to finely fibrillar, pale eosinophilic material that occasionally forms hyaline membranes along alveolar walls and alveolar ducts. (H&E, 40×)

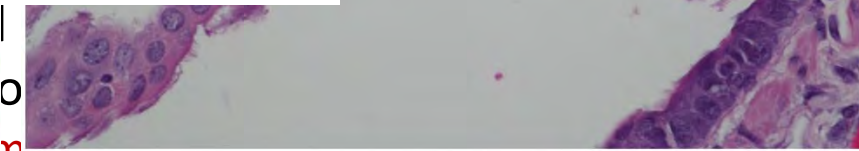


Figure 1-3. Lung, mouse. Hyperplastic bronchiolar epithelium with enlarged, nonbasilar, hyperchromatic nuclei, conspicuous nucleoli, frequent mitotic figures (arrows), and occasional foci of squamous metaplasia. (H&E, 40×)

3-month-old MISTRG ($M-CSF^{h/h}$ $IL-3/GM-CSF^{h/h}$ $SIRP\alpha^{h/h}$ $TPO^{h/h}$ $RAG2^{-/-}$ $IL2R\gamma^{-/-}$) mouse
Humanized Cytokine Signaling: Replacement of murine GM-CSF with human GM-CSF



Impaired Murine Alveolar Macrophage Function

Defective GM-CSF signaling → impaired terminal differentiation and function of alveolar macrophages



Impaired Surfactant Clearance

Accumulation of surfactant material within alveoli



Pulmonary Alveolar Proteinosis (PAP): spontaneous, strain-related findings

Lung: Alveolar proteinosis, multifocal to coalescing, mild to moderate

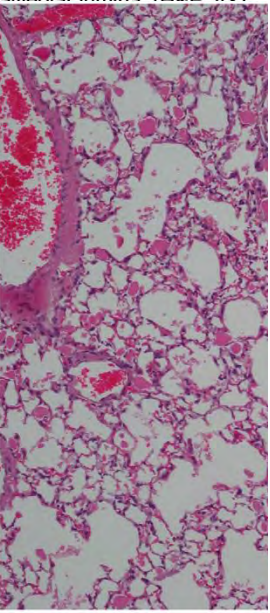


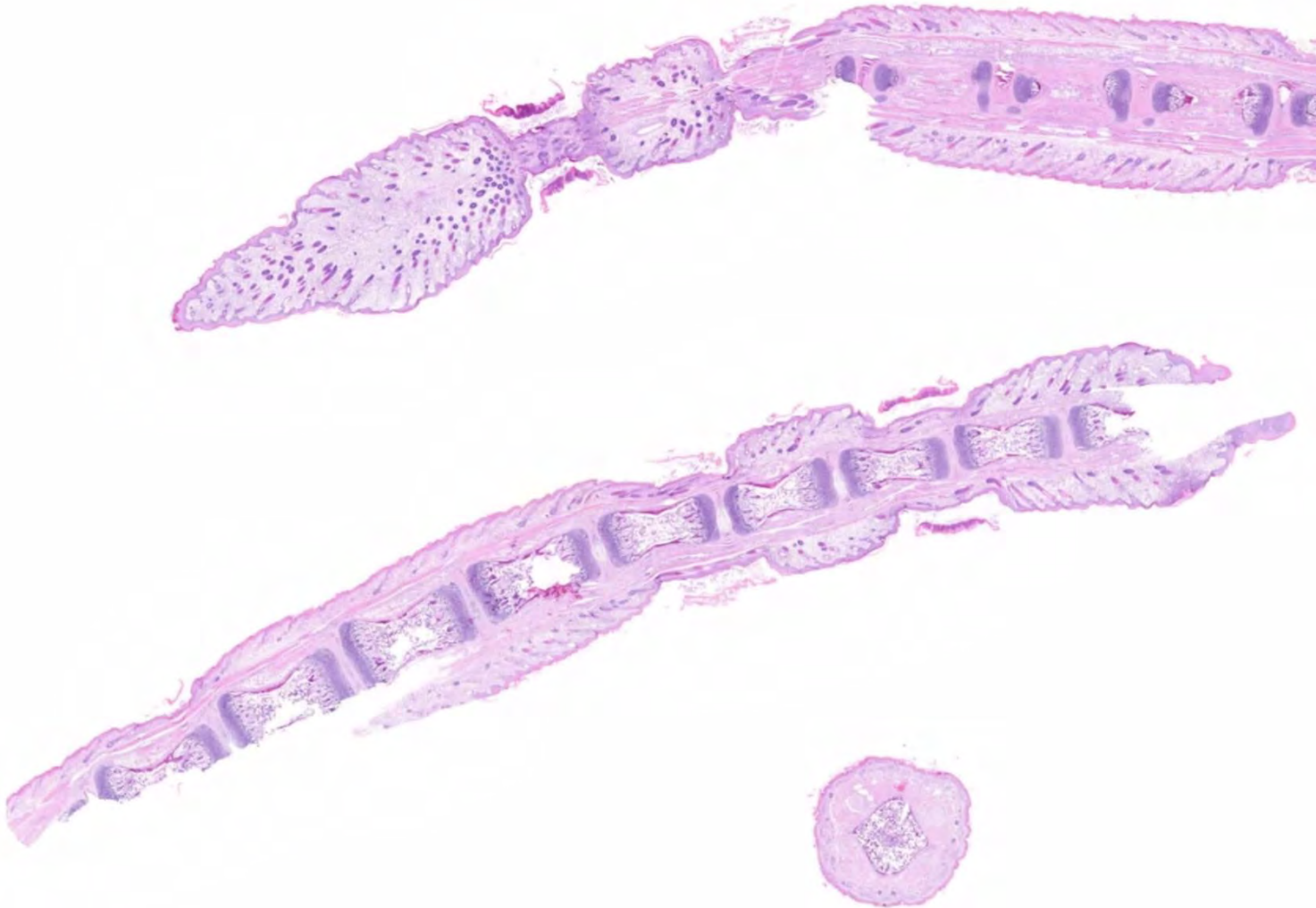
Figure 1-1. Lung, mouse. Low magnification view of the lung revealing multifocal adventitial (perivascular) edema and mixed inflammatory cell infiltrates forming nodular perivascular and peribronchiolar inflammatory cuffs, together with multifocal collapse of alveolar lumina. (H&E, 4×)

Figure 1-2. Lung, mouse. Abundant, amorphous to finely granular, intensely eosinophilic material fills alveoli, with minimal to absent associated inflammation. (H&E, 40×)



intensely PAS-positive, consistent with pulmonary alveolar proteinosis. (Periodic acid-Schiff stain, 40×)

W



Weanling FVB mouse. The cause is:

- A. Ectromelia virus
- B. Fur mite infestation
- C. Low humidity
- D. Low temperature

W

Ring Tail

- **Low relative humidity (<30–40%)** — most commonly implicated
- **High ambient temperature**
- **Nutritional imbalance:**
 - Essential fatty acid deficiency
 - B-vitamin deficiency
 - Zinc deficiency
- **Genetic susceptibility:** FVB, C57BL/6
- **Caging factors** Excessively dry bedding
- Rough cage surfaces
- **Dehydration / poor hydration status**
- **Pathogenesis:** a **disorder of cornification with abnormal desquamation** constitutes the primary lesion of ringtail in mice, resulting in circulatory disturbances (edema, hyperemia, thrombosis, and hemorrhage), ischemic necrosis, and eventual auto-amputation distal to the constriction

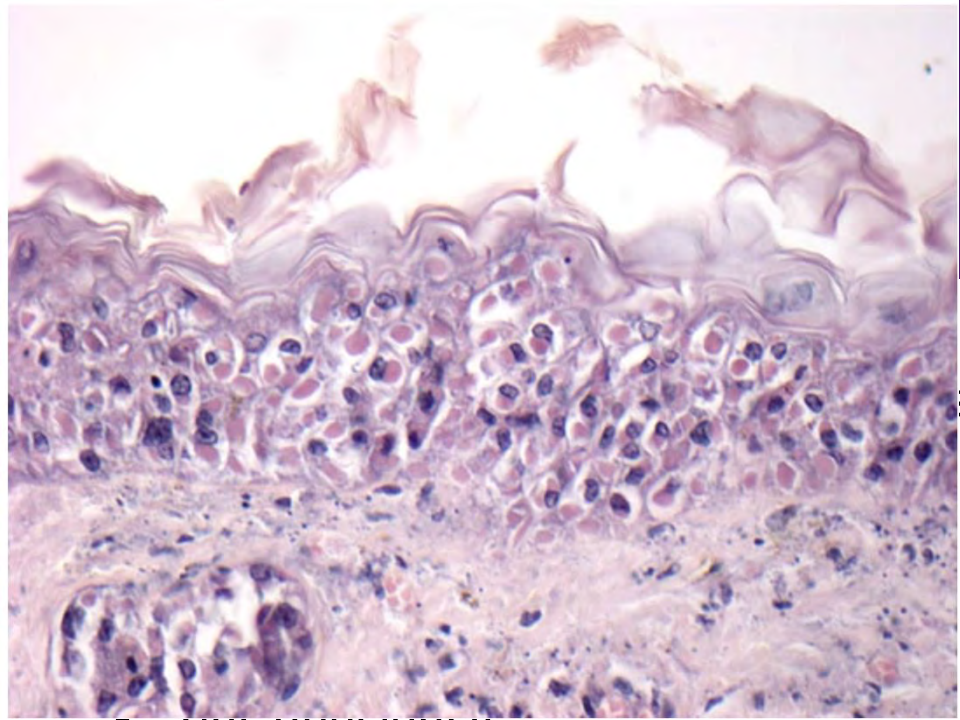


Annular constriction and distal edema

Weanling FVB mouse. The cause is:

- A. Ectromelia virus (mousepox)
 - B. Fur mite infestation
 - C. **Low humidity <40%**
 - D. Low temperature in rats
- **high temperature in mice >80F**

Ring Tail



most commonly implicated



desquamation constitutes the primary lesion of ringtail in mice, resulting in circulatory disturbances (edema, hyperemia, thrombosis, and hemorrhage), ischemic necrosis, and eventual auto-amputation distal to the constriction

with abnormal

Pathologic and Environmental Studies Provide New Pathogenetic Insights Into Ringtail of Laboratory Mice

C. Recordati¹, S. M. Basta^{1,2}, L. Benedetti³, F. Baldin^{4,5}, M. Capillo^{4,5}, E. Scanziani^{1,2}, and A. Gobbi^{4,5}

Abstract

Ringtail is a pathologic condition of laboratory rodents characterized by annular constrictions of the tail. Traditionally, it is classified as an environmental disorder caused by low relative humidity, but other factors (temperature, dietary deficiencies, genetic susceptibility, and caging type) have also been proposed. Twenty litters of mice with ringtail lesions occurred from September 2010 to August 2013 in a facility located in the northern Italy. Mice were maintained under controlled environmental conditions and fed a standard diet. Retrospective analysis of environmental data (relative humidity, temperature) was carried out. Gross, histopathologic, scanning, and transmission electron microscopy examination of tails and limbs was performed. The incidence of ringtail was 0.075% (20/26 800) of all weaned litters over the 3-year period of examination. Temperature and relative humidity remained within accepted limits in all cases except one. We observed annular constrictions in tail, digits of pes, crus, and antebrachium in 116 (100.0%), 47 (40.5%), 11 (9.5%), and 2 (1.7%) of 116 affected mice, respectively. Histologic and ultrastructural examination revealed abnormal keratin desquamation and presence of a keratin ring encircling the tail, causing progressive strangulation of the growing tail with subsequent compression and ulceration of underlying soft tissues, resulting in circulatory changes (edema, hyperemia, thrombosis, hemorrhages), ischemic necrosis, and eventually auto-amputation distal to the constriction. **On the basis of our findings, we suggest a disorder of cornification as the primary lesion of ringtail in mice.** The cause of these cases, however, remained undetermined, even though traditional etiologic factors (relative humidity, temperature, diet, caging type) were reasonably excluded.

Veterinary Pathology
2015, Vol. 52(4) 700-711
© The Author(s) 2014
Reprints and permission:
sagepub.com/journalsPermissions.nav
DOI: 10.1177/0300985814556191
vet.sagepub.com

Annular constriction and distal edema

Weanling FVB mouse. The cause is:

- A. Ectromelia virus (mousepox)
- B. Fur mite infestation
- C. **Low humidity <40%**
- D. Low temperature in rats

→ **high temperature in mice >80°F**

Collaborative Research Pathology Experience: 2019 to 2026

- **Research pathologist:** translational and interdisciplinary collaborative research (consultation, experimental design, histopathology analysis, scoring of lesion, figure preparation)
- Research domains: antibacterial peptides, biomedical implants, compound toxicology, DSS-induced colitis model, metabolic-associated fatty liver diseases, CAR regulatory T cells
- Mouse Models Handled: [C57 black 6](#), [CD1](#), [BALB/c](#), transgenic/KO mice (Lpcat3 liver-specific KO, IL17a KO), immunodeficient mouse strain (NSG/ NOD-scid, SCID, nude), rats (Sprague Dawley, Fischer 344) and many more
- Co-authorship and publications:
 - Published papers (*13): [Nature](#), [ACS Central Science](#), [Science Advances](#), [Hepatology](#), [PNAS](#), [Journal of Medicinal Chemistry](#), [ACS Infectious Diseases](#), [The American Journal of Pathology](#), and others
 - Manuscripts under review and revision (*5):
 - Millik et al ([Advanced Healthcare Materials](#), in revision, 2026)
 - Cain et al ([Nature Communications](#), under review, 2026)
 - Zhou et al ([Advanced Science](#), under review, 2026)
 - Mor et al ([Biomacromolecules](#), under review, 2026)
 - Bian et al ([Journal of Chemistry](#), under review, 2026)

Collaborative Research Pathology Experience: 2019 to 2026

Article [Open access](#) Published: 05 March 2025

Cell-autonomous innate immunity by proteasome-derived defence peptides

[Karin Goldberg](#), [Arseniy Lobov](#), [Paola Antonello](#), [Merav D. Shmueli](#), [Idan Yakir](#), [Tal Weizman](#), [Adi Ulman](#), [Daoud Sheban](#), [Einav Laser](#), [Matthias P. Kramer](#), [Ronen Shteinvil](#), [Guoyun Chen](#), [Angham Ibraheem](#), [Vera Sysoeva](#), [Vered Fishbain-Yoskovitz](#), [Gayatree Mohapatra](#), [Anat Abramov](#), [Sandy Shimshi](#), [Kseniia Ogneva](#), [Madhurima Nandy](#), [Sivan Amidror](#), [Hadar Bootz-Maoz](#), [Shanny H. Kuo](#), [Nili Dezurella](#), [Assaf Kacen](#), [Aaron Javitt](#), [Gee W. Lau](#), [Nissan Yissachar](#), [Zvi Hayouka](#) & [Yifat Merbl](#)  — Show fewer authors

[Nature](#) **639**, 1032–1041 (2025) | [Cite this article](#)

SCIENCE ADVANCES | RESEARCH ARTICLE

MICROBIOLOGY

Targeting the phosphatidylglycerol lipid: An amphiphilic dendrimer as a promising antibacterial candidate

[Nian Zhang](#)^{1†}, [Dinesh Dhumal](#)^{2†}, [Shanny Hsuan Kuo](#)³, [Shi Qian Lew](#)³, [Pankaj D. Patil](#)⁴, [Raleb Taher](#)⁴, [Sanika Vaidya](#)⁴, [Christina Galanakou](#)², [Abdechakour Elkihel](#)², [Myung Whan Oh](#)³, [Sook Yin Chong](#)³, [Domenico Marson](#)⁵, [Jun Zheng](#)¹, [Oleg Rouvinski](#)⁴, [Williams O. Abolarin](#)⁴, [Sabrina Pricl](#)^{5,6}, [Gee W. Lau](#)^{3*}, [Leo Tsz On Lee](#)^{1,7,8*}, [Ling Peng](#)^{2*}

Copyright © 2024 The Authors, some rights reserved; exclusive licensee American Association for the Advancement of Science. No claim to original U.S. Government Works. Distributed under a Creative Commons Attribution

SCIENCE ADVANCES | RESEARCH ARTICLE

ENGINEERING

A smart coating with integrated physical antimicrobial and strain-mapping functionalities for orthopedic implants

[Yi Zhang](#)¹, [Jinsong Cui](#)¹, [Kuan-Yu Chen](#)¹, [Shanny Hsuan Kuo](#)², [Jaishree Sharma](#)², [Rimsha Bhatta](#)¹, [Zheng Liu](#)³, [Austin Ellis-Mohr](#)¹, [Fufei An](#)¹, [Jiahui Li](#)¹, [Qian Chen](#)¹, [Kari D. Foss](#)^{4,5}, [Hua Wang](#)¹, [Yumeng Li](#)³, [Annette M. McCoy](#)^{4,5}, [Gee W. Lau](#)², [Qing Cao](#)^{1,6,7,8,9*}

PNAS

RESEARCH ARTICLE

MICROBIOLOGY



The quorum-sensing peptidic inhibitor rescues host immune system eradication: A novel infectivity mechanism

[Avishag Yehuda](#)^a, [Einav Malach](#)^a, [Shahar Vanunu Ofri](#)^a, [Leyla Slamti](#)^a, [Shanny Hsuan Kuo](#)^c, [Jonathan Z. Lau](#)^c, [Myung Whan Oh](#)^c, [John Adeoye](#)^d, [Neta Shlezinger](#)^d, [Didier Lereclus](#)^b, [Gee W. Lau](#)^c, and [Zvi Hayouka](#)^{a,1} 

Edited by E. Greenberg, University of Washington, Seattle, WA; received January 19, 2023; accepted June 23, 2023

PNAS

RESEARCH ARTICLE

ENGINEERING
APPLIED BIOLOGICAL SCIENCES



Leveraging intracellular ALDH1A1 activity for selective cancer stem-like cell labeling and targeted treatment via in vivo click reaction

[Yang Bo](#)^{a,1}, [Jingyi Zhou](#)^{a,1}, [Kaimin Cai](#)^{a,1}, [Ying Wang](#)^a, [Yujun Feng](#)^a, [Wenming Li](#)^a, [Yunjiang Jiang](#)^a, [Shanny Hsuan Kuo](#)^c, [Jarron Roy](#)^d, [Chelsea Anorma](#)^a, [Sarah H. Gardner](#)^e, [Long M. Luu](#)^b, [Gee W. Lau](#)^c, [Yan Bao](#)^c, [Jefferson Chan](#)^{a,h}, [Hua Wang](#)^{a,d,i,j,k,2}, and [Jianjun Cheng](#)^{a,b,d,i,j,k,2} 

Edited by David Tirrell, California Institute of Technology, Pasadena, CA; received February 16, 2023; accepted June 9, 2023

ACS
central
science

<http://pubs.acs.org/journal/acscii>

ACS
AUTHORCHOICE

Research Article

“Metaphilic” Cell-Penetrating Polypeptide-Vancomycin Conjugate Efficiently Eradicates Intracellular Bacteria via a Dual Mechanism

[Yujun Feng](#), [Wenming Li](#), [Jason Ren Wu](#), [Ziyuan Song](#), [Zihao Zhao](#), [Yurui Xue](#), [Zihuan Fu](#), [Shanny Hsuan Kuo](#), [Gee W. Lau](#),

ORIGINAL ARTICLES: STEATOHEPATITIS

Membrane phospholipid remodeling modulates nonalcoholic steatohepatitis progression by regulating mitochondrial homeostasis

[Tian, Ye](#)¹, [Jellinek, Matthew J.](#)², [Mehta, Kritika](#)³, [Seok, Sun Mi](#)⁴, [Kuo, Shanny H.](#)⁵, [Lu, Wei](#)¹, [Shi, Ruicheng](#)¹, [Lee, Richard](#)⁶, [Lau, Gee W.](#)⁵, [Kemper, Jongsook Kim](#)^{4,7}, [Zhang, Kai](#)³, [Ford, David A.](#)², [Wang, Bo](#)^{1,7,8}

Author Information 

Hepatology 79(4):p 882–897, April 2024. | DOI: 10.1097/HEP.0000000000000375

License: 4.0 (CC BY).

Journal of
Medicinal
Chemistry

pubs.acs.org/jmc

Article

Attenuating the *Streptococcus pneumoniae* Competence Regulon Using Urea-Bridged Cyclic Dominant-Negative Competence-Stimulating Peptide Analogs

[Muralikrishna Lella](#)^a, [Myung Whan Oh](#)^b, [Shanny Hsuan Kuo](#)^c, [Gee W. Lau](#)^a, and [Yiftah Tal-Gan](#)^a

ENGINEERING

A smart coating with integrated physical antimicrobial and strain-mapping functionalities for orthopedic implants

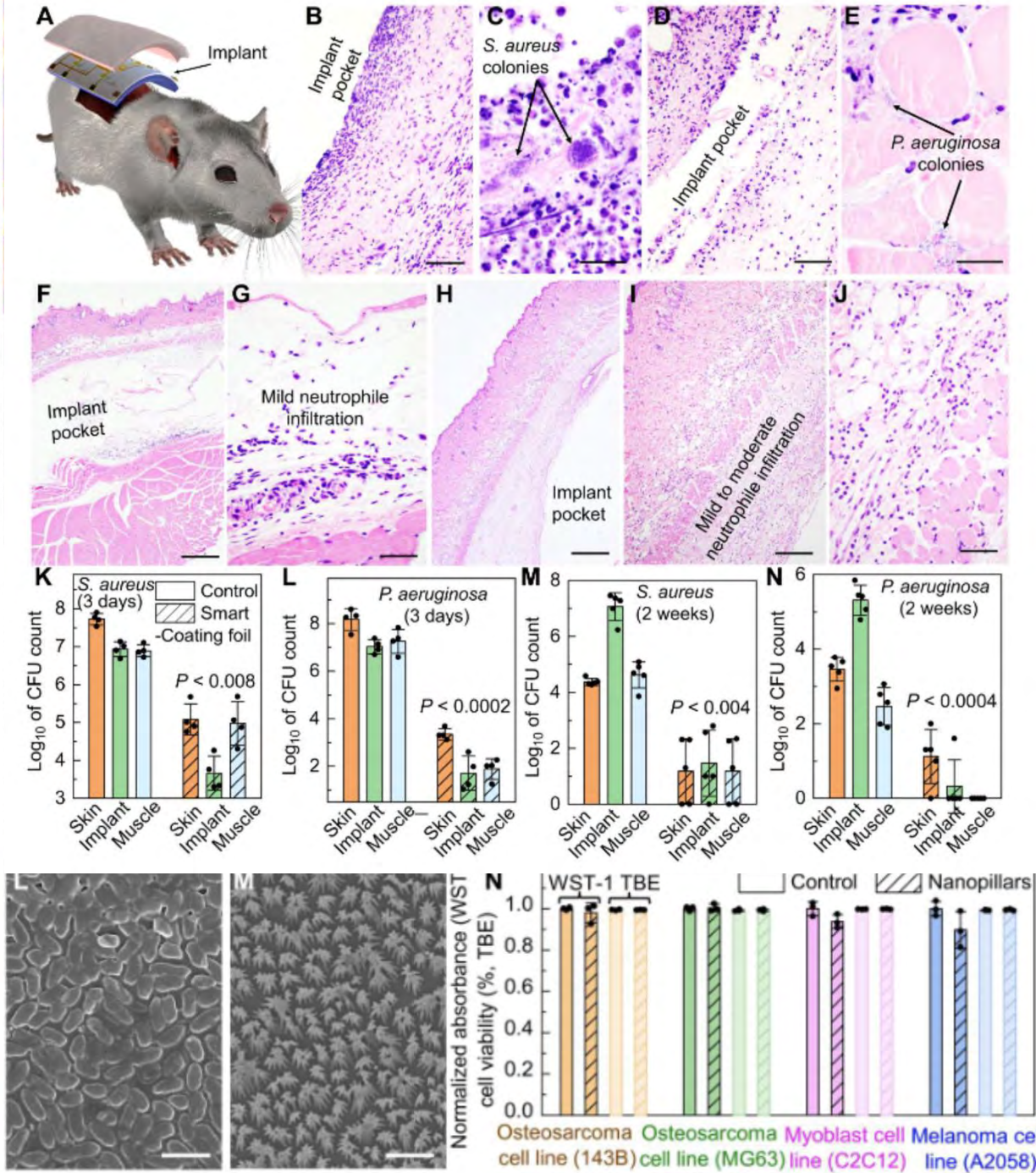
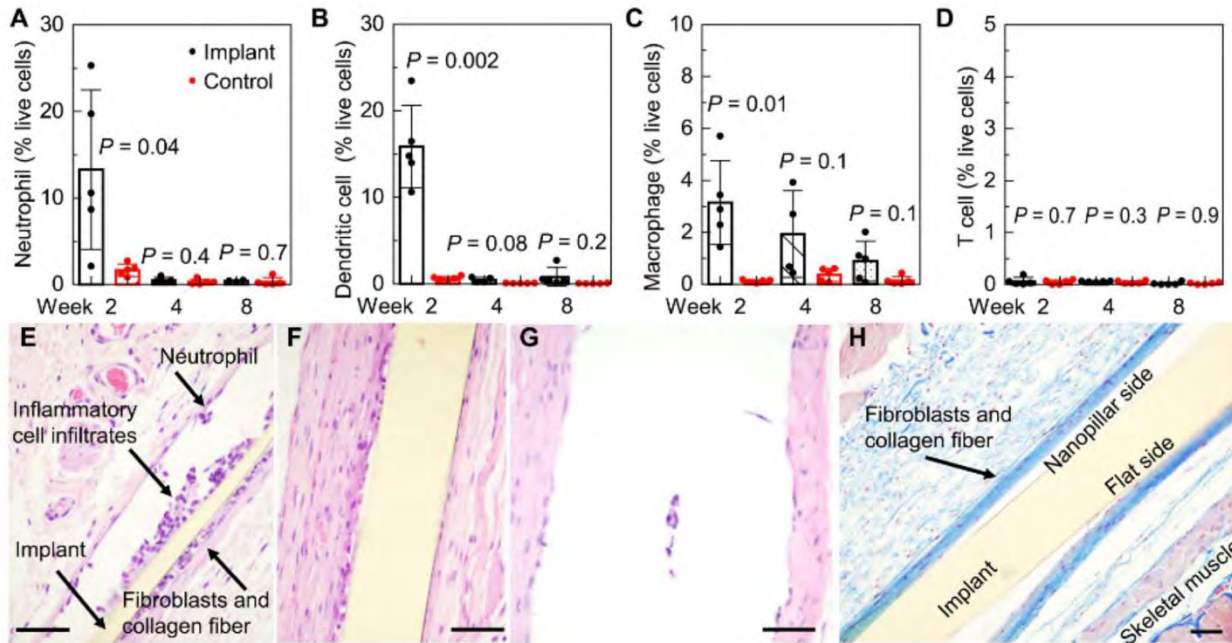
Yi Zhang¹, Jinsong Cui¹, Kuan-Yu Chen¹, Shanny Hsuan Kuo², Jaishree Sharma², Rimsha Bhatta¹, Zheng Liu³, Austin Ellis-Mohr¹, Fufei An¹, Jiahui Li¹, Qian Chen¹, Kari D. Foss^{4,5}, Hua Wang¹, Yumeng Li³, Annette M. McCoy^{4,5}, Gee W. Lau², Qing Cao^{1,6,7,8,9*}

The prevalence of orthopedic implants is increasing with an aging population. These patients are vulnerable to risks from periprosthetic infections and instrument failures. Here, we present a dual-functional smart polymer foil coating compatible with commercial orthopedic implants to address both septic and aseptic failures. Its outer surface features optimum bioinspired mechano-bactericidal nanostructures, capable of killing a wide spectrum of attached pathogens through a physical process to reduce the risk of bacterial infection, without directly releasing any chemicals or harming mammalian cells. On its inner surface in contact with the implant, an array of strain gauges with multiplexing transistors, built on single-crystalline silicon nanomembranes, is incorporated to map the strain experienced by the implant with high sensitivity and spatial resolution, providing information about bone-implant biomechanics for early diagnosis to minimize the probability of catastrophic instrument failures. Their multimodal functionalities, performance, biocompatibility, and stability are authenticated in sheep posterolateral fusion model and rodent implant infection model.

Bridging Disciplines to Advance Translational Research

Materials Science & Engineering • Veterinary Surgery • Microbiology • Veterinary Pathology

Copyright © 2023 The Authors, some rights reserved; exclusive licensee American Association for the Advancement of Science. No claim to original U.S. Government Works. Distributed under a Creative Commons Attribution License 4.0 (CC BY).



Diagnostic Pathology Presentation and Publication

Synchronous Medullary Thyroid Carcinoma and Parathyroid Carcinoma in a Beagle Dog

Shanny Hsuan Kuo, Chian-Ren Jeng, Victor Fei Pang, Hui-Wen Chang*

Institute of Molecular and Comparative Pathobiology, School of Veterinary Medicine, National Taiwan University

*Correspondent Authors: shannykuo@gmail.com

ACVP
AMERICAN COLLEGE OF
VETERINARY PATHOLOGISTS



Uterine Adenocarcinoma with Lung Metastasis in a Formosan Sika Deer (*Cervus nippon taiouanus*): a Case Report

Shanny Hsuan Kuo, Chi-Fei Kao, Yen-Hsueh Lai, Jun-Cheng Guo, Hui-Wen Chang, Chian-Ren Jeng, Victor Fei Pang*

Institute of Molecular and Comparative Pathobiology, School of Veterinary Medicine, National Taiwan University

*Correspondent Authors: pang@ntu.edu.tw

Introduction

Results

Discussion

Taiwan Veterinary Journal | Vol. 46, No. 02n03, pp. 111-122 (2020) | Case Study

DETECTION OF SPIKE-SPECIFIC MUTATIONS IN SEROTYPE I FELINE CORONAVIRUSES IN FORMALIN-FIXED AND PARAFFIN-EMBEDDED TISSUE

Shanny Hsuan Kuo, Yen-Chen Chang, Hui-Wen Chang✉, and Wei-Hsiang Huang✉

Vol. 126: 167–172, 2017
https://doi.org/10.3354/dao03166

DISEASES OF AQUATIC ORGANISMS
Dis Aquat Org

Published October 18

NOTE

Locally extensive meningoencephalitis caused by *Miamiensis avidus* (syn. *Philasterides dicentrarchi*) in a zebra shark

Wen-Ta Li¹, Chieh Lo², Chen-Yi Su², Hsuan Kuo¹, Susanne Je-Han Lin¹,
Hui-Wei Chang¹, Victor Fei Pang¹, Chian-Ren Jeng^{1,*}

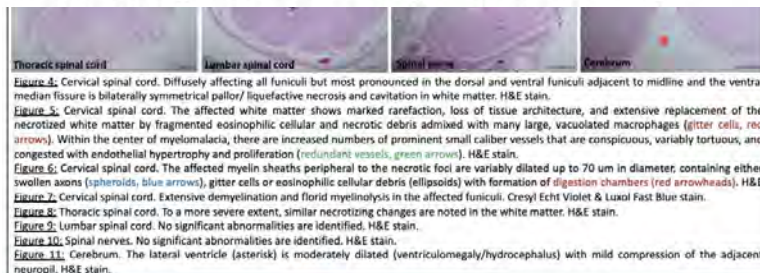


Figure 4: Cervical spinal cord. Diffusely affecting all funiculi but most pronounced in the dorsal and ventral funiculi adjacent to midline and the ventral median fissure is bilaterally symmetrical pallor/liquefactive necrosis and cavitation in white matter. H&E stain.
Figure 5: Cervical spinal cord. The affected white matter shows marked rarefaction, loss of tissue architecture, and extensive replacement of the necrotized white matter by fragmented eosinophilic cellular and necrotic debris admixed with many large, vacuolated macrophages (gitter cells, red arrows). Within the center of myelomalacia, there are increased numbers of prominent small caliber vessels that are conspicuous, variably tortuous, and congested with endothelial hypertrophy and proliferation (redundant vessels, green arrow). H&E stain.
Figure 6: Cervical spinal cord. The affected myelin sheaths peripheral to the necrotic foci are variably dilated up to 70 µm in diameter, containing either swollen axons (spheroids, blue arrows), gitter cells or eosinophilic cellular debris (ellipsoids) with formation of digestion chambers (red arrowheads). H&E.
Figure 7: Cervical spinal cord. Extensive demyelination and florid myelinolysis in the affected funiculi. Cresyl Echt Violet & Luxol Fast Blue Stain.
Figure 8: Thoracic spinal cord. To a more severe extent, similar necrotizing changes are noted in the white matter. H&E stain.
Figure 9: Lumbar spinal cord. No significant abnormalities are identified. H&E stain.
Figure 10: Spinal nerves. No significant abnormalities are identified. H&E stain.
Figure 11: Cerebrum. The lateral ventricle (asterisk) is moderately dilated (ventriculomegaly/hydrocephalus) with mild compression of the adjacent neuropil. H&E stain.

References

1. Auerell DR and Benson RT. 1977. Inherited necrotic lesions of the central nervous system in the zebra shark, *Stegostoma fasciatum*. J Neuropathol Exp Neurol 36(4): 733-744.
2. Bailey DB and Page RL. 2001. The Nervous System. Domestic Animals, Jubb KP, Kennedy PC, Palmer L, editors. Elsevier: 340-342.
3. Clemmens RM. 1982. Degenerative myelopathy. In: Small Anim Pract. 22(4): 965-973.
4. Cummings JR and Lohrman A de. 1978. Hereditary myelomalacia, a myelinolytic disease. Acta Neuro 181.
5. Jones BK and Richards RB. 1977. Myelomalacia in the zebra shark, *Stegostoma fasciatum*. J Neuropathol Exp Neurol 36(4): 733-744.
6. Kania B and Zee P. 2012. Hereditary myelomalacia. Vet Med Soc 121(1): 2369-2394.

Infection with either of two very different groups of viruses, the DNA-containing herpesviruses and RNA-containing retroviruses. In the literature, Herpesvirus saimiri (HVS), Herpesvirus atles (HVA), Epstein-Barr virus (EBV), Simian T-cell leukemia/lymphoma virus (STLV), and Simian foamy virus have been reported as the possible etiologies of transmissible lymphomas. These viruses have ability to cross species barriers with possible interspecies transmission and zoonotic potential.

Since 2012, there have been five necropsy cases of T cell lymphomas/leukemias identified in four fat-tailed dwarf lemurs (*Cheirogaleus medius*) and a pygmy slow loris (*Nycticebus pygmaeus*) in Taipei Zoo. The purpose of this article is to reveal insight into the possible oncogenic viruses in non-human primates (NHPs).

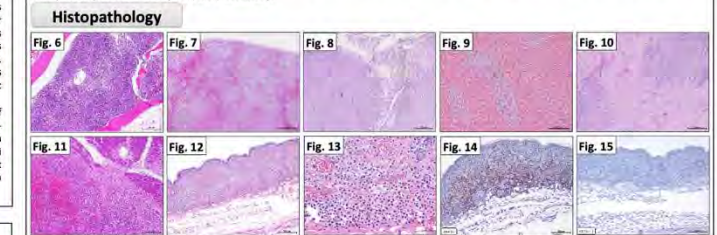
Materials and methods:

During 2012-2015, five NHPs of two distinct species in Taipei Zoo died sequentially. Age ranged from 10-17 years. Three of them presented severe alopecia whereas the remaining two animals were clinically normal. Necropsy was performed and tissues were processed for histopathology and immunohistochemistry. DNA retrieved from formalin fixed, paraffin embedded tissues (FFPE) was also subjected to further polymerase chain reaction (PCR) to screen for simlirine herpesvirus and simian retrovirus.

DIAGNOSIS AND TREATMENTS OF FELINE INFECTIOUS PERITONITIS: AN UPDATE

Chia-Yu Chang^{*,†}, Shanny Hsuan Kuo^{*,†}, Yun-Wen Peng^{*},
Chia-Hung Lin^{*}, Yuen-Kwan Lee^{*}, Yu-Chun Chen^{*}
and Hui-Wen Chang^{*,†,‡}

Figures 4-5: There was generalized lymphadenopathy (especially the mesenteric lymph nodes), hepatomegaly, and splenomegaly with presence of multiple white parenchymal nodules in spleen, liver, and kidney.



Figures 6-12: Histopathologically, lymphoid neoplasms were observed in all of the animals with a various degree of organ involvement. The neoplastic cells widely affected hematopoietic and lymphoid tissues, liver, kidney, gastrointestinal tract, pancreas, lungs, and skin.
Figure 13: Dense sheets of a monotonous population of small to medium-sized lymphoid cells with variable structural effacement of the affected organs further characterize the neoplastic growth.
Figures 14-15: These neoplastic cells were intensively labeled for CD3 and negative for CD79a, compatible with a T-cell origin.

Case	Species	Pathological Findings	Pathogenesis	CD3	CD79a
Case 1 (NYC012-1001)	18 y/o M	Diffuse T-cell lymphoma (neoplastic lymphocytes, atypical cells, and nodules)	CD3(+) and CD79a(-)	+	-
Case 2 (NYC012-1004)	22 y/o F	Diffuse T-cell lymphoma (neoplastic lymphocytes, atypical cells, and nodules)	CD3(+) and CD79a(-)	+	-
Case 3 (NYC012-1007)	27 y/o F	Diffuse T-cell lymphoma (neoplastic lymphocytes, atypical cells, and nodules)	CD3(+) and CD79a(-)	+	-
Case 4 (NYC012-1001)	12 y/o M	T-cell lymphoblastic leukemia, bone marrow	CD3(+) and CD79a(-)	+	-
Case 5 (NYC012-1019)	10 y/o M	T-cell lymphoblastic leukemia, bone marrow	CD3(+) and CD79a(-)	+	-

Rhadinovirus, also known as gamma-2 herpesviruses, is a genus of viruses that include human herpesvirus, Herpesvirus saimiri, Herpesvirus atles, and rhesus rhadinovirus. Herpesvirus saimiri (HVS, Saimirine herpesvirus 2), for instance, is a latent virus of squirrel monkeys. Most squirrel monkeys are infected with HVS early in life and remain constantly infected for their lifetime without the development of any overt disease. Although infections of squirrel monkeys with HVS are asymptomatic, the virus can cause fatal T cell lymphomas in several New and Old World primates like tamarins (*Saguinus* spp.), common marmosets (*Callithrix jacchus*) or owl monkeys (*Aotus* spp.). Besides, limited serologic data and infection of some human cell lines in vitro with transformation suggest the potential of zoonosis with unknown degree of hazard that should be aware of, especially for those with constant exposure and intimate contact to the captive non-human primates.

Literature cited

1. Estep JD, et al. Simian herpesviruses and their risk to humans. Vaccine 28: 78-84, 2010.
2. Fikselander K, et al. Herpesvirus saimiri. Philos. Trans. R. Soc. Lond., B, Biol. Sci. 355(1408): 545-562, 2001.
3. Lerner N.W. et al. Common Viral Infections of Laboratory Primates. In "The Laboratory Primate". Sinauer Associates, Inc., Sunderland, MA: 78-79, 2005.
4. Renwick A.K. et al. Neoplasia in primates: case series from a captive primate population and literature review. Vet. Pathol. 46: 162-172, 2009.
5. Voovala A. et al. Interspecies transmission of Macaque Simian T-cell leukemia/lymphoma virus type 1 in baboons resulted in an outbreak of malignant lymphoma. J. Virol. 70(3): 1842-1850, 1996.

The Many Hats of a Pathologist in Academia: Advancing Science and Beyond

- Research Hat
- Pathology Hat
- **Teaching & Mentorship Hat**
- Core Leadership & Collaboration Hat



W



Teaching and Mentorship

- **Anatomic Pathology Resident:** National Taiwan University, Taipei, Taiwan, 2014 to 2017.
 - **Necropsy clinical rotation:** 6 semesters
 - 5th year DVM students, visiting externs
 - **General and Systemic Pathology TA:** 6 semesters
- **Veterinary Anatomic Pathologist and Veterinary Medical Officer:** Animal Disease Diagnostic Center, National Pingtung University of Science and Technology, Pingtung, Taiwan 2017 to 2021. (Unpaid leave for PhD study from 2019 to 2021)
 - Teaching in **DVM clinical necropsy rotation**
 - 2nd to 5th year DVM students, pathology & poultry medicine residents, visiting externs
 - Mentorship: junior pathologists, pathology residents, histology technicians
- **Anatomic Pathology Resident :** University of Illinois at Urbana-Champaign, Illinois, USA, 2021 to 2024.
 - **Necropsy clinical rotation** (VM 692 Diagnostic Rotation): 6 semesters
 - 1st year, 2nd year, 4th year DVM students, Parkland students (vet tech), visiting externs
 - Leading resident Wednesday Mysterious Slide rounds
- **Graduate Research Assistant/ PhD candidate:** University of Illinois at Urbana-Champaign, Illinois, USA, 2019 to 2024.
 - **Microbiology TA** (VM607 Bacteriology): 2 semesters
 - Training and mentorship of lab personnel
 - Undergrade research assistant/intern, junior PhD students
 - Research project, techniques (cell culture, WB, IHC/IF, mouse necropsy, confocal microscopy), result analysis



Teaching and Mentorship

- **Instructor & course coordinator:** Department of Comparative Medicine, School of Medicine University of Washington, WA, USA, 2024 to present.
 - CMED 514 (Pathology Seminar: General Pathology, Systemic Pathology, Species Pathology)
 - CMED 512 (Pathology Rotation)
 - Weekly Pathology Round
 - Guest lecturer for UW School of Dentistry: DETNFN 502 Basic Histology Overview



[Home](#) / [Academic Programs](#) / Residency

Residency

The University of Washington Laboratory Animal Medicine Training Program is designed for graduate veterinarians and consists of three years of instruction and training. The program is designed to prepare veterinarians for careers in laboratory animal medicine, and is a combination of clinical training and research.

Trainees may complete advanced degrees, either [Master of Science in Comparative Medicine](#) and/or a Ph.D. (the latter taking 5-7 years to complete) in a variety of basic sciences. Additionally, resources are available to aid trainees in their pursuit of certification by the [American College of Laboratory Animal Medicine](#) and/or [American College of Veterinary Pathologists](#).

The primary goals of the program are to teach the knowledge, methodological skills, and scholarly work habits that will enable trainees to conduct research; confidently and competently work clinically with laboratory animals; and to advance knowledge in biology and medicine.

[Clinical duties](#), pathology responsibilities, and [research](#) completion are intermingled throughout the duration of the three-year program. Additional rotations include instruction in the areas of the IACUC, rodent health monitoring, environmental enrichment, biosafety and facilities. Residents also attend two weekly one-hour seminars that cover a variety of laboratory animal medicine, pathology, and experimental research topics as well as comparative pathology rounds.

The trainee is expected to complete and publish a first-author biomedical research project as part of the training program. The trainee will learn methodological skills and work habits that are needed for a successful career in biomedical research. This is accomplished through the mentor relationship with an established scientist and full participation in a research project. At the start of the program, the trainee will be encouraged, and assisted with, identifying a research mentor in their area of interest to complete their research training. Specific objectives of this portion of the program include the instruction of trainees in the principles of experimental design, statistics, data collection, grant writing, the preparation of manuscripts, and the ethical principles of research, including animal experimentation and the humane care and use of laboratory animals.

[Courses](#) cover laboratory animal biology and pathology, techniques and methods for use of animals, current uses of induced and naturally-occurring animal models, diseases and care of laboratory animals, gnotobiotics, facility design, regulations governing laboratory animal medicine, and discussions of the ethical questions surrounding animal use.

Yi-Fan Shen, 1st year resident



Yi-Fan Shen is originally from Taipei, Taiwan. He earned a B.S. in Microbiology and a B.A. in Business from the University of Rochester in 2020. After graduation, he completed his military service and spent a year working at a molecular diagnostics company in Taiwan.

Yi-Fan received his Doctor of Veterinary Medicine (DVM) degree from The Ohio State University in 2025. During his training, he completed research projects spanning swine epidemiology, canine oncology, non-human primate behavior, and vampire bat husbandry. Following graduation, he joined the Laboratory Animal Medicine program at the University of Washington. His professional interests include oncology, advancement of the 3Rs, and large animal surgery, anesthesia, and analgesia. His current research in the Duran-Struuck Lab focuses on the engineering and cross-species application of chimeric antigen receptors.

Outside of work, Yi-Fan enjoys playing tennis and golf, running and participating in races, working out, traveling, and playing video games.

Dan Swanson, 2nd year resident



and reading.

Dr. Swanson is originally from Boston, Massachusetts. He attended Bunker Hill Community College before transferring to UMass Boston, where he received his B.S. in Biology in 2019. He earned his DVM in 2024 from Western University of Health Sciences College of Veterinary Medicine. Dr. Swanson's professional interests include neurology, pharmacology, and molecular physiology. His current research at the University of Washington focuses on comorbidities in rodent models of epilepsy.

Outside of his residency, Dr. Swanson enjoys snowboarding, watching baseball, and exploring different cultures through travel

Jianing Xu, 3rd year resident



Jianing Xu is from Hangzhou, a historic and scenic city in eastern China. She earned her Animal Science degree from UC Davis in 2018 and her Doctor of Veterinary Medicine degree (VMD) from the University of Pennsylvania in 2023. Before vet school, she worked as a bioinformatician at a genetics company, where she developed expertise in computational biology and genomics. Her combined background in veterinary medicine and bioinformatics drives her interest in using genetic and computational tools to study disease mechanisms in both animals and humans. As a

future laboratory animal veterinarian, she hopes to integrate her expertise in comparative medicine, genetics, and computational biology to advance translational research.

Beyond her work, Jianing enjoys outdoor adventures such as climbing, mountaineering, paddleboarding, and backpacking. She also has a passion for growing plants and caring for animals. She adopted two Long-Evans rats, Naruto and Sasuke, and a Syrian hamster, Pumpkin, from the University of Washington at beginning of her residency. They now happily share their home with her beloved cats, Shan-shan and Foo-Foo.

Rachel Moore, 3rd year resident



Rachel Moore is originally from Cranston, Rhode Island and received her B.S. in Biomedical Science from the University of New Hampshire in 2018. She then worked for a year at a contract research organization in the Boston area primarily focused on cardiac medical devices. Rachel earned her Doctor of Veterinary Medicine degree from the University of Prince Edward Island in 2023. Her clinical interests include anesthesia and analgesia for laboratory animals, the refinement of surgical procedures and techniques, and the advancement of environmental enrichment and animal

welfare across species. Her current research project in the Mathieu laboratory investigates novel tooth enamel regenerative therapies using human induced pluripotent stem cells. In her free time, Rachel enjoys hiking, running, woodworking, exploring Seattle's food scene, reading, traveling to new places, and spending time with her Siamese cat, Kiwi.

HINDLIMB PARESIS IN A R672C SPRAGUE DAWLEY RAT DUE TO A RARE MYELOID LEUKEMIA

Rachel Moore, Nick Reyes, Heather Sheppard, Shanny Kuo, Jessica Snyder

1. Department of Comparative Medicine, University of Washington, Seattle, WA 2. Department of Pathology, St. Jude Children's Research Hospital



CLINICAL BACKGROUND/PRESENTATION

GROSS NECROPSY FINDINGS: FIGURE 1

HISTOPATHOLOGY AND IMMUNOHISTOCHEMISTRY DIAGNOSIS

Figure 1: Bilaterally the

SPONTANEOUS RHABDOMYOSARCOMAS IN *DMD^{mdx}* RATS

Rachel Moore¹, Siwei Luo², Caroline Le Guiner¹, Aude Lafoux^{3,4}, Corinne Huchet^{3,4}, Olivia Terceve⁵, David Mack², Shanny Kuo¹, Heather Sheppard⁵, Thibaut Larcher⁶, Jessica M. Snyder¹

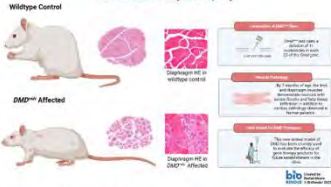
1. Department of Comparative Medicine, University of Washington, Seattle, WA 2. Department of Rehabilitation Medicine, School of Medicine, University of Washington, Seattle, WA 3. Nantes Université, CHU de Nantes, INSERM UMR 1089, Translational Gene Therapy Laboratory (TaGeT), Nantes, France 4. Therassay Platform, Capacités, Nantes Université, Nantes, France 5. INRAE, PAnTher, APEX, Oniris VeAgroBio, Nantes, France 6. Department of Pathology, St. Jude Children's Research Center, Memphis, TN



DUCHENNE MUSCULAR DYSTROPHY

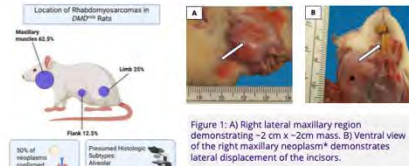
- Most severe and common form of inherited muscular dystrophy, caused by mutations in the DMD gene, the largest gene in the human genome (79 exons).
- Leads to absence or deficiency of dystrophin, a key structural protein in skeletal and cardiac muscle.
- Results in progressive muscle wasting, respiratory and cardiac failure, and premature death in patients.

The *DMD^{mdx}* Rat as a Model of Duchenne Muscular Dystrophy



CASE SERIES OVERVIEW

In this case series, we describe eight *Dmd^{mdx}* rats from 2 different institutions presenting between 6-17 months of age with rapidly growing masses localized predominantly to the muscles of mastication (n=5), but also on the limb (n=2) and the flank (n=1). The masses were diagnosed as rhabdomyosarcoma on the basis of desmin, myogenin and MyoD1 immunoreactivity.



MACROSCOPIC FINDINGS, HISTOLOGY, AND IMMUNOHISTOCHEMISTRY OF RHABDOMYOSARCOMAS AFFECTING *DMD^{mdx}* RATS

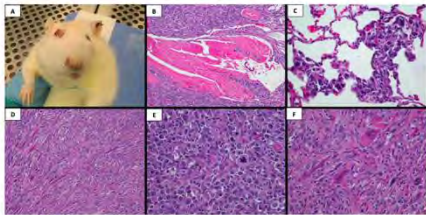


Figure 2: A. Suborbital maxillary neoplasm causing globe protrusion. B. Neoplastic cells infiltrate adjacent skeletal muscle. C. Pulmonary metastases, with polygonal to round cells expanding alveolar capillaries and the interstitium. D. Neoplastic cells with a spindle cell morphology arranged in streams, with interspersed multinucleated cells consistent with rhabdomyoblasts. E. Neoplastic cells with a round cell morphology arranged in sheets, with occasional bizarre mitoses. F. Higher magnification image of strap and tadpole-shaped rhabdomyoblasts.

REFERENCES

1. Larcher T, Lafoux A, Terceve O, et al. Characterization of dystrophin-deficient rats as a model for Duchenne muscular dystrophy. *PLoS One*. 2014;9(4):e91101.
2. Le Guiner C, Luo S, Larcher T, et al. Evaluation of an AAV microRNAi gene therapy candidate in an animal model of Duchenne muscular dystrophy. *Mol Ther*. 2016;24(10):2016-2024.
3. Larcher T, Lafoux A, Terceve O, et al. Rhabdomyosarcoma: updates on classification and the necessity of molecular testing beyond immunohistochemistry. *Hum Pathol*. 2016;51(1):1-11.
4. Larcher T, Lafoux A, Terceve O, et al. Rhabdomyosarcoma: updates on classification and the necessity of molecular testing beyond immunohistochemistry. *Hum Pathol*. 2016;51(1):1-11.

ACKNOWLEDGEMENTS

We would like to acknowledge the histology and imaging Core at the University of Washington for preparation of HE slides. We acknowledge Emily Spaulding, LVT, for her dedication to the veterinary care of these animals at the University of Washington.

Yi-Fan Shen, 1st year resident



Yi-Fan Shen is originally from Taipei, Taiwan. He earned a B.S. in Microbiology and a B.A. in Business from the University of Rochester in 2020. After graduation, he completed his military service and spent a year working at a molecular diagnostics company in Taiwan.

Yi-Fan received his Doctor of Veterinary Medicine (DVM) degree from The Ohio State University in 2025. During his training, he completed research projects spanning swine epidemiology, canine oncology, non-human primate behavior, and vampire bat husbandry. Following graduation, he joined the Laboratory Animal Medicine program at the University of Washington. His professional interests include oncology, advancement of the 3Rs, and large animal surgery, anesthesia, and analgesia. His current research in the Duran-Struick Lab focuses on the engineering and cross-species application of chimeric antigen receptors.

Outside of work, Yi-Fan enjoys playing tennis and golf, running and participating in races, working out, traveling, and playing video games.

Dan Swanson, 2nd year resident



Dr. Swanson is originally from Boston, Massachusetts. He attended Bunker Hill Community College before transferring to UMass Boston, where he received his B.S. in Biology in 2019. He earned his DVM in 2024 from Western University of Health Sciences College of Veterinary Medicine. Dr. Swanson's professional interests include neurology, pharmacology, and molecular physiology. His current research at the University of Washington focuses on comorbidities in rodent models of epilepsy.

Outside of his residency, Dr. Swanson enjoys snowboarding,

Jianing Xu, 3rd year resident



Jianing Xu is from Hangzhou, a historic and scenic city in eastern China. She earned her Animal Science degree from UC Davis in 2018 and her Doctor of Veterinary Medicine degree (VMD) from the University of Pennsylvania in 2023. Before vet school, she worked as a bioinformatician at a genetics company, where she developed expertise in computational biology and genomics. Her combined background in veterinary medicine and bioinformatics drives her interest in using genetic and computational tools to study disease mechanisms in both animals and humans. As a future laboratory animal veterinarian, she hopes to integrate her expertise in comparative medicine, genetics, and computational biology to advance translational research.

Beyond her work, Jianing enjoys outdoor adventures such as climbing, mountaineering, paddleboarding, and backpacking. She also has a passion for growing plants and caring for animals. She adopted two Long-Evans rats, Naruto and Sasuke, and a Syrian hamster, Pumpkin, from the University of Washington at beginning of her residency. They now happily share their home with her beloved cats, Shan-shan and Foo-Foo.

Rachel Moore, 3rd year resident



Rachel Moore is originally from Cranston, Rhode Island and received her B.S. in Biomedical Science from the University of New Hampshire in 2018. She then worked for a year at a contract research organization in the Boston area primarily focused on cardiac medical devices. Rachel earned her Doctor of Veterinary Medicine degree from the University of Prince Edward Island in 2023. Her clinical interests include anesthesia and analgesia for laboratory animals, the refinement of surgical procedures and techniques, and the advancement of environmental enrichment and animal welfare across species. Her current research project in the Mathieu laboratory investigates novel tooth enamel regenerative therapies using human induced pluripotent stem cells. In her free time, Rachel enjoys hiking, running, woodworking, studying, Seattle's food scene, reading,

AALAS National Meeting 2025

Date: November 9 – 13, 2025

Location: Long Beach, CA

Booth: #1212



AMERICAN ASSOCIATION FOR LABORATORY ANIMAL SCIENCE

UW Medicine
UNIVERSITY of WASHINGTON



manuscripts, and the ethical principles of research, including animal experimentation and the humane care and use of laboratory animals.

[Courses](#) cover laboratory animal biology and pathology, techniques and methods for use of animals, current uses of induced and naturally-occurring animal models, diseases and care of laboratory animals, gnotobiotics, facility design, regulations governing laboratory animal medicine, and discussions of the ethical questions surrounding animal use.

The Many Hats of a Pathologist in Academia: Advancing Science and Beyond

- Research Hat
- Pathology Hat
- Teaching & Mentorship Hat
- **Core Leadership & Collaboration Hat**



W



Core Leadership & Collaboration



-  **Comparative Pathology Consultation**
 - Access to experienced **comparative pathologists** through the CPP
 - Research consultation, study design, pathology interpretation, and collaboration
-  **Histology & Immunohistochemistry**
 - Routine and specialized tissue processing, embedding, sectioning, and staining
 - **IHC, ISH, and multiplex fluorescence** assays
 - Automated Leica Bond RX enables **high-throughput, standardized, and reproducible** IHC staining
-  **Fluorescent & Digital Microscopy**
 - EVOS M5000 for **multicolor fluorescence imaging**
 - Hamamatsu NanoZoomer for **high-throughput whole-slide scanning**
 - Digital slide access for review, annotation, and collaboration
-  **Quantitative Image Analysis**
 - **Visiopharm**-based **digital pathology and quantitative analysis**
 - Manual and AI-assisted image analysis
 - Customized datasets for **objective, data-driven tissue assessment**



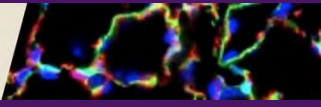
- **Integrates comparative pathology, basic science, and systems biology**
- **Advances and validates animal models** for improved translation to human disease
- **Research**
 - Comparative pathology + basic science + systems biology
 - Development and translation of animal models for human disease
- **Expertise**
 - Molecular disease pathogenesis
 - Comparative pathobiology
 - Laboratory animal pathology
- **Programs**
 - Comparative Neuropathology
 - Comparative Pathology of Aging
- **Education & Mentorship**
 - ACLAM residency pathology rotations
 - Pathology rounds & courses
 - Training of residents, graduate students, researchers, technical staff



Diabetes Research Center

UNIVERSITY of WASHINGTON

Associate Director



Hat #1 — The Veterinarian
Hat #2 — The Pathologist
Hat #3 — The Scientist
Hat #4 — The Educator
Hat #5 — The Collaborator
Hat #6 — The Core Director
Hat #7 — The Academic Leader

© CHUCK INGERSSEN, captainscratchy.com

Follow me on Instagram: @captainscratchy

- **Beyond the Microscope: The Many Roles of an Academic Pathologist**
 - Veterinarian
 - Diagnostic pathologist
 - Research pathologist & Comparative pathologist in biomedical research
 - Researcher (microbiologist & respiratory scientist)
 - Educator/Mentor
 - Core director
 - Collaborator and grant writer/ scientific communicator (Center for Lung Biology, Diabetes Research Center, Seattle Children's Hospital, Fred Hutchinson Cancer Center, Allen Institute, biotech, etc.)
- **Future Vision: Where Can Pathology Take Me Next?**
 - **Integrating** pathology, research, education, and collaboration
 - **Developing** comparative and translational research programs
 - **Establishing** a large-animal translational research center within DCM
 - **Expanding** comparative and translational pathology
 - **Mentoring** the next generation of laboratory animal veterinarians and scientists
- **My vision as a comparative pathologist: using pathology as a bridge between basic science and meaningful biomedical discoveries (“bench to bedside”)**



Key Takeaways

- Choose the veterinary pathology residency route that best fits you
- Have a Plan A, B, C, D... and stay flexible
 - Plan A in 2018: Residency in Anatomic Pathology
 - Plan B: PhD program at UIUC
 - Plan C: Government Fellowship for Studying Abroad
 - Plan D: Taiwan Key Field Fellowship
- Make the most of available resources—apply for scholarships, grants, and poster/travel awards to strengthen your CV
- Keep trying—and don't give up easily (**Daniel Morton & Laura Dill Morton Scholarship Award**)
- **Help others whenever you can**



Thank you!



*"Well, it's finally happened,
they put me in the corner!"*



W