

TANJA SERENA ZABKA, DVM, DIPLOMATE ACVP

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EMPLOYMENT

- Veterinary Pathologist** October 2011-Present
Genentech Inc., South San Francisco, CA
Supervisor: Reina Fuji
- GLP regulatory and investigative toxicological pathology (dog, monkey, rodent)
 - Co-chair of Vascular Injury Working Group of Predictive Safety Testing Consortium
 - Member Skeletal Muscle Working Group of Predictive Safety Testing Consortium
- Global Safety Biomarker Lead** May 2010 – October 2011
Veterinary Pathologist March 2009 – October 2011
Roche Pharmaceuticals, Nutley, NJ
Supervisor: Dr. Marielle Odin
- Developed and maintain global strategy for safety biomarker development and use in NCS toxicology studies and integration with the discovery and clinical biomarker strategies
 - Co-Supervisor of NCS Clinical Pathology Safety Biomarker Laboratory
 - GLP regulatory, investigative and research toxicological pathology (dog, monkey, rodent)
 - Received distinguished acknowledgement as “High Potential”
- Veterinary Pathologist** April 2007 – March 2009
Supervisor Necropsy/Histology Laboratory October 2007 – March 2009
Roche Pharmaceuticals, Palo Alto, CA
Supervisor: Dr. Mudher Albassam
- Manage histology and necropsy staff and operations
 - GLP regulatory, investigative, and research toxicological pathology (dog, monkey, rodent)
- Veterinary Pathologist** September 2005 - April 2007
Wildlife Health Center, University California, Davis, CA
Supervisors: Drs. Jonna A.K. Mazet, Frances M. D. Gulland, David A. Jessup
- Provide diagnostic and research pathology service for The Marine Mammal Center, Sausalito, CA and Marine Wildlife Veterinary Care and Research Center, Santa Cruz, CA
 - Provide pathology consultation and response for the U.S. Department of Commerce, National Oceanographic and Atmospheric Administration, National Marine Fisheries Service
 - Design and implement educational tools and instructional forums for veterinary and graduate students, clinical veterinarians, technicians, biologists, and field personnel
- ## EDUCATION
- The Zoological Society of San Diego**, Veterinary Pathology Service, San Diego, CA 2004-2005
- Anatomic Pathology Resident III, Zoo and Wildlife Position
- University of California at Davis**, Veterinary Pathology Service, Davis, CA 2002-2004
- Anatomic Pathology Resident I & II, Zoo and Wildlife Position
 - Ancillary Pathology Service for Fish & Invertebrates, Office of Animal Care, U.C. Berkeley
- Veterinary Specialty Hospital**, Rancho Santa Fe, CA 2002
- Small Animal Medicine and Surgery Intern and Emergency Veterinarian
- University of Georgia, College of Veterinary Medicine**, Athens, GA 2001
- Doctor of Veterinary Medicine
 - Cum Laude; Phi Zeta Honors Society
 - Specialty courses: Fish medicine, Exotic animal medicine, Pathology
- Princeton University**, Princeton, NJ 1996
- BA with Honors in Ecology and Evolutionary Biology
 - Published thesis: Female mate choice in the black molly (*Poecilia sphenops*) and its implications in the Poeciliini tribe
 - *Sigma Xi*, The Scientific Research Society, Elected Member 1996
- James Cook University**, Townsville, Queensland, Australia 1995 Fall Term
- Specialized study in marine zoology and conservation

PUBLICATIONS

- Misner DL, Kauss MA, Singh JT, Uppal H, Bruening-Wright A, Liederer BM, Lin T, McCray B, LaN, Nguyen T, Sampath D, Dragovich PS, O'Brien T, **Zabka TS**. 2015. Cardiotoxicity associated with nicotinamide phosphoribosyltransferase inhibitors in rodents and in rat and human-derived cells lines. *British J Pharmacology*: in press
- Sampath D, O'Brien T, **Zabka TS**, Misner DL, Dragovich PS. 2015. Inhibition of Nicotinamide Phosphoribosyltransferase (NAMPT) as a Therapeutic Strategy in Cancer. *Pharmacology and Therapeutics*: on-line.
- Frazier KS, Engelhardt J, Fant P, Guionaud S, Henry SP, Leach M, Louden C, Scicchitano MS, Weaver JI and **Zabka TS**. 2015. Drug-Induced Vascular Injury associated with non-small molecule therapeutics in preclinical development: Part I. *Biotherapeutics*. *Tox Path*: in-press.
- Engelhardt J, Fant P, Guionaud S, Henry SP, Leach M, Louden C, Scicchitano MS, Weaver JL, **Zabka TS**, and Frazier KS. 2015. Drug-Induced Vascular Injury associated with non-small molecule therapeutics in preclinical development: Part 2. Antisense oligonucleotides. *Tox Path*: in-press.
- Zabka TS**, Singh JT, Dhawan P, Liederer BM, Oeh J, Kauss MA, Xiao Y, Zak M, Lin T, McCray B, La N, Beyer J, Farman C, Uppal H, Dragovich PS, O'Brien T, Sampath D, and Misner DL. 2014. Retinal toxicity, in vivo and in vitro, associated with inhibition of nicotinamide phosphoribosyltransferase. *Tox Sci*: in press
- Mikaelian I, Cameron M, Dalmas D, Enerson B, Gonzalez R, Guionaud S, Hoffman P, King N, Lawton M, Scicchitano M, Smith H, Thomas R, Weaver J, **Zabka TS**. 2014. Nonclinical Safety Biomarkers of Drug-Induced Vascular Injury: Current Status and Blueprint for the Future. *Tox Path* 42: 635-657.
- Garrido R, **Zabka TS**, Tao J, Fielden MR, Fretland A, Albassam M. 2013. Quantitative histologic assessment of xenobiotic-induced liver enzyme induction and pituitary-thyroid axis stimulation in rats using whole slide automated image analysis. *Journal of Histochemistry and Cytochemistry* 61: 362-371.
- Morgan SJ, Berens, SJ, Elangbam CS, Janovitz E, Vitsky A, **Zabka TS**. 2013. Use of Animal Models of Human Disease for Non-Clinical Safety Assessment of Novel Pharmaceuticals. *Toxicologic Pathology* 41(3):508-18.
- Dunn ME, Coluccio D, **Zabka TS**, Gopalakrishnan G, Hirkaler G, Geng W, Nicklaus R, Lipshultz S, Doessegger L, Saladino B, Singer T, Mikaelian I. 2012. Myocardial Mononuclear Cell Infiltrates Are Not Associated with Increased Serum Cardiac Troponin I in Cynomolgus Monkeys. *Toxicologic Pathology* 40(4): 647-650.
- Burkhardt JE, Pandher K, Solter PF, Troth SP, Boyce RW, **Zabka TS**, Ennulat D. 2011. Recommendations for Pathology Data Review in Non Clinical Safety Biomarker Qualification Studies. *Toxicologic Pathology* 39: 1129-1137.
- Zabka TS**, Fielden MR, Garrido R, Tao J, Fretland A, Fretland J, Albassam M, Singer T, Kolaja K. 2011. Characterization of xenobiotic-induced hepatocellular enzyme induction in rats: anticipated thyroid effects and unique pituitary gland findings. *Toxicologic Pathology* 39(4):664-677.
- Olaharski AJ, Bitter H, Gonzaludo N, Kondru R, Goldstein D, **Zabka TS**, Lin H, Kolaja K. 2010. A model using kinase structural motifs and the inhibition profiles of small molecular kinase inhibitors to predict bone marrow toxicity and structural solutions. *Toxicological Sciences* 118(1) 266-275.
- Burkhardt JE, Ennulat D, Pandher K, Solte PF, Troth SP, Waite Boyce R, **Zabka TS**. 2010. Topic of histopathology blinding in nonclinical safety biomarker qualification studies. *Toxicologic Pathology* 38:666-667.
- Gill S, Goldstein T, Situ D, **Zabka TS**, Gulland FMD, Mueller RW. 2010. Cloning and characterization of glutamate receptors in California sea lions (*Zalophus californianus*). *Marine Drugs* 8:1637-1649.
- Zabka TS**, Albassam M. 2009. Spontaneous cardiomyopathy in cynomolgus macaques (*Macaca fascicularis*). *Toxicologic Pathology* 37:814-818.
- Olaharski AJ, Goldstein DM, Uppal H, Cooper M, Platz S, Jin JK, **Zabka TS**, Kolaja K. 2009. In vitro to in vivo concordance of high throughput assay of bone marrow toxicity across a diverse set of drug candidates. *Toxicology Letters* 188(2): 98-103.
- Tzipory L, Vernau K, Sturges B, **Zabka TS**, Highland M, Petersen S, Wisner E, Moore P, Vernau W. 2009. Antemortem Diagnosis of Localized Central Nervous System Histiocytic Sarcoma in Two Dogs. *JVM* 23:369-374.
- Hill RJ, Dabbagh K, Phippard D, Li C, Suttman, R, Papp E, Song K, Chang K, Leaffer D, **Zabka TS**, Aud D, Dal Porto J, Manning AM, Peng SL, Wong BR, Goldstein DM. 2008. Pamapimod, A Novel p38 MAP Kinase Inhibitor: Preclinical Analysis of Efficacy and Selectivity. *Journal of Pharmacology and Experimental Therapeutics* 326(4).
- Zabka TS**, Goldstein T, Cross C, Mueller RW, Kreuder-Johnson C, Gill S, Gulland FMD. 2009. Characterization of a degenerative cardiomyopathy associated with domoic acid toxicity in California sea lions (*Zalophus californianus*). *Veterinary Pathology* 46:105-119.
- Goldstein T, **Zabka TS**, DeLong RL, Wheeler EA, King DP, Reid S, Ylitalo G, Bargu S, Silver M, Leighfield T, Van Dolah F, Gulland FMD. 2009. The role of domoic acid in abortion and premature parturition of California sea lions (*Zalophus californianus*) on the San Miguel Island rookery. *Journal of Wildlife Diseases* 45(1): 91-108.
- Ramsdell J, **Zabka TS**. 2008. *In Utero* Domoic Acid Toxicity: A Fetal Basis to Adult Disease in the California Sea Lion (*Zalophus californianus*). *Marine Drugs* 6: 262-290.
- Sarran D, Greig DJ, Rios CA, **Zabka TS**, Gulland FMD. 2008. Evaluation of Aqueous Humor as a Surrogate for Serum Biochemistry in California Sea Lions (*Zalophus californianus*). *Aquatic Mammals* 34: 157-165.
- Goldstein T, Mazet JAK, **Zabka TS**, Langlois G, Colegrove KM, Silver M, Bargu S, Van Dolah F, Leighfield T, Conrad

- PA, Barakos J, Williams DC, Dennison S, Haulena M, Gulland FMD. 2007. Novel symptomatology and changing epidemiology of domoic acid toxicosis in California sea lions (*Zalophus californianus*): an increasing risk to marine mammal health. *Proceedings of the Royal Society Biological Sciences* 275: 267-76.
- Singleton CL, Wack RF, **Zabka TS**, Kent MS, Larsen RS. 2007. Diagnosis and treatment of chronic T-lymphocytic leukemia in a spotted hyena (*Crocuta crocuta*). *Journal of Zoo and Wildlife Medicine* 38:488-91.
- Zabka TS**, Papendick RE, Benirschke K. 2006. Placental tumor from an East African bongo (*Eurycerus isaaci*) fetus. *Veterinary Pathology* 43(5): 785-789.
- Zabka TS**, Campbell F, Wilson DW. 2006. Pulmonary arteriopathy and idiopathic pulmonary arterial hypertension in six dogs. *Veterinary Pathology* 43(4): 510-522.
- Zabka TS**, Haulena M, Puschner B, Lowenstine LJ, Gulland FMD. 2006. Acute lead toxicosis in a Harbor seal (*Phoca vitulina vitulina*) consequent to ingestion of a lead fishing sinker. *Journal of Wildlife Diseases*, 42(3): 651-657.
- Zabka TS**, Nollens HH, Goldstein T. Diagnostic techniques in aquatic animal medicine. Living document on International Association for Aquatic Animal Medicine website (<http://www.iaaam.org>), May 2005
- Zabka TS**, Lavelly JA, Higgins RJ. 2004. Primary intra-axial leiomyosarcoma with obstructive hydrocephalus in a young dog. *Journal Comparative Pathology* 131(4):334-337
- De Cock HEV, Marks SL, Stacy B.A, **Zabka TS**, Burkitt J, Lu G, Steffen DJ, Duhamel GE 2004. Ileocolitis associated with *Anaerobiospirillum* in cats. *Journal of Clinical Microbiology* 42(6):2752-2758
- Zabka TS**, Romano TA. 2003. The distribution of MHC II (+) cells in skin of the Atlantic bottlenose dolphin (*Tursiops truncatus*): An initial investigation of dolphin dendritic cells. *The Anatomical Record* 273A:636-647
- Zabka TS**, Gulland FMD, Haulena M, Lowenstine LJ, Naydan D, Buckles EL. 2003. Pleomorphic rhabdomyosarcoma with pulmonary metastasis in a stranded Steller (Northern) sea lion (*Eumetopias jubatus*). *Journal Comparative Pathology* 130(2-3):195-8
- Gulland FMD, Haulena M, Fauquier D, Langlois G, Lander ME, **Zabka TS**, Duerr R. 2002. Domoic acid toxicity in California sea lions (*Zalophus californianus*): clinical signs, treatment and survival. *Veterinary Record* 150:475-480
- Gould JL, **Zabka TS**, Malizia RW, Park A, Mukerji J. 1999. Possible decision-making pre-adaptations in the Molly, *Poecilia shenops*. *Animal Cognition* 2:91-95

PRESENTATIONS

- Zabka TS**, Kim A, Uppal H, Kauss A, Dhawan P, Liederer B, Lin T, McCray B, Nguyen T, Chou C, Misner DL. Considerations for In Vitro Systems to Reflect In Vivo Toxicities to Facilitate Drug Development. (invited platform presentation). Society of Toxicology Annual Meeting, San Diego CA, March 2015.
- Hughes A, Dalmas D, Thomas R, Hughes-Earle A, King N, **Zabka TS**, Enerson B, Kambara T. Immunohistochemical Characterization of Candidate Biomarkers of Drug-Induced Vascular Injury in Rat. Society of Toxicology Annual Meeting, San Diego CA, March 2015.
- Enerson B and **Zabka TS**. DIVI biomarker validation & leveraging nonclinical data for clinical qualification. PSTC/FDA 2015 Annual Scientific Workshop, Washington DC, January 2015 (invited speaker).
- Snyder C, Kauss M, Doudement E, Musinipally V, Ngo T, **Zabka TS**, Uppal H, Misner DL, Dambach DM, Pai R. Comparative analysis of endogenous gene expression levels across human and rat primary endothelial cells. American College of Toxicology Meeting, Orlando, FL, November 2014.
- Singh J, **Zabka TS**, Uppal H, Diaz D, Tarrant J, Clarke E, Lin T, McCray B, La N, Nguyen T, Dhawan P, Doudement E, Kauss A, Dambach D, Misner D. Effects of Nicotinamide Phosphoribosyltransferase inhibitors on platelet development. Society of Toxicology Meeting, San Antonio, TX, March 2013.
- Bertinetti-Lapatki C, Mikaelian I, Fischer S, Eichinger-Chapelon A, **Zabka TS**, Weiser T, Albassam M, Singer T, Suter-Dick L. Plasma miRNAs are early markers of drug-induced liver injury in the rat. Society of Toxicology Meeting, San Francisco, CA, March 2012.
- Dunn ME, Sanders M, Coluccio D, Nicklaus R, Mikaelian i, **Zabka TS**, Geng W, Reddy M, Doessegger L, Singer T, Hirkaler G. NT-proANP, Serum Cardiac Troponin I and Echocardiography are Early Markers of Minoxidil-Induced Structural and Functional Changes of the Left Ventricle in Rats. Society of Toxicology Meeting, San Francisco, CA, March 2012
- Boess F, Kemper R, Kustermann S, **Zabka TS**, Lawson C, Singer T, Roth AB, Kolaja KL, Weiser T. Comparison of Rat and Dog Hepatocyte-Kupffer cell cocultures as a model of drug-induced hepatic microgranuloma. Society of Toxicology Meeting, San Francisco, CA, March 2012
- Kameoka S, **Zabka TS**, Ott V, Singer T, Weiser T, Kolaja KL, Chiao E. Comparison of two cell model systems, primary human hepatocytes and hiPSC-derived hepatocytes to determine the hepatotoxicity of three candidate drugs developed for Rheumatoid Arthritis. Society of Toxicology Meeting, San Francisco, CA, March 2012
- Singh U, Adames V, **Zabka TS**, Jacobsen B, Odin M, Albassam M, Singer T, Garrido R. Tissue Based Kidney Biomarkers in Efficacy and Safety Studies. Society of Toxicological Pathology Meeting, June 2011.
- Burkhardt JE, Pandher K, Solter PF, Troth SP, Boyce RW, **Zabka TS**, Ennulat D. 2011. STP Best Practices for Evaluation of Non Clinical Safety Biomarkers. Society of Toxicological Pathology Meeting, June 2011.

- Stephan-Gueldner M, Buergin H, Funk J, Grimm HP, Sanders M, **Zabka TS**, Platz S, Singer T, Bergstroem M. Opportunities for In Vivo Imaging in Non-clinical Safety Studies. Eurotox Annual Meeting, Paris, France, 2011.
- Zabka TS**. Cardiac Biomarkers in Non Clinical Safety Studies. 23rd Annual EuroMeeting, Geneva, Switzerland, March 2011.
- Zabka TS**, Liu W, Benjamin D, Adames VR, Wolujczyk A, Garrido R. Improved Tissue Morphology, Antigen Preservation and Section Quality of Bone with EDTA, Microwave, and Barnacle Glue Procedure. Society of Toxicological Pathology Meeting, June 2010.
- Olaharski AJ, Bitter H, Gonzaludo N, Kondru R, Goldstein D, **Zabka TS**, Lin H, Kolaja K. 2010. Modeling bone marrow toxicity using kinase structural motifs and the inhibition profiles of small molecular kinase inhibitors. Society of Toxicology Meeting, Salt Lake City, UT, March 2010.
- Zabka TS**, Albassam M. Background cardiomyopathy in cynomolgus macaques. Society of Toxicology Meeting, Washington, DC, June 2009.
- Olaharski AJ, Uppal H, Goldstein DM, Cooper M, Platz S, **Zabka TS**, Jin JK, Kolaja K. *In vitro* to *in vivo* Concordance of a High Throughput Assay of Bone Marrow Toxicity Across a Diverse Set of Drug Candidates. Society of Toxicology Meeting, Baltimore, MD, March 2009.
- Stock H, Ji C, Liu G, **Zabka TS**, Kirschenbaum F, Spindeldreher S, Kropshofer H, Beck J, Cooper M. Non-Clinical Safety Assessment of a Bi-Functional Antibody Fusion Inhibitor Targeting CD4 and HIV. Society of Toxicology Meeting, Baltimore, MD, March 2009.
- Lorenz M, **Zabka TS**, Lollini L, Day-Lollini P, Weller P, Alfredson T, Li F, Wong B, Hill R, Goldstein D, Cooper G, Platz S, Kolaja K, Chanda S. Comparative Toxicity Profile In Rats And Monkeys Following Exposure To A Novel P38 MAP Kinase Inhibitor. American College of Toxicology Meeting, Tuscon, AZ, November 2008.
- Zabka TS**, Fielden MR, Tao J, Fretland JL, Knapp D, Irwin M, Nguyen KC, Fretland AJ, Caplazi P, Kolaja K, Albassam M. Adaptive physiologic hypertrophic response in the liver, thyroid glands, and pituitary gland to hepatocellular microsomal enzyme induction in rats after drug administration. 27th Annual Symposium of the Society of Toxicologic Pathology, San Francisco, CA, June 2008.
- Zabka TS**, Gulland FMD, Lowenstine LJ. Normal gastrointestinal anatomy and perforating ulcerative gastroduodenitis in California sea lions (*Zalophus californianus*). 36th Annual Conference of the International Association for Aquatic Animal Medicine, Seaward, AL, May 2005
- Gulland FMD, Nollens HH, **Zabka TS**, Rowles T. Emerging Health Threats. National Marine Mammal Stranding Network Conference. Washington, D.C., April 2005
- Nollens HH, **Zabka TS**, Gulland FMD. Emerging disease and recognition in pinnipeds. Florida Marine Mammal Health Conference II, Gainesville, FL, April 2005
- Zabka TS**. Marine mammals: Emerging disease and recognition. MARVET, Marin Headlands, CA, June, 2004
- Zabka TS**, Andersen AA, Leutenegger CM, Anderson NL, Tell LA, Johnson SP, Lowenstine LJ. A new strain of *Chlamydiophila psittaci*, strain G, isolated from red-tailed hawks (*Buteo jamaicensis*): identification, prevalence, diagnostic testing, and pathology. Joint Conference of the American Association of Zoo Veterinarians and American Association of Wildlife Veterinarians, San Diego, CA, August-September 2004
- Zabka TS**, Jang SS, Timmel GB, Lowenstine LJ. Necrotizing dermatitis and septicemia in green sunfish (*Lepomis cyanellus*) and isolation of *Corynebacterium ulcerans*. 34th Annual Conference of the International Association for Aquatic Animal Medicine, Kohala, HI, May 2003
- Zabka TS**, Gulland FMD, Haulena M, Lowenstine LJ, Nayden D, Buckles EL. Anaplastic sarcoma in a stranded Steller (Northern) sea lion (*Eumetopias jubatus*) in northern California. 32nd Annual Conference of the International Association for Aquatic Animal Medicine, Tampa, FL, May 2001
- Zabka TS**, Quist CF. Death of Farmed Red Deer (*Cervus elaphus*). Southeastern Veterinary Pathology Conference, Tifton, GA, May 2000
- Zabka TS**, Miller G, Steffens WF, Poet SE, Romano TA. Immunological characterization of skin from the Atlantic bottlenose dolphin (*Tursiops truncatus*). UGA Immunology Lecture Series, Athens, Georgia, March 2000; Joint Conference of the International Association for Aquatic Animal Medicine and American Association of Zoo Veterinarians, New Orleans, LA, September 2000
- Schock TB, Smith SA, Howard KE, **Zabka TS**, Poet SE. Evaluation of the humoral immune response to DNA vaccination in Tilapia (*Oreochromis niloticus*). Joint Conference of the International Association for Aquatic Animal Medicine and American Association of Zoo Veterinarians, New Orleans, LA, September 2000
- Zabka TS**, Anders BB, Van Bonn W, Poet SE. The basis for assessing the humoral immune response of the Atlantic bottlenose dolphin (*Tursiops truncatus*) to DNA vaccines. 30th Annual Conference of the International Association for Aquatic Animal Medicine, Boston, MA, May 1999
- Zabka TS**, Rogers T. Aerial acoustic repertoire of the crabeater seal (*Lobodon carcinophagus*); Audiometric abilities of a captive leopard seal (*Hydrurga leptonyx*). Geraldine R. Dodge, Frontiers of Veterinary Medicine Symposium, West Lafayette, IN, October 1998
- Zabka TS**. Female mate choice in the black molly (*Poecilia sphenops*) and its implications in the Poeciliini tribe. Princeton University Departmental Symposium, Princeton, NJ, May 1996

GRANTS

Center for Companion Animal Health, U.C. Davis: New Strain of *Chlamydiophila psittaci* isolated from red-tailed hawks (*Buteo jamaicensis*). July 2003-July 2004; \$4,225.00

Office of Naval Research: Immunological characterization of skin from the Atlantic bottlenose dolphin (*Tursiops truncatus*). May 1999-May 2000; \$12,681.50

C.L. Davis Foundation Grant: Completion of a medicine and pathology preceptorship at The Marine Mammal Center and Department of Pathology, Microbiology, and Immunology at U.C. Davis. June 2000; \$250.00

Geraldine R. Dodge Foundation: Aerial acoustic repertoire of the crabeater seal (*Lobodon carcinophagus*), Audiometric abilities of a captive leopard seal (*Hydrurga leptonyx*). May-September 1998; \$5,000.00

ADDITIONAL SKILLS

- Experience with progressive assay validation and qualification, multiple techniques for tissue preservation, cryostat sectioning, vibratome sectioning, immunohistochemistry, immunofluorescence, immunoelectron microscopy, confocal microscopy, and enzyme-linked immunosorbent assay.
- Familiar with aptamer-based assays, IMS-MALDI, and single-plex, multiplex and ultrasensitive immunoassays.
- Trained in First Aid and Community Emergency Response Teams (CERT) Program (FEMA).

EDITORIAL REVIEW

Aquatic Mammals; Diseases of Aquatic Organisms; Journal of the Pancreas; Journal of Wildlife Diseases; Journal of Zoo and Wildlife Medicine; Marine Mammal Science; Veterinary Pathology; Toxicologic Pathology

PROFESSIONAL AFFILIATIONS

American College of Veterinary Medicine

American College of Veterinary Pathology

Society of Toxicologic Pathology

C.L. Davis Foundation

International Association of Aquatic Animal Medicine