

SEEWIESEN

Max Planck Institute
for Ornithology

LECTURE SERIES

FALL/WINTER 2017/18



MAX-PLANCK-GESELLSCHAFT

THURSDAY | NOVEMBER 2, 2017 | 13 P.M. | HOUSE 4 LECTURE ROOM

HAROLD ZAKON

University of Texas at Austin | Host: Baldwin Research Group

Stinging scorpions, poison frogs: two stories of molecular evolution in action

Many animals use venoms or toxins to protect themselves against predators or to obtain prey. Thus, there is strong selection pressure to evolve resistance to these toxins on the part of the targeted animal and, in the case of alkaloid toxins that may diffuse throughout the body, in the animal that possess the toxins. I will first describe a situation in which a predator—the grasshopper mouse—has evolved resistance to voltage-gated sodium channel-targeting peptide components in the venom of their scorpion prey. This allows these carnivorous mice to exploit an abundant food resource in the Sonoran Desert in America. Then, I will show how poison arrow frogs from South America have evolved resistance to the acetylcholine receptor agonist epibatidine which is found in different independently evolved lineages of frogs. In both examples, resistance is conferred by a single, or at most a few, amino acid substitutions in key parts of the target molecule.

WHO IS HAROLD ZAKON

- 1981** PhD Cornell University
1981 Postdoctoral fellowship University of California, San Diego (USA)
1983-present Professor University of Texas, Austin (USA)

SELECTED PUBLICATIONS

Rowe A, Xiao Y, Rowe M, Cummins T, Zakon HH (2013) Voltage-gated sodium channel in grasshopper mice defends against bark scorpion toxin. **Science** 25: 441-446.

Gallant JR, Traeger LL, Volkening JD, Moffett H, Chen PH, Novina CD, Phillips Jr. GN, Anand R, Wells GB, Pinch M, Robert Güth R, Unguez GA, Albert JS, Zakon HH, Samanta MP, Sussman MR (2014) Genomic basis for the convergent evolution of electric organs. **Science** 344: 1522-1525.

Liebeskind BJ, Hillis DM, Zakon HH (2015) Convergence of ion channel gene content in early animal evolution. **Proceedings of the National Academy of Sciences USA** 112: E846-E851.

Tarvin RD, Santos JC, O'Connell LA, Zakon HH, Cannatella DC (2016) Convergent substitutions in a sodium channel suggest multiple origins of toxin resistance in poison frogs. **Molecular Biology and Evolution** 33: 1068-1081.

Tian R, Losilla M, Lu Y, Yang G, Zakon H (2017) Molecular evolution of globin genes in Gymnotiform electric fishes: relation to hypoxia tolerance. **BMC Evolutionary Biology** 17:1.

Tarvin RD, Borghese CM, Sachs W, Santos JC, Lu Y, O'Connell LA, Cannatella DC, Harris RA, Zakon HH (2017) Interacting amino acid replacements allow poison frogs to evolve epibatidine resistance. **Science** (in press).

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