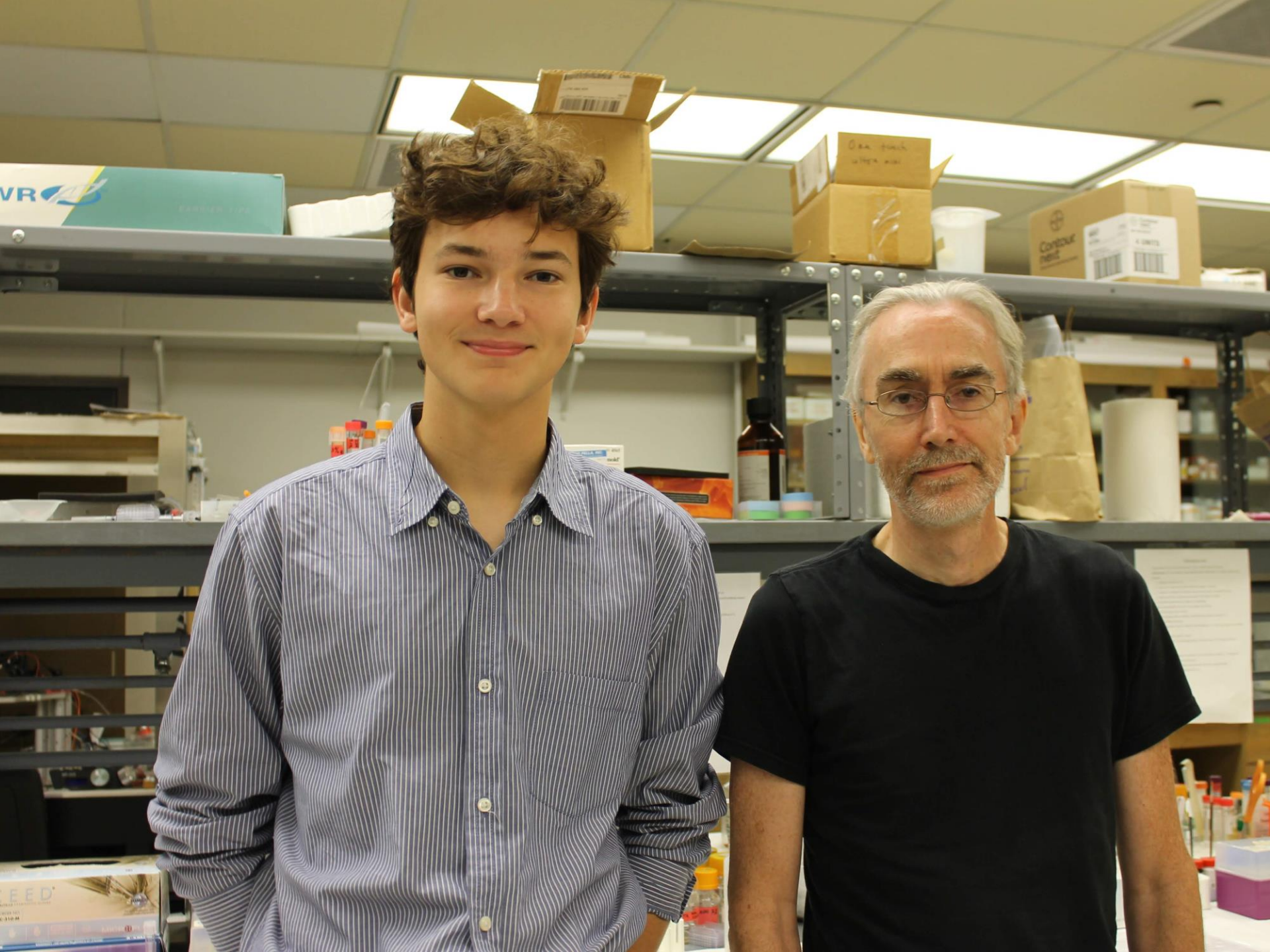


Jason D Gardner, PhD
Dept of Physiology

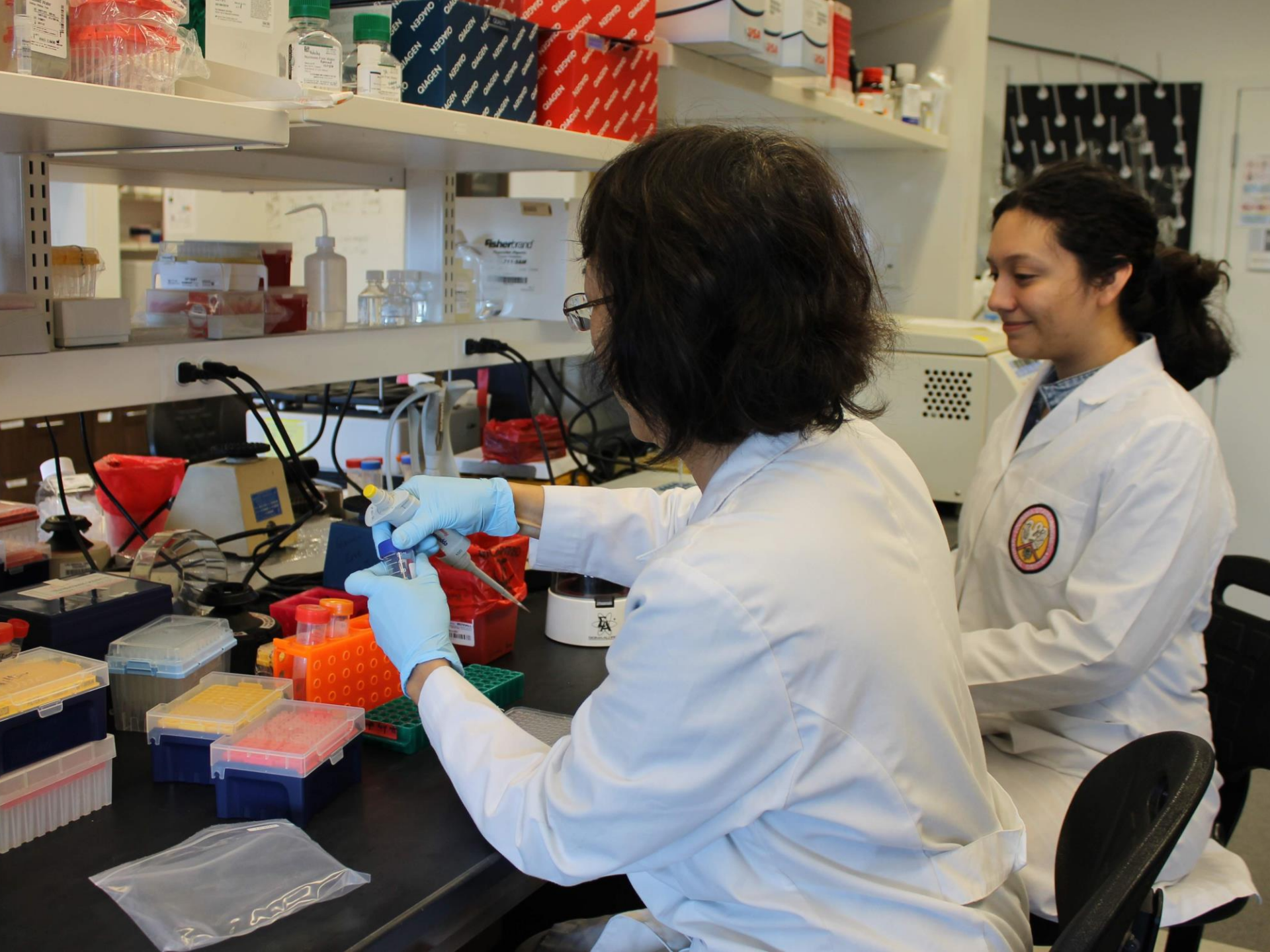


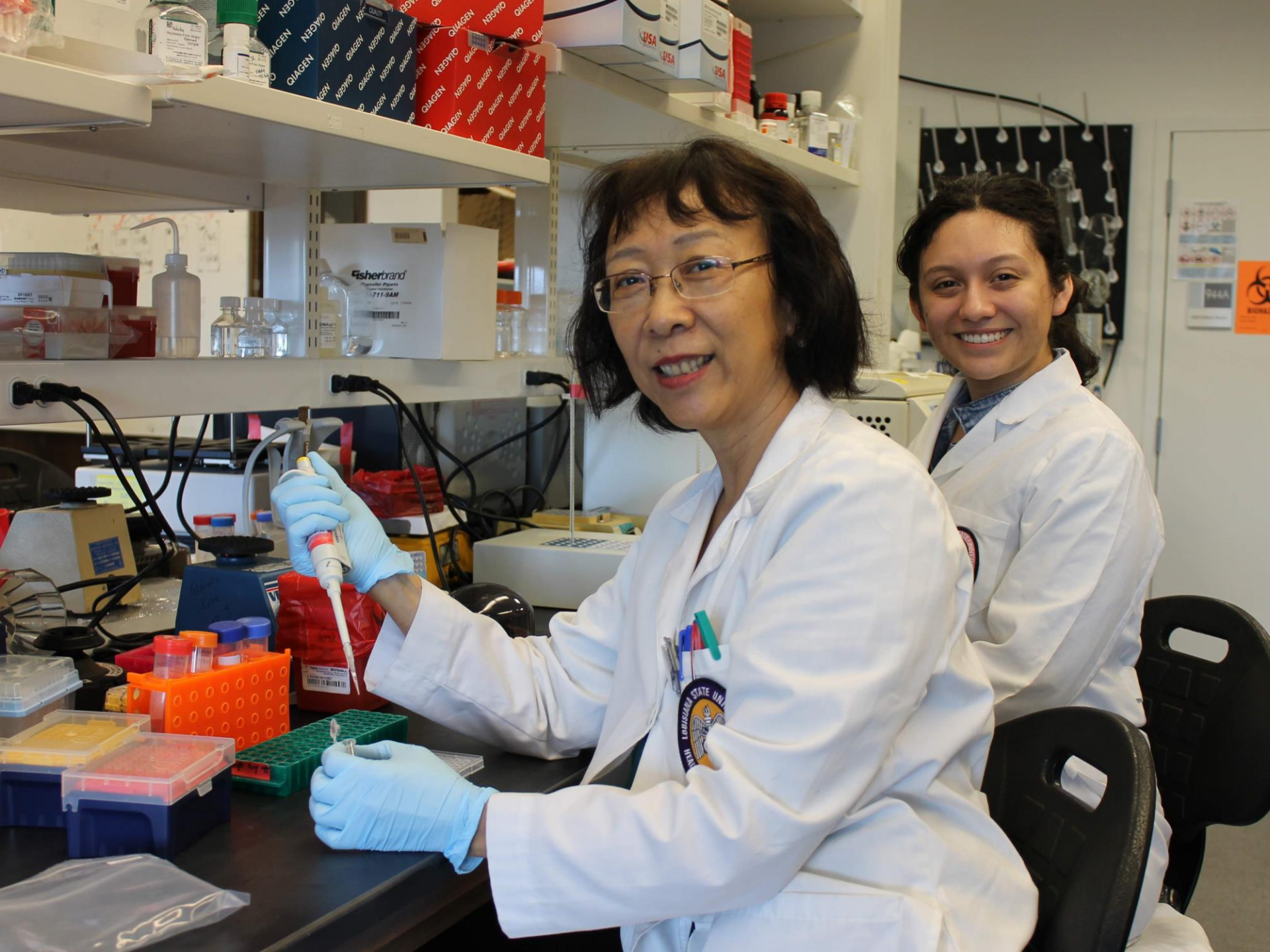


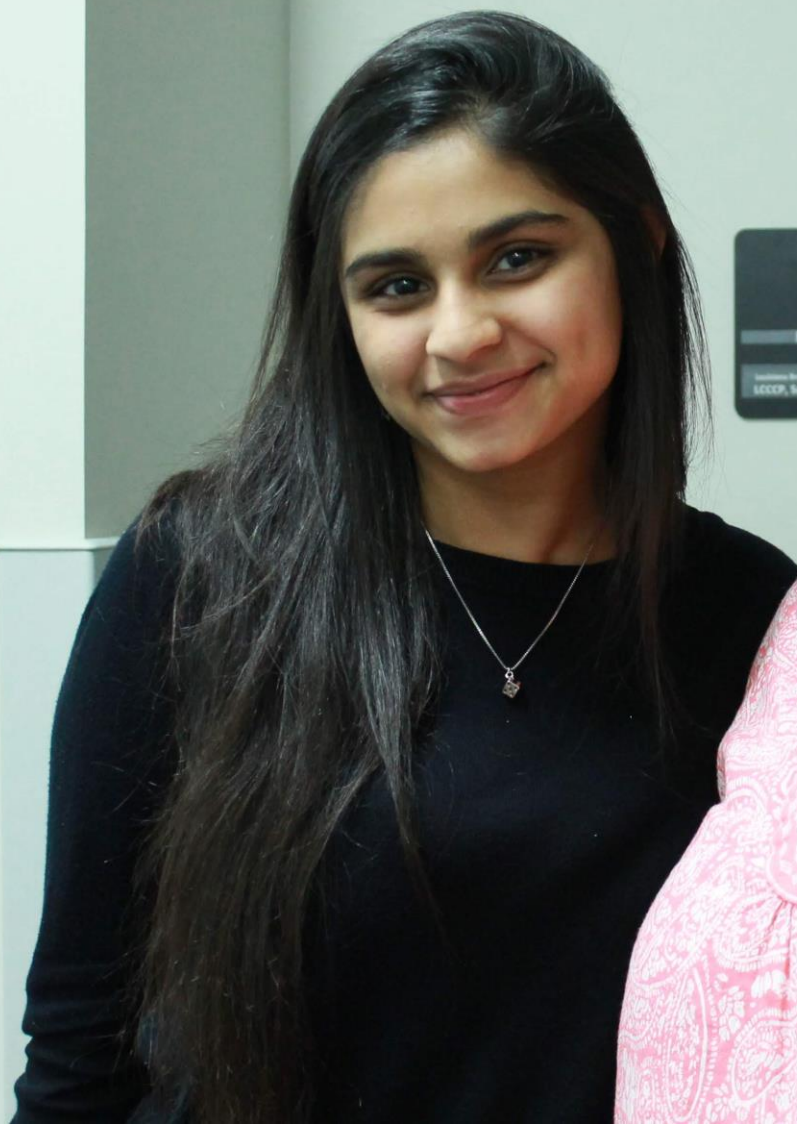












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DIPHTHERIA	HEPATITIS A
Diphtheria is a bacterial infection that can affect the throat, nose, and skin. It is highly contagious and can be fatal. Symptoms include a sore throat, difficulty swallowing, and a white coating on the throat. It is caused by the bacterium <i>Corynebacterium diphtheriae</i> .	Hepatitis A is a viral infection that affects the liver. It is spread through contaminated food or water. Symptoms include fatigue, loss of appetite, and jaundice. It is caused by the Hepatitis A virus (HAV).
Polio is a viral infection that can cause paralysis. It is spread through contaminated food or water. Symptoms include muscle weakness and paralysis. It is caused by the Poliovirus.	Tetanus is a bacterial infection that causes muscle spasms and stiffness. It is spread through wounds contaminated with soil or rust. Symptoms include muscle stiffness and spasms. It is caused by the bacterium <i>Clostridium tetani</i> .

HEALTHY PEOPLE 2020
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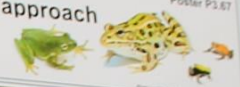


Visual sensitivity and optics of nocturnal and diurnal frogs: a comparative approach

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Poster P3.87

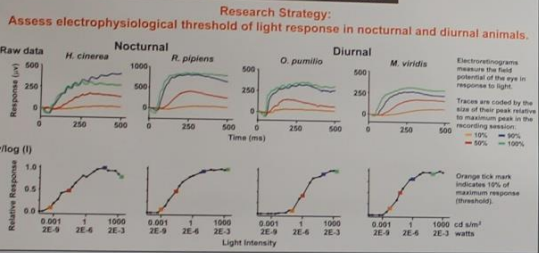


Abstract

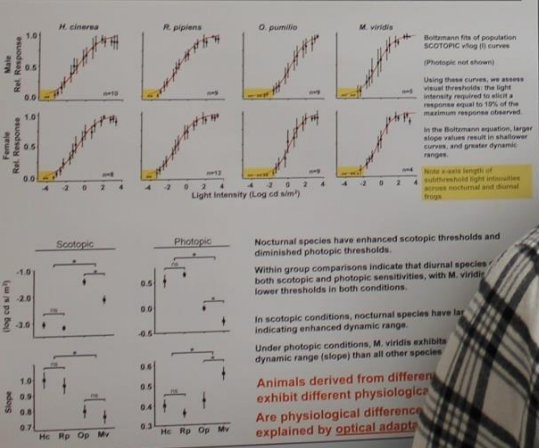
Solutions of the visual system often employ anurans models, yet few data indicate the degree of variance in retinal anatomy and physiology across species. Specialization is most likely for species in different diel niches, as light intensity varies by 8 orders of magnitude. In the present study, we examined light sensitivity and optics in nocturnal (*Hyla cinerea* and *Rana pipiens*) and diurnal frogs (*Oophaga splanchnotis* and *Mantella viridis*). Using electroretinogram recordings, the minimum light intensity necessary to elicit second order neural responses was determined (scotopic B-wave threshold), the minimum light intensity necessary to elicit second order neural responses (photopic B-wave threshold) and, in a third experiment, photopic B-wave threshold (i.e., cone response) was determined by introducing constant background illumination. Nocturnal species require approximately 1.5 log units less light to elicit scotopic B-waves than diurnal counterparts. No variance is observed in photopic thresholds, indicating increased visual sensitivity may be limited to rod photoreceptors (PRs). In a third experiment, we characterized optical sensitivity. Pupillary diameter was determined using infrared photography. Focal length was measured in flash-frozen eye sections, and PR outer segment diameter and length were measured in plastic sections. Correlated with Noma'ski microscopy in frozen sections. These measurements were used in the Land sensitivity equation (1981) to estimate optical sensitivity. Results show a strong correlation between optical and physiological sensitivity providing compelling evidence of variance in the peripheral sense organ, which should be taken into account when building models of central visual processing.

Overall Questions:
 Does light habitat predict sensitivity? If so, what mechanism explains the difference?

Scotopic Electroretinograms: Individual Data



Scotopic and Photopic ERG: Population Curves and Results



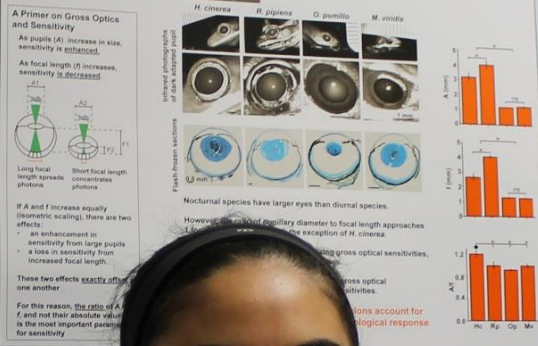
Land Sensitivity Equation

A simple and useful tool to describe the optical sensitivity of any eye using four parameters

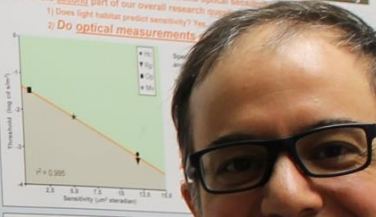
$$S = \left(\frac{\pi}{4}\right)^2 A^2 \left(\frac{d}{f}\right)^2 \left(\frac{k+1}{2.3+k+1}\right)$$

S = sensitivity (Land equivalent)
 A = Pupil diameter
 d = photoreceptor diameter
 f = focal length
 k = photoreceptor length
 $k+1$ = constant 0.3 to probability of absorption per unit length

Pupil Diameter and Focal Length



Correlation of Physiological Threshold and Optical Sensitivity



Rhodopsin Immunohistochemistry



Diminishing Rate of Return in Rod Photoreceptors



Conclusions

- As expected, nocturnal species exhibit enhanced scotopic sensitivities and diminished photopic sensitivities.
 - Variance in physiological responses is explained by optical adaptations.
 - This represents a convergent evolution of visual systems across different habitats.
- References**
 - Froese, R. and Land, M.F. (1981) Optics of the eye. In: Land, M.F. and Mollon, J.D. (eds) The Visual System. London: Chapman and Hall.
- Support: NSF REU Grant IBN-97-07091

