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Light, Imaging, Vision: An interdisciplinary undergraduate course[1] PHILIP NELSON, Univ Pennsylvania — The vertebrate eye is fantastically sensitive instrument, capable of registering the absorption of a single photon, and yet generating very low noise. Using eyes as a common thread helps motivate undergraduates to learn a lot of physics, both fundamental and applied to scientific imaging and neuroscience. I'll describe an undergraduate course, for students in several science and engineering majors, that takes students from the rudiments of probability theory to the quantum character of light, including modern experimental methods like fluorescence imaging and Förster resonance energy transfer. After a digression into color vision, we then see how the Feynman principle explains the apparently wavelike phenomena associated to light, including applications like diffraction, subdiffraction imaging, total internal reflection and TIRF microscopy. Then we see how scientists documented the single-quantum sensitivity of the eye seven decades earlier than "ought" to have been possible, and finally close with the remarkable signaling cascade that delivers such outstanding performance. Parts of this story are now embodied in a new textbook (WH Freeman and Co, 1/2015); additional course materials are available upon request.

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