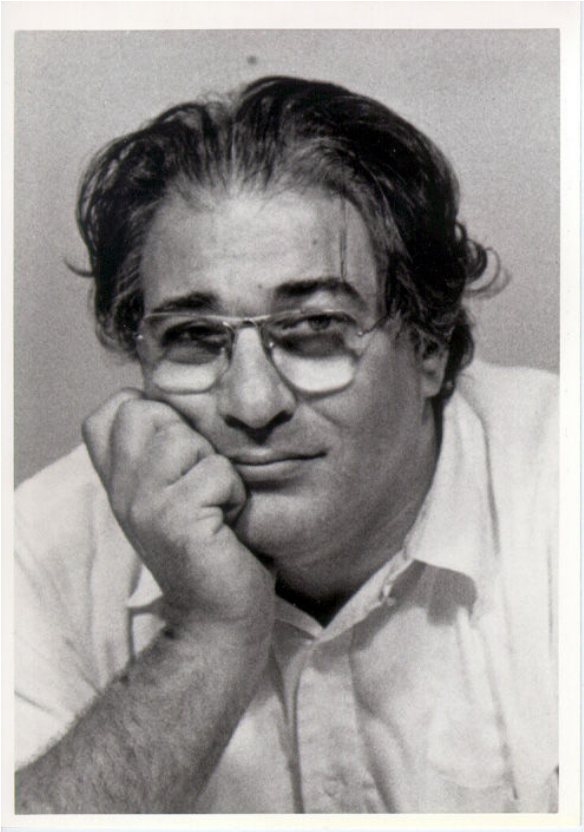
Jerome Ysroael Lettvin (1920 -)



(photo ca. 1975, © Arnold Newman)

Jerome Ysroael Lettvin is a cognitive scientist and Professor Emeritus of Electrical and Bioengineering and Communications Physiology at the Massachusetts Institute of Technology (MIT). He was born in Chicago on 23 February 1920 as the eldest of four siblings (including renowned pianist Theodore Lettvin). Trained as a neurologist and psychiatrist at the University of Illinois (B.S., M.D. 1943), he practiced medicine at the battle of the Bulge during World War II. After the war, he continued practicing neurology and researching nervous systems, partly at Boston City Hospital, and then at MIT with Walter Pitts and Warren McCulloch under Norbert Wiener. There he became a professor attached to MIT's Research Laboratory of Electronics, and remained there (except for a five-year term at Rutgers University in the 1990s) until his retirement. His wife Maggie (nee Margaret Warshawsky Brady, to whom he has been married since 1947). is publicly known for her spectacular recovery from injuries in a car accident, and subsequent advocacy of physical health through books and a PBS television show.

Lettvin is best known for the 1959 article, "What the frog's eye tells the frog's brain," which he wrote with Humberto Maturana, Warren McCulloch and Walter Pitts [1]. One of the most cited papers in the *Science Citation Index*, the article reports the first demonstration of "feature detectors" in the visual system. Lettvin also studied neurophysiology in the spinal cord and information processing in the terminal branches

of single axons. Around 1969, he originated the term “grandmother cell” to denote neurons in our brain that uniquely carry information about remembered things (such as grandmothers), to the extent that these things are lost to us if those cells are removed.

"Grandmother cells" were never intended as a serious entity, but were part of a satirical story Lettvin devised to neutralize a simplistic notion that emerged after the "frog's eye" paper was published. The “frog’s eye” paper pointed to neurons that have highly specialized functions, but people had begun to think of specific functions as uniquely captured in single neurons. Instead, Lettvin emphasized, single-neuron functionality may appear specialized but is shared, adaptable, and not at all like the “grandmother cell.” “The way he put it, one cannot eliminate a single given concept from the brain. Were one to do so, the conceptual hole established by the remaining concepts recreate the eliminated one.” [3]

The “frog’s eye” and “grandmother cell” example shows a hallmark of Lettvin’s career: An attempt to give enough nuance to the way we describe nature. This same motivation resulted in Lettvin writing articles on many subjects related only tangentially to neurophysiology, particularly in philosophy and in the history of science. In pursuit of his moral imperatives in neuroscience, he sometimes reached the public eye, as when he debated Timothy Leary on television in 1967 and used the uncensored word “bullshit” to describe Leary’s rationale for endorsing drug-induced euphorias. “The word ‘bullshit’ was used to criticize Leary for his professional incompetence as a psychologist in mistaking frank symptoms of temporal lobe seizure for a religious experience. It was not a gentle ribbing, but a powerful clarifying point.” [3]

One can get an idea of the breadth of Lettvin’s interests and accomplishments through http://en.wikipedia.org/wiki/Jerome_Lettvin , compiled by his son Jonathan D. Lettvin. Several documents attached there, including a 2007 interview and a 60th birthday “roast,” show through anecdotes a philosophy and sense of humor that cannot be captured in scientific papers.

One thread in the tapestry of Lettvin’s career was color science, which we can see from a sentence in the Wikipedia article: “Color constancy derives from boundaries and vertices imaged on the retina; color is not related to wavelength.” A good citation for this distillation would be the paper posted here and discussed below.

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Datacolor

[1] Jerome Y. Lettvin, Humberto Maturana, WarrenMcCulloch, and Walter Pitts, “What the frog’s eye tells the frog’s brain”, *Proc. Inst. of Radio Engineers*, **47**, 1940-1951(1959).

[2] Charles G. Gross, “Genealogy of the ‘grandmother cell,’” *The Neuroscientist* **8** (5), 512-518 (2002).

[3] Jonathan D. Lettvin, personal communication (June 2010).

Retrospective Introduction:
The Colors of Colored Things, by Jerome Y. Lettvin, MIT RLE Quarterly Progress Report No. 87, 15 October 1967, pp. 193-229.

Lettvin wrote several articles on color perception [1-3 and the title above], but most were not published in refereed journals. The only one that had significant public exposure was the 1986 *Scientific American* article, "The colors of things." [3] That article is complete, unified, and wedded to a technology (the use of digital displays to show color effects). To paraphrase Douglas Adams, it was almost, but not exactly unlike the earlier paper posted here, which is incomplete (lacking a Part 2), wide-ranging (from Helmholtz's discourses on colored shadows and color constancy to the evolution of vision), and wedded to no technology fancier than a variety of colored lights and paper samples.

One should also mention the philosophical differences between the two papers, starting from their titles. "The colors of colored things" implies that color inheres in real things and can be pronounced repeatably by a human perceiver. "The colors of things" is more noncommittal, and the first sentences of that paper (beginning "Color, like beauty, is in the eye of the beholder" and continuing that color cannot be measured) were, I am assured, implanted by the *Scientific American* editors, who did not have to live with the incongruity of science and unmeasurability. “The colors of colored things" has been seminal, within the MIT community, in such ideas as "natural computation" [4] (common design principles between biological vision and computer vision) and the importance of third-degree (trihedral) vertices in the visual field (which Tom Binford carried to Stanford and promulgated from there [5]). One can even find titles that mimic Lettvin's---e.g., Mark Lavin's 1973 MIT report, "The gloss of glossy things" [6].

Note that I have qualified the impact of "The colors of colored things" as being within the MIT community, with only secondary impact on the world at large. This is because the article is published only in a report of the MIT Research Laboratory of Electronics, which---although archived by the U.S. government and shelved by NIST---is known by few and read by almost nobody. I hope this omission can be rectified by the good services of the Internet.

Given that this article is in English and only 43 years old, why does it belong in an archive of Historical Translations on the ISCC website? I could point to Lettvin's abundant quotes on colored shadows and color constancy from Southall's translation of Helmholtz's *Physiological Optics*. Or I could quip as a mathematician that I am *translating* the paper from obscurity to a place where it can be read. (Actually, it was very recently posted on Wikipedia as well.) But it is fairer to say that, in keeping with the ISCC's mission of color education, Lettvin's paper can still benefit students today. The old goal of making a machine that pronounces the same color judgments we do is still mainly unmet, and it will be helpful for all of us (including students) to return to first principles, simple experiments, and intriguing beginnings of a theory that still could meet the original goal.

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[1] Jerome Y. Lettvin, “Color vision I,” MIT RLE Quarterly Progress Report No. 70, 327-337 (1963).

[2] Lynette Linden and Jerome Y. Lettvin, “Freedoms and constraints in color vision,” *Brain Theory Newsletter* **3** (2) December 1977.

[3] P. Brou, T. R. Sciasia, L. Linden, and J. Y. Lettvin, The colors of things,” *Scientific American* **255** (3), 84-91 (1986).

[4] Whitman Richards (ed.), *Natural Computation*, MIT Press, 1988.

[5] Tom Binford, “Inferring surfaces from images,” *Artificial Intelligence* **17**, 205-244 (1981).

[6] Mark A. Lavin, “The gloss of glossy things”, MIT AI Vision Flash # 41, 1973.