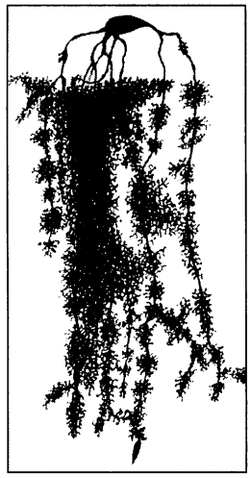
ly few insights into the detailed physiological mechanisms actually responsible for the implementation of behavioral routines related to time, love, and memory. By contrast, studies carried out in other laboratories, on larger animals that are more accessible to physiological (especially neurophysiological) experimentation than *Drosophila*, have already provided a somewhat deeper understanding of mechanisms that generate animal behavior.

The chief merit of *Time, Love, Memory* is its empathetic description—neither panegyric nor carping—of the remarkable personalities of the story's protagonist and his disciples. Benzer is convincingly portrayed as one of those few people who really does merit the appellation "scientist's scientist," one who presents that rare conjunction of genius, lucidity, fairness, maximal self-confidence, and minimal self-promotion. Weiner thus provides his readers with an enjoyable yet realistic account of the working interactions among a top-of-the-line, end-of-the-millennium, life-science research coterie and its distinguished leader.



Brain wiring. Drawings of nerves from the brains of a fly by the pioneer neuroanatomist Santiago Ramón y Cajal.

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BOOKS: PRACTICE OF SCIENCE

Seasoned Suggestions for Success

Jon H. Kaas

In 1887 Santiago Ramón y Cajal, Spain's most distinguished scientist and a founder of modern neuroscience, gave up a promising career in bacteriology when he first saw sections of brain tissue stained with Camillo Golgi's then-new silver chromate technique. The Golgi method had the great advantage of staining only a scattering of the densely packed nerve cells in the brain, so that "the trees could be seen in the forest." Cajal soon realized that the method is most effectively applied to embryonic material, and the complexity of the brain is best understood by studying smaller animals at early, simpler stages of development. Cajal went on to publish impressive drawings and descriptions of neurons throughout the nervous system. He became known for his successful defense of the neuron doctrine, the now basic idea that the nervous system is constructed of separate neurons that conduct information from the cell body along axons that contact and activate the dendrites and cell bodies of other neurons. In contrast, Golgi and others held the "false theory" that neurons are joined to form a continuous net without polarity. Cajal also discovered the growth cone (the growing tip of developing and regenerating axons), and he formulated a theory of neurotropism (the attraction of growing axons by distant targets). He strongly believed in the plasticity of even the mature nervous system, an area of considerable research today. In 1906 Cajal shared the Nobel Prize in Medicine with his scientific rival, Golgi. Ramón y Cajal remains perhaps the best known and most influential neuroanatomist of all time. He continues to be frequently cited in scientific publications, and students of neuroanatomy have long been reminded that much of what we know now was described in detail by Cajal nearly 100 years ago.

Remarkably, Cajal took time to write a small book of advice to young scientists. The book, based on a 1897 speech, was subsequently revised several times. Neely Swanson, a translator, and Larry Swanson, a neuroscientist, have now produced a very readable, modern (rather than literal) rendition based on the fourth edition, which was published in 1916, and a previous English translation of the sixth edition (*1*). Cajal wrote the book for Spanish scientists of his time. Thus some of the advice is specific or dated, but much is more universal and still applicable. The advice was intended for serious young scientists, with the hope that it would "increase their love for laboratory work." Most of Cajal's pronouncements were based on strong opinion and most were clearly and amusingly expressed. More than anything, Cajal believed that devotion to laboratory work would bring rewards. As he noted, "the turtle may pass the hare."

Advice for a Young Investigator
by Santiago Ramón y Cajal
translated by Neely Swanson and Larry W. Swanson
MIT Press, Cambridge, MA, 1999. 172 pp. $22.50. ISBN 0-262-18191-6.

Cajal wrote that almost anyone of normal intelligence could become a productive scientist. He believed the plasticity of the brain allowed for improving and refining its machinery so that with experience one would become better and better at scientific thinking. He felt that work "creates talent." Furthermore, one should focus one's efforts on one or two interests, rather than many. Cajal concluded that "multifaceted investigators have disappeared, perhaps forever." He likened focused interest in a single research issue to sharpening a single-edged sword until it cuts efficiently. Adding more cutting edges would progressively diminish such a sword into "a dull bludgeon." Cajal recognized that it is best to start sharpening the mind while one is young, for "the youthful brain is wonderfully pliable." Late in life, the "plasticity of nerve cells is greatly reduced."

Concentration and laboratory work not only improve the mind for further discovery, but produce "the fruit of patience and perseverance." Cajal concluded that the theoretical scientist with an aversion to the laboratory "is a lazy person masquerading as a diligent one." He reminded us that discoveries are made by people and not by scientific instruments or overflowing libraries. The misguided addict of instruments is "as fascinated by the gleam of metal as the lark is with its own reflection in a mirror," and the reader of books needs to contribute as well as acquire knowledge. To allow scientists to focus on research, Cajal thought that the "ideal university would be a monastery with monks consecrated for life to the study of nature." Cajal, however, recognized that the life of a monk would be an "intolerable sacrifice for the majority of scholars." Thus, some of his advice was on how to limit the impact of social distractions. He advises the young male scientist never to marry a wealthy woman, for "a wife's riches are fatal to one's work." After such a marriage, evenings in the laboratory would be replaced by "useless hours spent at parties or the theater." In regard to writing, he simply stated, "have something to say, say it, and stop."

For practical advice on how to write a first grant or address the concerns of manuscript reviewers, we will need to look elsewhere. Cajal's conclusions were meant to encourage and motivate. The book is short, enjoyable, and valuable as a view of a great scientist of another time.

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