

Advice for a Young Investigator

by Santiago Ramón y Cajal

Translated by Neely Swanson and Larry W. Swanson

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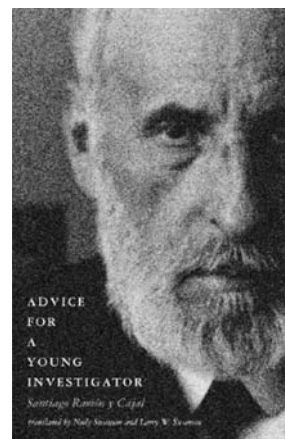
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The Spanish scientist, Santiago Ramón y Cajal (1852-1934) is regarded as one of the founders of modern neuroscience. As a talented artist and a photographer, he converted numerous microscopic images into scientific drawings which still continue to be used in neuroscience textbooks today. He was in conflict with his contemporary Camillo Golgi who supported the widely accepted idea that the nervous system was a meshwork made of continuous nerve fibers. Instead, he proposed that the nervous system consisted of individual nerve cells connected to each other by contact zones (synapse). He postulated the Law of Dynamic Polarization, which stated that the dendrites and the cell body of a neuron received information whereas the axon transmitted it to distant sites. In 1906, Nobel Prize was awarded to Cajal and Golgi in recognition of their work on the structure of the nervous system.

Advice for a Young Investigator, first published in 1897, reflects Cajal's extensive scientific experience acquired over the years. This book is a guide showing novice investigator how to succeed in scientific research. It spans 150 pages organized into nine chapters. In Chapter 1, Cajal emphasizes that formal knowledge of logic and philosophical methods of investigation are just formal expressions of the mechanisms underlying human understanding and studying them does not improve scientific research abilities. In an attempt to explain his point of view, he mentions the futile effort of a speaker trying to refine his oratory skills by learning how language is processed in the brain. He uses the example of a speaker trying to refine his oratory skills by learning how language is processed in the brain. He claims that science cannot solve ultimate causes of the universe. However, science can demonstrate how phenomena occur, so that we can control and use the phenomena for the benefit of humanity. Chapter 2 describes four erroneous attitudes which damage the self-confidence of the novice. First one is excessive admiration of great minds and being cap-

tivated by their scientific work. This destroys initiative in young investigators and prevents production of original work. Second is the false assumption that most important problems are already solved. In fact, there are no small problems. However, there are intellectuals who cannot understand the importance of those problems. Third is preoccupation with applied science and thinking investigations of pure science are worthless unless their results can be applied to commerce, industry, agriculture, medicine and military. Last one is perceived lack of ability. Cajal states that patience and determination are as important as intellectual abilities in scientific research. Even the researchers with modest intellectual abilities achieve success through persistent hard work.

Cajal indicates the essential qualities that a scientist should possess in Chapter 3: the ability to judge independently, intellectual curiosity, perseverance, devotion to country and desire for reputation. Chapter 4 emphasizes the need for specialization in science. Also in this chapter, Cajal explains the importance of reading monographs thoroughly and choosing the appropriate analytical method available. Chapter 5 describes six types of unsuccessful scientists who are ineffective in making contribution to our scientific knowledge: contemplators, bibliophiles and polyglots, megalomaniacs, instrument addicts, misfits and theorists. In Chapter 6, Cajal mentions that a lack of financial support and having a family are among the common excuses for not performing research. However, scientists with limited resources should only limit the scope of the investigation instead of abandoning research. Cajal thinks that scientists should select a suitable partner and get married. Having a family is important in learning responsible behavior and it removes selfishness from the soul. Chapter 7 outlines the stages of scientific research. Observation requires disregarding what we have learned from the books and the perspectives of other



experts. Following observation and experimentation, a hypothesis should be generated. Further experiments should be performed to test this hypothesis and finally our hypothesis should be accepted or rejected. Chapter 8 deals with how to write scientific papers and lastly, in Chapter 9 the investigator is considered as a teacher.

In “Advice for a Young Investigator”, Cajal expresses his thoughts about science, philosophy and social life in such a detail that reader easily gains insight into the author’s personality. In certain cases, author’s approach

to the subject may be regarded as outdated. However, in general, this book is certainly a timeless and universally valid piece of work, which provides immense motivation for the young investigator.

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