
Triological Society President's Address

Scientific Attributes of a Researcher and Member of the Triological Society

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This presidential address discusses the comments from the first Mayo Clinic's Chair, Harold Lille, MD, regarding different contributions by members of The Triological Society in his 1939 presidential address. It then goes on to discuss scientific research attributes expected of members of the Society that were gleaned from a fusion of Dr. Berke's notions with what other famous researchers, inventors, and philosophers have said about aspects of research. The areas covered include research motivation, the process of research, the scientific method, imagination, intuition and luck, questioning in science, tenacity, ideas, and knowledge. In summary, the following are the expected attributes of a researcher and member of the Society. The individual should enjoy the creation of new knowledge and appreciate the mysteries of life and the joy of discoveries. He or she should be a staunch supporter of the scientific method, but should also understand that every researcher is a professional amateur, and that the process of research is often fraught with blind alleys and incorrect ideas and assumptions, and that ultimately hypotheses must be substantiated by experiments. A researcher must exhibit imagination and intuition augmented by tenacity and scientific questioning. Finally, he or she should recognize that chance favors the prepared mind, and always be on the lookout for novel ideas framed by a comprehension of existing knowledge, not just in one domain but across a broad horizon of disciplines.

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Good morning. I have a short presentation for you this morning, so that we can leave enough time for our Ogura Lecturer, Lord Bernard Ribeiro, MD.

One of the many fun things about being the president of The Triological Society is to look back and see all the giants in our field who held this position in the past. In perusing the Presidents' Book, this statement from Harold I. Lille in 1939, caught my eye. He was the first Chair of the Mayo Clinics, and stressed in his presidential address the individual contributions that members can make to the Society. He said, "Some contribute by presenting research, others by their clinical observations; some for refining surgical techniques, and others for their philosophical observations. A large group con-

tributes simply by their attendance and attention at meetings."¹

I believe those words are just as pertinent today as they were 72 years ago, and that all of us present today will contribute in some fashion to this 114th Annual Meeting.

In fact, so many have contributed to our Society, I thought it would be a useful exercise to see what scientific attributes our members and researchers should strive to maintain. To do this, I have fused my own notions about this topic with what other successful researchers, philosophers, and inventors have said about science and research. Their selected quotes are surprising, and seem to be organized into research motivation, the process of research, the scientific method, imagination, intuition and luck, questioning in science, tenacity, ideas, and knowledge. I have tried to develop this presentation primarily for my younger colleagues in the audience.

RESEARCH MOTIVATION

While many, including Neil Armstrong, have commented on research as the "creation of new knowledge,"² and have expressed the excitement of doing research, there also seems to be a mystical appreciation for the task. For example, Louis Pasteur said, "I am on the

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verge of mysteries, and the veil which covers them is getting thinner and thinner. The nights seem to me, too long.”³ Albert Einstein commented, “The most beautiful thing we can experience is the mysterious. It is the source of all true art and all science. He to whom this emotion is a stranger, who can no longer pause to wonder and stand rapt in awe, is as good as dead; his eyes are closed.”⁴ Pretty heady words from Professor Einstein who, by the way, became very famous as a young man. He almost sustained a “rock star” status and was quoted frequently in the newspaper. In his later years many of his writings took on the style of a philosopher scientist.

WHAT DO FAMOUS RESEARCHERS SAY ABOUT THE PROCESS?

Although many young researchers believe that research is primarily formal logic or a pure reason-driven process, it is clear from some of the comments that it is more akin to just trying out new ideas and assumptions and seeing what happens. For example, Einstein said, “If we know what we were doing it wouldn’t be research.”⁵ In a similar vein, the famous German rocket engineer, Werner Von Braun, said, “Basic research is what I am doing when I don’t know what I am doing,”⁶ and Charles Franklin Kettering summed it up by saying, “Every honest researcher I know admits he’s just a professional amateur. He’s doing whatever he’s doing for the first time. That makes him an amateur. He has sense enough to know that he’s going to have a lot of trouble, so that makes him a professional.”⁷

WHAT DO FAMOUS RESEARCHERS SAY ABOUT THE SCIENTIFIC METHOD?

As you know, the scientific method is a procedure that has existed since the 17th century.⁸ It consists of keen observation, the development of hypotheses, and then the testing of those hypotheses using scientific experimentation. Clearly, the scientific method reigns supreme with famous researchers. Richard Feynman said, “It doesn’t matter how beautiful your theory is, it doesn’t matter how smart you are—if it doesn’t agree with the experiment, it’s wrong,”⁹ and Einstein commented, “No amount of experimentation can ever prove me right; a single experiment can prove me wrong.”¹⁰ However, there seems to be an acknowledgement that the process is not nearly as tidy as we make it out to be. It is fraught with many incorrect assumptions, wrong ideas, and blind alleys. In addition, when we read a scientific manuscript, we don’t get to read about all of these road blocks and the muck that one had to wade through in order to get to do the work.

IMAGINATION, INTUITION, AND LUCK

It is surprising how significant these creative, humanistic, artistic traits are in guiding a researcher’s ideas. For example, inscribed in metallic letters to the entrance to the Salk Institute, “Hope lies in dreams, in imagination and in the courage of those who dare to make dreams into reality,”¹¹ and John Dewey pointed

out that, “Every great advance in science has issued from a new audacity of imagination.”¹² Jonas Salk commented that, “Reason alone will not serve; intuition alone can be improved by reason, but reason alone without intuition can easily lead the wrong way. They both are necessary.”¹³

With respect to luck, Louis Pasteur understood that somewhere between 33% of 50% of all scientific discoveries are estimated to have been stumbled upon, rather than sought out. To this end he is quoted as saying, “However, chance favors the prepared mind.”¹⁴ In other words, one needs to immerse oneself in the process in order to recognize when that once-in-a-lifetime discovery comes along. Isaac Asimov said it another way, “The most exciting phrase to hear in science, the one that heralds the most discoveries, is not ‘Eureka!’ (I found it!) but ‘That’s funny,’”¹⁵ and then finally, “Scientific research consists in seeing what everyone else has seen, but thinking what no one else has thought.”¹⁶

QUESTIONING IN SCIENCE

While famous scientists and researchers certainly pay homage to their predecessors, for example, a giant such as Sir Isaac Newton commenting that he was “standing on the shoulders of giants.”¹⁷ Questioning in science seems to be the largest gear in the engine, which helps propel the process forward. For example, in *The Ascent of Man*, Jacob Bronowski commented, “It is important that students bring a certain ragamuffin, barefoot irreverence to their studies; they are not here to worship what is known, but to question it,”¹⁸ and Robert Heinlein states, “Everything is theoretically impossible, until it is done. One could write a history of science in reverse by assembling the solemn pronouncements of highest authority about what could not be done and could never happen.”¹⁹

TENACITY

Clearly successful researchers, once they set their minds to a goal, are not easily dissuaded. Louis Pasteur said, “Let me tell you the secret that has led me to my goal: My strength lies solely in my tenacity.”²⁰ Niels Bohr commented, “An expert is a person who has made all the mistakes that can be made in a very narrow field,”²¹ and finally the very famous quote by Thomas Edison, “Genius is 1% inspiration and 99% perspiration.”²² It seems as though Edison was quite a character; he slept very little, and took cat naps during the day. Once when asked about the rules in his laboratory he said, “Rules, hell, there ain’t no rules around here, we’re trying to accomplish something,”²³ and once when asked about results stated, “Results, I have a ton of results, I know a thousand things that don’t work” (probably referring to the development of the light bulb).²⁴

IDEAS

I can’t tell you how many times I have heard someone say, “You know I have this great idea,” or “I thought of that idea first.” Thomas Edison said, “Keep on the lookout for novel ideas that others have used

successfully. Your idea has to be original only in its adaptation to the problem you're working on."²⁵ Sir William Osler stated the same general idea another way, "In science the credit goes to the man who convinces the world, not to the man to whom the idea first occurred."²⁶ Ideas are a dime a dozen. It is what you do with those ideas, how you bring them to fruition, that counts.

KNOWLEDGE

This last quotation by Sir Francis Crick is quite long, but I wanted to read it to you: "By the time most scientists have reached age 30 they are trapped by their own expertise. They have invested so much effort in one particular field that it is often extremely difficult, at that time in their careers, to make a radical change. I, on the other hand, knew nothing, except for a basic training in somewhat old-fashioned physics and mathematics and an ability to turn my hand to new things... Since I essentially knew nothing, I had an almost completely free choice."²⁷

Imagine the new disciplines and domains that Crick had to master in order to become one of the world's first and most successful molecular geneticists. While focusing your energies on a narrow research topic can be crucial to success, it is also important that researchers are familiar with allied disciplines and domains in order to help them understand what they are trying to accomplish and how to best achieve their goal.

So based on what I have presented this morning, here is my description of what scientific attributes should constitute a researcher and member of The Triological Society. The individual should enjoy the creation of new knowledge, and appreciate the mysteries of life and the joy of discoveries. He or she should be a staunch supporter of the scientific method, but should also understand that every researcher is a professional amateur, and that the process of research is often fraught with blind alleys and incorrect ideas and assumptions, and that ultimately, hypotheses must be substantiated by experiments. A researcher must exhibit imagination and intuition augmented by tenacity and scientific questioning. Finally, he or she should recognize that chance favors the prepared mind and should always be on the lookout for novel ideas framed by a comprehension of existing knowledge not just in one domain, but across a broad horizon of disciplines.

Thank you very much for your attention this morning.

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