A Letter to Young Scientists

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Psychological science in the 21st century promises to be quite different from that of the preceding century. During the 20th century, we saw a specialization, differentiation, and development of various approaches, methods, and levels of analysis, producing distinct fields — bounded areas whose borders were defended as the turf within was developed. Research questions were simplified to fit behavioral phenomena into these bounded fields and to bring them into the laboratory under experimental control which permitted careful dissection and analysis.

Contemporary psychological scientists stand on the shoulders of those who went before. From this perch it is now possible to see that the bounded fields of the 20th century are related parts of the same landscape. This is a requisite step for bringing research on pieces of related problems together to address bigger questions and to develop more comprehensive scientific theories. Many of these bigger questions require larger and more interdisciplinary teams than were common in the prior century, and with their assemblage the borders between the different fields of psychology and the boundaries between psychology and other scientific fields have changed. Whereas less than two decades ago the future of psychology as a coherent scientific discipline was questioned, psychology has now emerged as one of the hub sciences, and the societal relevance and impact of serious psychological research is being expounded not only in scientific journals but in the popular media, best-selling books, board rooms, court rooms, and government corridors. The obstacles of geographical boundaries between scientists are diminishing, and the quality of scientific teams is no longer hostage to the quality of the faculty in a particular department, region, or nation. Psychology continues to be one of the most popular undergraduate majors, and among the best and brightest are pursuing graduate degrees and joining our faculties.

In this, my final presidential column, I thought I would write about what I wish for the young scientists in whose hands the future of our science rests. For help with this task, I turned to a letter from Ivan Pavlov (1936) to young scientists published in Science three months following his death at the age of 87. The letter is a mere 301 words long but is full of wisdom.

Pavlov first advised gradualness: “From the very beginning of your work, school yourselves to severe gradualness in the accumulation of knowledge… Never begin the subsequent without mastering the preceding. Never attempt to screen an insufficiency of knowledge even by the most audacious surmise and hypothesis” (Pavlov, 1936, p. 369).

Major scientific advances may be remembered for a single study, but most such advances are the result of programs of research. Gradualness promotes the parsing of a big research question into smaller, tractable series of research questions that ultimately constitute a systematic and meticulous program of research. Moreover, gradualness promotes sufficient attention to the details in each study, from its conceptualization and execution to its analysis and interpretation. The empirical results constitute replicable scientific facts upon which one can solidly build.

Replicable facts are the precondition of worthwhile scientific theory. “Facts are the air of a scientist. Without them you can never fly…But learning, experimenting, observing, try not to stay on the surface of the facts. Do not become an archivist of facts. Try to penetrate to the secret of their occurrence, persistently search for the laws which govern them” (Pavlov, 1936, p. 369).

Scientific theories are not personal possessions even if they are personal constructions. Theories are not delivered truths to be defended against all who express doubt, they are intellectual structures that we create with disciplined imagination to organize and explain a systematic body of evidence, and to help answer questions and solve problems in a given domain. Your ability to develop a coherent theoretical structure that explains a body of evidence is a measure of your cleverness, not the inherent veracity of the theory. Always respect the data, but play with ideas, feel free to be imaginative with ideas, consider alternative conceptualizations, search for the most useful, comprehensive, generative, parsimonious, and falsifiable formulations you can conceive. And when you have succeeded, do it all over again.

Gradualness also makes it simpler to maintain the objectivity and discipline required of rigorous science. A measure of your objectivity is the extent to which you treat confirmatory results with the same scrutiny, skepticism, and search for alternative accounts as you treat unexpected or disconfirmatory results.

Be serious and not at all serious about your science, at the same time, all the time.

For young investigators science can sometimes appear to be a race. The tenure clock is ticking, family obligations may be placed on hold, other labs are closing in on the brass ring you are striving to grasp, the position or esteem one desires is just ahead if only one can reach it in time. But if a scientific career can be thought of as a race, it is an ultra-marathon event, not a sprint. Enjoy the run and, definitely, cultivate a sense of humor.
Easy for someone with tenure to say, but isn’t the tenure clock real? Yes, and no. The threat of “publish or perish” is a myth. It seems to be a well-kept secret, but not getting tenure at one institution does not mean one’s academic options are closed. There also is a first-rate world beyond the walls of academia. Intelligence, objectivity, scholarship, expertise in experimental logic and analytic methods, and skills in oral and written expression are valuable skills, and they are certainly less common per capita outside than inside academia. Every PhD I have known who either did not pursue or did not receive tenure has not only survived but has thrived. Most are paid better and work fewer hours than the average faculty. Scientists, the story goes, sacrifice fortune for fame. It is helpful to remember that well known psychological scientists are a relative unknown compared to even a second-rate celebrity. Yes, we know who Pavlov is, but I suspect that many, many more people know Dr. Phil than Pavlov. Perhaps the best for which we can reasonably strive is to contribute a comparatively anonymous brick to the temple of science with the recognition that the temple will most likely carry the name of a politician or wealthy benefactor. (For more on the public view of psychology, see this month’s Then and Now column on page 31).

As a young scientist, you are part of a larger, remarkable community of scientists, past, present, and future. Integrity in this context is your most precious attribute as a scientist. Given the dearth of external rewards and the superfluity of criticism in academia, it is understandable why the regard of one’s peers is cherished. Such regard can be found in various forms — the acceptance of a paper, the granting of tenure, the receipt of an award, the appointment to an editorial board, the selection of your doctoral

student for a faculty appointment, even the simple recognition by others of you by name. Pursue your work for the contribution it can make to human understanding and for the satisfaction of a job well done, not for the adulation of others. You will never be able to get enough of the latter (or get it for long enough), but the supply of the intrinsic rewards are endless and largely under your control. If the pursuit of these rewards ever does come at the cost of the values and ideals that made a career in science appealing in the first place, you may find that science is reduced in your own mind to a cynical and futile game.

In addition to gradualness, Pavlov (1936) advised modesty: "…always have the courage to say of yourself – I am ignorant" (p. 369). You can certainly learn faster if you do not think you already know the answer. One's best friends in academics are those who care enough they provide more than noncontingent positive regard, they present you with constructive criticism and intellectual challenges that elevate your work to levels you might not have thought possible. With success, one might become immodest, if for no other reason than to create a buffer against future criticisms (as if that would work). But without modesty, Pavlov noted, "…you will be obstinate where it is necessary to agree, you will refuse useful advice and friendly help, you will lose the standard of objectiveness" (p. 369).

Modesty also means that you feel grateful to those who preceded you and set the stage for what is now possible, you feel responsible to those who are to follow in your footsteps to be open and straightforward, and you feel an obligation to give back to science even as you pursue your dreams of success.

Finally, Pavlov advised passion in one's scientific work, recognizing that science is a full-time commitment to a life of the mind. "If you had two lives that would be not enough for you" (Pavlov, 1936, p. 369). Committing yourself to a life of the mind does not mean you are not mindful of your life. For scientific passion to last, the work needs to be fun and it needs to fit within a richer complex of life. Place your passion for science within your passion for a full life. It is true that there are only 24 hours in a day but there are real synergisms, especially for psychological scientists, from pursuing a life of the mind in all life's offerings.

Do not confuse effort with work. People can spend a lot of effort on tasks that are not particularly productive. Spending countless hours in the lab collecting data is not the same as advancing knowledge. Insights and breakthroughs favor the prepared mind but spending a relaxing evening with friends and family, reading a novel, going for a stroll or run or bike ride, working on a piece of art, or getting a good night's sleep can often contribute more to achieving that breakthrough than an endless slog at the benchtop or desktop. A scientific career requires discipline: selecting problems that may be difficult but are worth your pursuit, remaining abreast of ever-changing methodologies and literatures, recognizing and correcting one's biases to approach objectivity, fulfilling professional obligations, reining in the tendency to commit to more than one can provide, and doing all this in a way that contributes to the community of science and to one's life satisfaction.

Teaching and mentoring students, fellows, and young faculty can be one of the real joys of a career in science. By explaining one's work to intelligent, receptive, and inquisitive students and colleagues, you can actually broaden and deepen your understanding of the work. Enjoy the opportunity to teach and work with some of the brightest, kindest, most gracious people, young and old, that you could ever hope to meet.

Above all, pursue what you believe is important throughout your scientific career. Listen to advice and feedback, and perhaps even think about it seriously, but ultimately your career decisions have to be owned by you. This includes the issues raised here. If this column causes you to think, or think a little differently about your scientific career, then I feel like my time has been well spent, but any consequences of your cogitation are uniquely your own. ?

References

Pavlov, I. (1936). Bequest of Pavlov to the academic youth of his country. Science, Vol. 85, No. 2155 (April 17), p. 369.