Dionysians and Apollonians

Wilhelm Ostwald (*1*) divided scientists into the classical and the romantic. One could call them also systematic and intuitive. John R. Platt (*2*) calls them Apollonian and Dionysian. These classifications reflect extremes of two different attitudes of the mind that can be found equally in art, painting, sculpture, music, or dance. One could probably discover them in other alleys of life. In science the Apollonian tends to develop established lines to perfection, while the Dionysian rather relies on intuition and is more likely to open new, unexpected alleys for research. Nobody knows what "intuition" really is. My guess is that it is a sort of subconscious reasoning, only the end result of which becomes conscious.

These are not merely academic problems. They have most important corollaries and consequences. The future of mankind depends on the progress of science, and the progress of science depends on the support it can find. Support mostly takes the form of grants, and the present methods of distributing grants unduly favor the Apollonian. Applying for a grant begins with writing a project. The Apollonian clearly sees the future lines of his research and has no difficulty writing a clear project. Not so the Dionysian, who knows only the direction in which he wants to go out into the unknown; he has no idea what he is going to find there and how he is going to find it. Defining the unknown or writing down the subconscious is a contradiction in absurdum. In his work, the Dionysian relies, to a great extent, on accidental observation. His observations are not completely "accidental," because they involve not merely seeing things but also grasping their possible meaning. A great deal of conscious or subconscious thinking must precede a Dionysian's observations. There is an old saying that a discovery is an accident finding a prepared mind. The Dionysian is often not only unable to tell what he is going to find, he may even be at a loss to tell how he made his discovery.

Being myself Dionysian, writing projects was always an agony for me, as I described not long ago in *Perspectives of Biology and Medicine* (*3*). I always tried to live up to Leo Szilard's (*4*) commandment, "don't lie if you don't have to." I had to. I filled up pages with words and plans I knew I would not follow. When I go home from my laboratory in the late afternoon, I often do not know what I am going to do the next day. I expect to think that up during the night. How could I tell then, what I would do a year hence? It is only lately that I can see somewhat ahead (which may be a sign of senescence) and write a realistic proposal, but the queer fact is that, while earlier all my fake projects were always accepted, since I can write down honestly what I think I will do my applications have been invariably rejected. This seems quite logical to me; sitting in an easy chair I can cook up any time a project which must seem quite attractive, clear, and logical. But if I go out into nature, into the unknown, to the fringes of knowledge, everything seems mixed up and contradictory, illogical, and incoherent. This is what research does; it smooths out contradiction and makes things simple, logical, and coherent. So when I bring reality into my projects, they become hazy and are rejected. The reviewer, feeling responsible for "the taxpayer's money," justly hestitates to give money for research, the lines of which are not clear to the applicant himself.

A discovery must be, by definition, at variance with existing knowledge. During my lifetime, I made two. Both were rejected offhand by the popes of the field. Had I predicted these discoveries in my applications, and had these authorities been my judges, it is evident what their decisions would have been.

These difficulties could perhaps be solved to some extent, by taking into account the applicant's earlier work. Or, if the applicant is young and has had no chance to prove himself, the vouching of an elder researcher acquainted with the applicant's ability may be considered. The problem is a most important one, especially now, as science grapples with one of nature's mysteries, cancer, which may demand entirely new approaches.

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4. L. Szilard, personal communication.

Science Education

Beall (Letters, 14 Jan., p. 123) criticizes the destructively excessive high school science assignments since Sputnik. This criticism also applies at the undergraduate and graduate levels, particularly in medical schools. The amount of material to be covered in science courses, more often in the quarter rather than the semester system, seems to be just about what an intelligent, strongly motivated, energetic, well-organized, perpetually healthy student to whom science comes easily can assimilate while retaining his sanity.

The response of educators during the ill-fated surge of interest in science of the past decade has generally been to pour it on, as though learning, like athletics, benefited from regular exercise to the point of exhaustion. The answer to the continuing information explosion should not be just an additional course in speed-reading, but rather a reduction and distillation of the material considered essential. Judicious pruning of requirements should be a prime objective of all educators. Many of us never discard anything, and our academic attic is becoming hopelessly cluttered. We must discard on a one to one basis as new additions are made. Unless some major changes take place soon, science may become unteachable.

Unfortunately, there is little incentive to reduce the material designated as "necessary." Such reduction would lead to shorter courses, less faculty, and, ultimately, loss of departmental identity and strength. It behooves each department to sell as much "absolutely required" material as the administration will swallow.

Expansionism has, for most students, made science a tedious, inaccessible, discouraging discipline that seemingly can never be encompassed. If I were today confronted by the herculean task of learning undergraduate science, I seriously doubt that the sense of wonder which carried me through undergraduate school 30 years ago could lift me over the barricades erected by modern educators who feel compelled to require that every detail of their field be crammed into the hapless and often numb student.

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