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EDITORIAL

The Koshland Years—A Decade of Progress

When Dan Koshland began his editorship of this magazine, Science was already the leading weekly journal of science and brimmed with innovative features that had been initiated by his predecessor, Philip H. Abelson. Not only did Science promptly publish original science of general interest and high quality, but its News & Comment section provided readers with information about developments in science policy and funding in an era when federal support for U.S. science seemed only to grow and grow, and its Research News section helped scientists follow and comprehend breakthroughs in fields outside their own.

All this is to say that the seeds of many of the features that make up today's Science were planted some time ago. Under Koshland, these seeds have sprouted even greater diversity while the publication process has been accelerated and the high quality maintained. This extraordinary achievement has largely been credited to a Koshland innovation, the Board of Reviewing Editors, composed of active scientists who review submissions in their fields on a regular basis and appraise them for the potential of breadth, interest, quality, and potential importance to the progress of science. From these ratings, the top 40% of papers are sent for in-depth reviews, permitting 60% to be returned quickly to authors who will submit them elsewhere.

Not satisfied with improving the review process, Koshland expanded the editorial landscape. “This Week in Science” summarizes an issue’s original research papers for the general reader, in order to transmit the impact of the research to those who lack special disciplinary expertise. “TWIS” has by now grown so familiar to our readers that some may not have noticed when competing journals recently began to copy it. Policy Forums, Perspectives, Random Samples, ScienceScope, and the Molecule of the Year have all blossomed during the Koshland era. The News section, which reader surveys have shown to be one of the most popular sections of the magazine, was moved from the front and provides enhanced coverage of our own scientific papers and of those from the world of scientific meetings and workshops.

This week’s issue on plant biotechnology is an example of the special issues on scientific frontiers that Koshland began. And under Koshland the news team has pioneered highly popular special sections on careers, scientifically active countries, and important, current scientific controversies.

For the past 3 years, Koshland has led an intensified effort to extend Science’s coverage across national boundaries to the entire world. In 1993, Science opened an office in Cambridge, UK. In addition, Koshland encouraged the use of science journalists located across the globe to bring the world’s science policy and research to our readers quickly. Seventy different reporters augmented the core staff last year alone.

But the mainstay of the magazine has remained its fabulously broad coverage of excellent original scientific research. The modest growth in the number of pages of original science published in our Reports section (around 1500 pages per year in 1985 to around 2300 in 1994, of which some 530 pages were from international authors) pales in comparison with the more than 10-fold growth in the global research enterprise. The relative constraint on the number of scientific articles Science can publish means that the standards by which papers are deemed acceptable for publication have also escalated. Yet the intent has been not merely to publish the most important advances in the hot fields, but also to find the new fields that will drive the science of the future.

The winner’s circle of papers accepted has therefore grown at a relatively frugal rate, while the desire to be among the chosen few has led to continued growth in the number of papers submitted, amounting to more than 6200 in 1994. Moderating this nuclear reactor of highly competitive science is a cadre of highly professional, scientifically trained editors personally selected by Dan Koshland. With their assistance, the magazine we hold today is a tribute to Koshland’s vision of what this scientific journal can be and how it can best serve its readers, be they scientists themselves or observers of the scientific scene. When one realizes that Koshland has remained an active laboratory scientist throughout this period, publishing nearly 100 original peer-reviewed papers alongside his more than 200 editorials, his string of accomplishments remains an unequalled scholarly achievement. As Mark Twain said, “Few things are harder to put up with than the annoyance of a good example.” This new editor recognizes that his work is only beginning.

Floyd E. Bloom
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MUSICAL ABILITY

The report by Gottfried Schlaug et al. (3 Feb., p. 699) regarding the enlargement of the left planum temporale in professional musicians, and especially those with absolute pitch, provokes many thoughts. Absolute pitch, while extremely rare in the general population [its incidence has been estimated as 1 in 10,000 (1)], is relatively common among professional musicians, and to a limited extent [as is also suggested by Schlaug et al.’s magnetic resonance images (MRIs)] may serve as a marker for musicality. But as N. Slonimsky, in his autobiography, Perfect Pitch, writes (2) the lack of it does not exclude musical talent, or even genius. Neither Wagner nor Tchaikovsky had absolute pitch, while a legion of mediocre composers possessed it to the highest degree.

There is a greatly heightened occurrence of absolute pitch in some other populations: among the autistic the incidence may be about one in 20; and among those with savant syndrome, more than a third have musical gifts—and all musical savants, apparently, have absolute pitch (3).

A comparable incidence seems to exist among individuals with Williams syndrome—a syndrome which predisposes to hyperacusis and exceptional development of auditory, musical, and verbal skills, combined with striking visual and conceptual deficits. Current neuromorphological studies show a relative enlargement of primary auditory cortex (Heschl’s gyrus, A1) in subjects with Williams syndrome (4). It would be worthwhile to extend high-resolution magnetic resonance morphometry to studying the planum temporale in these special, musically gifted but disabled populations.

The extremely precarious appearance of absolute pitch, which tends to manifest itself full-blown before the age of five, its relative isolation from conceptual, verbal, or even general musical powers (it may indeed interfere with musical enjoyment and performance), and its remarkable incidence in individuals with neurodevelopmental disorders such as Williams syndrome and autism all suggest that it is a “savant” talent. Savant talents, in their functional isolation, their autonomy, and their independence of training or practice, seem to be rather different in character from “normal” talents. It has been hypothesized by Lynn Waterhouse (5) and others that such talents may be dependent on the development of a specialized focal neural network or “neuromodule.” One must wonder whether the presence of such a neuromodule is being demonstrated in the MRIs done by Schlaug et al.

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References

Response: Sacks argues that the exaggerated leftward asymmetry of the planum temporale found in musicians with perfect pitch may also underlie perfect pitch as a “savant talent” in disabled persons. Although his comments are speculative, they may help to form new concepts for a neuropsychology of special talents, in particular because planum temporale asymmetry in humans has been shown to reflect asymmetrical development of nonprimary auditory cortices (1).

In spite of the fact that Sacks’s suggestions are germane to our work, we are somewhat reluctant to compare savant subjects with gifted musicians. In contrast to sa-
vants, the subjects included in our study exhibited average or above average intelligence and exceptional musical skills, with no apparent deficits in other cognitive functions. Furthermore, our subjects did not exhibit either of the two poles of aberrant social behavior, such as the extreme sociability of Williams syndrome patients or the withdrawal of autistic savants. Also, savants are more compulsive in pursuing their special abilities than are normal musicians. Thus, savants demonstrate patterns of psychosocial functions that are different from those of the musicians we studied, making a comparison difficult.

Nevertheless, a thought-provoking hypothesis implicit in Sacks’s comment would be that special talents may be a result of the asymmetrical development of specialized “neuromodules.” This hypothesis, which is compatible with our study and with the work of others (2), is intriguing and testable, at least in the case of perfect pitch.

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References

World Wide Web and Molecular Biology

Bruce R. Schatz and Joseph B. Hardin (Articles, 12 Aug. 1994, p. 895) write, “The revolution of the Net is just beginning.” This may be so, but of critical importance to many researchers—especially biologists—is the fact that the Net, and the World Wide Web (WWW) set of protocols in particular, are of immense utility now. For example, every molecular biologist could make fruitful use of the WWW GenBank/Entrez (1). A collection of nearly all biosciences WWW information servers is maintained by Keith Robison at Harvard (2).

At a most fundamental level, these network resources are equivalent to storing current databases locally, but without consuming resources. In addition, most facilities provide additional features; for example, WWW Entrez includes links to images and coordinates of proteins whose structures have been solved. A single Web viewer can provide a simple interface that embodies many of the complex features of sophisticated database access and analysis systems. Moreover, the WWW is indeed worldwide and encourages links between databases. The paragon of this connectivity is the Sequence Retrieval System (SRS) (3), which interlinks some two dozen databases. It has, in essence, merged many of the major biological databases of the world into one comprehensive structure.

Another major feature of the WWW is the ease with which complex, hierarchical data structures can be made accessible and intelligible. The ability to separate different levels of information has caused the network version of FlyBase (4) to virtually supplant the Red Book (5). Similarly, a number of model organism databases using ACEDB (6) have been made available on the WWW (7). Although WWW implementations currently lack ACEDB’s powerful visualization tools (for example, for viewing and modifying sequences), stan-

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standardized protocols and display systems can work surprisingly well, even with specialized information. One is not always tied to the generic viewers, though; for example, a server at the National Institutes of Health (8) will rotate a protein structure into a prepared conformation and send it to an interactive molecular viewer on a user's personal computer.

The convenience and utility of microcentrifuges, thermocyclers, and other molecular biology tools are greatly enhanced by standard size tubes. Information resources will soon become as crucial to biological research as those devices are today. Likewise, they need common access standards. Networked databases with complex, independent annotation are already beginning to provide students and researchers with previously unimaginable fingertip access to comprehensive and coherent views of known biology.

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Responses

Response: We thank Brenner for his excellent brief summary of how the Net has revolutionized molecular biology. The speed with which biology databases simply “came up,” first with Gopher and then with Mosaic/WWW, is perhaps the most striking illustration of the power of the new computer tools. An earlier version of our paper contained a section with biology examples but, because of space limitations, the published version only mentioned how research systems such as the Worm Community System (WCS) might lead to a new branch of science where analysis environments make possible using the Net as a “dry lab.”

It should also be noted that new features of Mosaic mentioned in our paper illustrate the forthcoming era. The Common Client Interface (CCI) complements the Common Gateway Interface (CGI) and enables external viewers (visualization tools) to be not only invoked but interacted with. For example, the Net database federation prototype ENQuire (1) uses Mosaic to emulate such WCS functionality as following a link from a literature document to a gene description to a separate genetic map display to a sequence record. Finally, digital library technology is developing new architectures that will fully support analysis environments, with such features as recording navigation paths [see the Illinois Digital Library project (2) and, in particular, the next-generation system called the “Interspace” (3)]. Since the realization of these architectures lies in the (near) future, the revolution of the Net is indeed just beginning.

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1. http://csl.ncsa.uiuc.edu/ENQuire

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Darwin in the Headlines

I enjoyed Richard A. Kerr’s article about support for punctuated equilibrium (Research News, 10 Mar., p. 1421), but the accompanying headline—“Did Darwin get it all right?”—is a bit problematic for those of us who deal regularly with the continuing evolution-creation controversy. It is virtually certain that this headline soon will reappear in creationist literature, accompanied by assertions that Darwin was completely wrong and that evolution theory therefore is bankrupt. It matters not that the article says nothing of the kind, that research on punctuated equilibrium occurs within a solidly Darwinian framework, or that debates about the mode and tempo of evolution demonstrate the nature and methods of science and the differences between science and religion. Creationists will distort the headline to meet their needs.

This headline is reminiscent of one from some years back, when Science covered a meeting at Chicago's Field Museum of Natural History, also devoted to the debate about gradualism and punctuated equilibrium (R. Lewin, Research News, 21 Nov. 1980, p. 887). The headline, “Evolutionary theory under fire,” provided a gold mine for subsequent creationist propaganda.

I do not propose editorial censorship, but I suggest that a journal representing an organization of some 130,000 scientists be a bit more judicious in its choice of headlines. I realize that such headlines are intended to attract readers, but they should not have the subsidiary effect of providing support for those whose views are antithetical to science and reason.

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The headline “Did Darwin get it all right?” refers to punctuated equilibrium in evolution. But Ernst Mayr (1) has “partitioned Darwin's evolutionary paradigm into five theories.” They are (i) evolution as such, the theory that the world is steadily changing and that organisms are transformed in time; (ii) common descent from a single ancestor; (iii) multiplication of species, the origin of organic diversity; (iv) gradualism; and (v) natural selection. Only the fourth of these theories relates to punctuated equilibrium. The “punctuations” are actually fairly long periods. The time cited by Kerr is "less than 160,000 years"; Niles Eldredge and Stephen J. Gould (2) cited 100,000 years. Darwin's other four main precepts are unaffected, and a punctuation of 100,000 years might be time enough for evolutionary changes to take place in bryozoa.

References


No Perpetual Motion Machine

John Travis’s Research News article “Making light work of Brownian motion” (17 Mar., p. 1593) should not be misinterpreted as saying that the “optical thermal ratchet” invented by Albert Libchaber and his colleagues extracts energy from Brownian motion. While Brownian motion is an important component of Libchaber’s arrangement, it is the force of the light on the bead that does the work. No energy is extracted from the thermal noise. A perpetual motion machine has not been invented.

In fact, a more efficient system for moving the beads around the circle is evident. Rather than turning the ramped intensity on and off, one could just rotate the ramped intensity in the desired direction. The beads would then move to the intensity peaks and be dragged along with the rotation. This would be more efficient in that none of the particles, once pulled to the peak, would wander backward and lose the ground already gained. In this arrangement, the asymmetry of the ramp would also be unnecessary.

Nature, however, is not always able to “rotate the ramp,” hence the importance of the “optical thermal ratchet” work.

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An Ominous Blooding?

Many nations have fewer restrictions on unreasonable searches than does the United States. For example, blood analysis from a large cohort can be of significant forensic import. A recent example may be that in St. Mellons, Cardiff, Wales. A tragic rape and murder of a 15-year-old girl has stirred a drive for a “voluntary” citizen sampling of 2000 persons.

The molecular analysis of blood has advanced briskly in the hands of scientists in search of facts. The polymerase chain
reaction technique alone has won a Nobel prize. There are Nobel prizes for those who work for freedom of peoples as well. With a tube of blood, we can match DNA with a reasonably low chance of error. We can also test blood for genes, viruses, drugs, alcohol, medications, and more substances every day. Blood analysis can be a more precise tool than a strip search. It can become a tool that can be used to improperly invade the privacy of mass populations of innocent individuals.

Someone in early pregnancy, on the birth control pill, just out of a pub in Cardiff, or carrying any number of viruses could be singled out and embarrassed by such tests. We should be aware of their potential for stigmatizing these innocent individuals.

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Corrections and Clarifications
Discrepancies appeared between the Perspective “Springs for wings” by R. M. Alexander (7 Apr., p. 50) and the report “Muscle efficiency and elastic storage in the flight motor of Drosophila” by M. H. Dickinson and J. R. B. Lighton (7 Apr., p. 87). Substantial changes were made in the report after its submission: the original calculations of inertial power overestimated elastic storage and so precluded direct calculation of muscle efficiency. Revised calculations of inertial power resulted in greatly reduced estimates of minimum elastic storage and a direct calculation of muscle efficiency. Because of an oversight, these changes were not communicated to Alexander, who based his Perspective on the original manuscript. Science regrets the error.

In figure 3A (p. 1961) of the Research Article “Architectures of class-defining and specific domains of glutamyl-tRNA synthetase” by O. Nureki et al. (31 Mar., p. 1958), the labels for the ribbon diagrams showing the folding of Thermus thermophilus glutamyl-tRNA synthetase (GluRS) and glutaminyl-tRNA synthetase (GlnRS) were inadvertently interchanged. The diagram for GluRS appeared at the top, and that for GlnRS appeared at the bottom.

In table 1 (p. 1124) of the article “Prehistoric extinction of Pacific island birds: Biodiversity meets zooarchaeology,” by David W. Steadman (24 Feb., p. 1123), the column headings for modern and fossil record were reversed; under each island name, the letters “F M” should have appeared.

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33. A667.3 first produced PW flowers, which were pollinated. After fruit harvest, it was pruned just below the first flowering node (approximately 20 nodes above the base of the plant). In petunia, each node has a single leaf and in the axil of each leaf is a dormant axillary shoot. Pruning releases axillary shoots from dormancy.

34. Backcross progeny of basal branches produced many P and few PW plants. PW plants often exhibited vein-based patterns (Fig. 1), and IM plants possessed both vein and junction influences (Fig. 1K). Many more progeny of the upper branches were fully purple (Table 2) than are usually observed in CS41. PW plants that did not exhibit such instability (as in Table 1) and vein-based sectors (as in Fig. 1K) were common, indicating that A667.3, although phenotypically PW, was already in a new state that permitted its further change to new purple and patterned states. These purple and vein-patterned states were transmissible to a second backcross generation (32).

35. These changes were observed in plants grown from rooted cuttings of the three revertant branches. Each branch produced a plant with a different pattern. Two distinct classes of vein-based patterns were produced: sharply pointed tips (as in Fig. 1, K and L) by branch A and rounded tips (Fig. 1N) by branch C. The junction-based PP pattern JPP (Fig. 1M) was produced by branch B. Each was stably maintained during subsequent plant growth. Progeny of these two vein-based pattern states were almost exclusively purple, indicating full progression to the purple state, whereas progeny of the JPP pattern state were essentially the same as for any plant exhibiting that pattern, which indicates full reversion to the original interconvertible pair of PP and PW junction pattern states (Table 2).

36. This cross produced three epigeneotypes: (i) hemizygous for T-CHS41, a transgene deriving from the white parent (W-); (ii) hemizygous for T-CHS41, a transgene deriving from the purple parent (P-), and (iii) "homozygous" for T-CHS41, each parent contributing one allele (W/P). In outcrosses to V26, W-plants yielded progeny with patterns in the ratios typical of such plants, whereas P-plants produced mainly purple progeny as well as a few PP progeny, but no PW progeny. W/P "homozygotes" (which were always white-flowered, as might be expected from the gene dosage effect), in an outcross to segregate the two transgene alleles, yielded mostly fully purple progeny, many PP progeny, and few PW progeny. After correction to remove the 50% purple progeny whose transgene derived from the purple grandparent, it was seen that nearly half of the progeny receiving the transgene from the white grandparent were purple and most of the rest had the PP phenotype. The results are consistent with the possibility that the purple state is a stably transmitted epiallele of the transgene and the white state is a paramutable epiallele of the transgene.


38. In the second and third backcross (BC2 and BC3) generations, the predominantly purple state of the junction pattern (JPP) and the predominantly white state of the junction pattern (JPP) were equally likely when averaged over multiple populations (Table 1). However, individual populations deviated substantially from this average. Some populations produced over 90% JPP patterns and some produced over 90% JPP patterns. Different plantings of seed from the same fruit frequently resulted in significantly different frequencies of the two patterns.


42. For review, see (19).

43. Regeneration from tissue explants grown in culture often yields plants with heritable epigenetic changes. Alterations in the 41P/P genotype were induced at high frequency by regeneration of adventitious shoots on leaf explants (19).

44. I thank C. Napoli and J. Harding for space, encouragement; J. Bedbrook, Florigene BV, and DNA Plant Technology Corp. for permitting use of transgenic plants; and X.-M. Sha, G. Shariat, W. Bonnes, and F.-C. Tang for technical assistance. Supported by U.S. Department of Agriculture NRICGP grant 92-37301-7597.
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