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Figure 1 shows two examples of *in vitro* amplification reactions that are significantly enhanced by the addition of Perfect Match polymerase enhancer to the polymerase preparation. Note that in lanes 1 and 2, the desired PCR product cannot be detected unless Perfect Match polymerase enhancer is added to the amplification reaction. In lanes 3 and 4, Perfect Match polymerase enhancer not only increases the intensity of the desired amplification products, but dramatically reduces the background artifacts generated by non-specific priming events.

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Figure Legend: A photograph of a 1% agarose gel stained with ethidium bromide representing reaction products from PCR amplifications using the GeneAmp™ Kit† from Perkin-Elmer Cetus according to manufacturer’s instructions. The reactions were conducted with (lanes 1 and 3) and without (lanes 2 and 4) the inclusion of 1 unit Perfect Match polymerase enhancer. Lanes 1 and 2 represent 100 ng of human genomic DNA amplified with two 26-mer primers separated by 1400 nucleotides. Lanes 3 and 4 represent 100 ng of mouse genomic DNA amplified with two 23-mer primers separated by 550 nucleotides.

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The American Association for the Advancement of Science was founded in 1848 and incorporated in 1874. Its objectives are to further the work of scientists, to facilitate cooperation among them, to foster scientific freedom and responsibility, to improve the effectiveness of science in the promotion of human welfare, to advance education in science, and to increase public understanding and appreciation of the importance and promise of the methods of science in human progress.
Cover  Containment of elevated concentrations of the ClO free radical (shown in green) in the stratosphere above the Antarctic continent occurs within the wind jet generated by cooling during the austral winter night. Isolation of the vortex, that region poleward of the wind field maximum, is an important element in the case linking chlorofluorocarbon release to ozone destruction over Antarctica. See page 39. [Artwork by Joseph Spatola]

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New Year’s Resolutions and Future Shock

As I sit down to the momentous task of preparing my 1991 New Year’s resolutions, it occurs to me that modern science has made obsolete many of the maxims by which sincere and conscientious people such as myself have guided our lives. Although scientists are expected to alter the technologies of nutrition, communication, locomotion, and the like, we assume that the homilies identified with personal rectitude and moral uplift will remain inviolate. Yet viewed against the advances in society, these homilies become testimonial to the rapidity of change.

“Don’t count your chickens before they’re hatched.” The modern chicken will have been analyzed by ultrasound and amniocentesis, will have had its sex determined and its DNA sequenced. It will not only have been counted but discounted before it is hatched.

“It’s not over until it’s over.” Of course, most things are over long before they’re over.

Elections, for example. The pollsters are now able to predict every aspect of campaigning, from the type of television commercial that will change voters’ minds to how they will vote on election day. Soon or later, we will save a great deal of money by simply eliminating elections.

“Speak softly and carry a big stick.” The updated version of this old maxim would certainly be, “Speak into the microphone and carry an AK47.” The congressional version is, “Speak loudly and notify everyone you won’t use the stick.”

“Neither a borrower nor a lender be.” People who do not have plastic cards and mortgages, and who have not invested in some go-go get-rich-quick scheme, are certain to spend their lives paying taxes, sending their children to school, and fading into that unrecognized middle known as the backbone of America. In an up-front society, backbones never get mentioned.

“Beauty is in the eye of the beholder,” can be modernized to, “I’ve never seen a billboard I didn’t like.”

“Eat, drink, and be merry, for tomorrow we die.” It is of course important to keep eating and drinking, but no one can be merry about it, because we now know that food and drink are filled with carcinogens, teratogens, and fat. Since life expectancy keeps steadily going up, “tomorrow” is obviously interpreted as sometime between 114 and 116 years old. While you can plan on living longer, you should be extremely morose about it, and point out that the bibronic plague was trivial compared to the trials of those dying of Alar in apples and the red dye in maraschino cherries.

“Don’t shoot until you see the whites of their eyes.” In a world with launch-on-warning missiles and satellite snooping, by the time you see the whites of their eyes the fat lady is singing.

“Plus ça change, plus c’est la même chose.” That is generally regarded as a tranquilizer, which implies that technology changes but human nature remains invariant. But even that’s no longer true. In an era of computers, DNA sequences, nuclear missiles, and population explosions, the relationships between human beings are changing. The follies of the past—prejudice, chauvinism, exploitation, complacency—have different faces in a crowded and technologically advanced world. Modern science is providing us with the knowledge about our environment and ourselves that may teach us to avoid those follies, but whether we are willing to use our new knowledge of human motivation is not clear. Sometimes that knowledge leads to politically unpopular conclusions, such as the urgent need to find alternatives to fossil fuels. Everyone is for fuel efficiency. No one is in favor of restrictions on building locations to make mass transportation economically feasible. Then the temptation is to give moralistic reasons for avoiding harsh reality. The “right to have a house where I want it” and the “right to drive to work” are great moral and conflicting policies.

The good solution may be labeled “scientific,” implying that the cold-blooded brain is at work, and the easy solution may be called “humane,” implying that the caring and empathetic heart is making the decision. In the long run, however, facing scientific facts may be more humane than clinging to comforting anachronisms.

So perhaps there is at least one proverb that has not been changed by time: “Necessity is the mother of invention.” Let us, therefore, guide ourselves in 1991 so that we can have the will to recognize the necessity and the resourcefulness to provide the inventions.

—DANIEL E. KOSHLAND, JR.
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Workshop participants will explore in depth various minority perspectives on science and technology, how they compare to prevailing perspectives, and the different influences that these perspectives can have on scholarship, individual practices, and policy decisions regarding science and technology. The workshop will also review important theoretical work and research methodologies in ethics and values research, as well as publishing outlets and resources that can help support scholarship in this field.

While persons of any minority group may apply, preference will be given to applicants from the following groups: Asian/Pacific Islander, Black/African-American, Hispanic/Chicano/Puerto Rican/Latino, or Native American/American Indian. Persons with an advanced degree in any field of science, engineering, medicine, law, or the humanities may apply. Participants will receive expenses for travel to and from the workshop, and for accommodations and meals.

For further information or to request an application form, contact A. Crumpton, Directorate for Science and Policy Programs, AAAS, 1333 H Street, N.W., Washington, D.C. 20005; (202) 326-6798.

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For a complete program and a registration form, see any of the following issues of Science magazine: 19 October, 26 October (insert), or 7 December; or write to AAAS Meeting Promotion Dept., Room 815, 1333 H Street, NW, Washington, DC 20005.
Rehabilitation for Burt?

Two British scholars—apparently unbeknownst to each other—have reassessed the famous “Burt scandal” and come up with a surprising conclusion: British psychologist Sir Cyril Burt, whose work on the genetics of IQ stirred fierce antagonsism and, ultimately, allegations of fraud, may have gotten a bum rap.

Burt, who died in 1971 at the age of 88, was a pioneer in the use of twins to explore the heritability of IQ. In the mid-1970s, however, scholars began to question the authenticity of his data, and an exhaustive 1979 biography by Leslie Hearnshaw seemed to clinch the case that Burt had fabricated much of his work.

Now, however, two new books have entered the fray: *The Burt Affair*, by psychologist Robert B. Joyson of the University of Nottingham, and *Science, Ideology, and the Media: The Cyril Burt Scandal*, by sociologist Ronald Fletcher of Reading University. According to psychologist Arthur Jensen of the University of California at Berkeley, who has reviewed both works in a chapter for an upcoming book on research fraud, both scholars conclude that the evidence against Burt does not fully substantiate accusations of fraud.

Many of Hearnshaw’s charges against Burt were based on second-hand information, the authors write, much of it from people opposed to Burt and his ideas. Furthermore, while Hearnshaw said all data reported by Burt after 1955 were fraudulent, the authors believe that the data had been collected earlier and mislaid during wartime moves. Much of Hearnshaw’s credibility is based on his access to Burt’s diaries, but Joyson and Fletcher found that the diaries add little to the picture.

Jensen, a Burt admirer who was among the first to raise questions about the psychologist’s data (see *Science*, 26 November 1976, p. 916), says that although some people have always felt Burt was unjustly condemned, “I myself was quite convinced by Hearnshaw’s biography.” Now he says he thinks Hearnshaw’s conclusions are open to “reasonable doubt.” Psychologist Robert Plomin of Pennsylvania State University also finds Joyson’s argument “convincing.”

Not so, says Northeastern University psychology chairman Leon Kamin, a vocal critic not only of Burt, but of IQ heritability studies in general. Kamin admits that much of Joyson’s work is sound, but says the author has postulated so many “plausible explanations” for anomalies in Burt’s data that he “seems to stretch credibility beyond the point where a sensible person would want to go.”

Whatever the final verdict, Plomin notes, it will not matter for science since Burt’s conclusions are in line with subsequent research. “The point,” he says, “is that a distinguished scientist may well have been unjustly condemned.”

Science Money Woes in the U.S.S.R.

Academician Roald Sagdeev feels like a U.S. citizen these days. The former Soviet space program guru—turned Gorbachev arms control adviser, then elected member of the Congress of People’s Deputies—now spends 80% of his time teaching at the University of Maryland. But he still worries about his homeland and, in particular, the sorry state of its science.

At a seminar at George Washington University last month, Sagdeev noted that top scientists are leaving the Soviet Union in droves, and predicted that those who stay “will become beggars.” The danger, he says, is that the central government will have no funds for anything besides national defense and essential bureaucratic functions once the restive republics get done stripping it of its powers. And the republics, faced with critical shortages, will be less than eager to divert funds from, say, food supplies to research.

Sagdeev believes the government will be forced to create a national research funding pool and give each republic a vote in the allocation of science rubles. But he predicts that the result will be like Europe’s space program, limited in size and fragmented by parochial interests. He illustrated the point with a parable about the European Space Agency. One day, he said, delegates were debating the funding of an advanced meteorological capability when “the Spanish delegate got up and said, ‘We won’t vote for it: the weather in Spain is always fine.’ Then the Dutch delegate rose: ‘We won’t either, because the weather in Holland is always terrible.’” The result of this “democracy,” according to Sagdeev, is a European space budget that is an order of magnitude smaller than the U.S. budget. That’s exactly what he fears for the U.S.S.R.

NASA’s Wish List

Having successfully launched three shuttles in a row since October, NASA’s confidence is running high. Just how high can be seen in the agency’s new shuttle manifest, released last month. The agency plans to launch 7 flights this year, 8 flights in 1992, and 12 in 1993. The fleet will be bolstered by the addition of the new orbiter Endeavor, scheduled to fly in May 1992. Is this schedule realistic? Thanks to persistent hydrogen leaks that grounded the fleet last summer, NASA launched only six shuttles last year.

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**Units of measure.** Use metric units. If measurements were made in English units, give metric equivalents.

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This is 7-point type.

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Tables should be typed double-spaced and numbered in the order of citation in the text; each table should be on a separate page and have a brief descriptive title as the first sentence of the legend. Three horizontal lines are used: at the top and at the bottom of the table and between the column headings and the table body. Vertical lines are not used between the columns.

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Meeting of the Society for Neuroscience, Anaheim, CA, 10–15 October 1984. Sponsoring organization should be mentioned if it is not part of the meeting name.

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Fig. 7. Dynamic focus correction in spot-scan images. Two spot-scan images of the same specimen tilted at $45^\circ$ were recorded, with the focus correction switched on in (A, B, and C), and off in (D, E, and F). Optical transforms from the same areas of the two micrographs are shown (A and D, area at top of micrograph; B and E, middle; C and F, bottom).

pattern still compensates for the defocus gradient as before. The benefit of dynamic adjustment is that the defocus value can be kept within a range such that the spatial coherence envelope function (9) does not take too severe a toll on the signal (contrast) at high resolution.

In this context, the use of higher accelerating voltage should be advantageous in reducing the defocus change across the small spot. The shorter electron wavelength should allow formation of a smaller spot and, at the same time, increase the depth of field.

**Conclusion**

In high-resolution imaging of specimens that are sensitive to damage or charging, spot-scan illumination can provide an important improvement over conventional illumination. This finding has been confirmed in several laboratories where spot-scan methods have been implemented with a wide variety of organic specimens. Although the best conventional images may be of the same high quality as the spot-scan images, the conventional yield of very good images has been painfully low. In other cases, spot-scan images provide resolution that is unattainable with conventional illumination. Much of our work in electron crystallography and other high-resolution studies has been limited by the low $S/N$ ratio in the image. The ability that spot-scan imaging provides to obtain images reliably and routinely with nearly the theoretically full $S/N$ ratio represents a major advance in the case with which structural studies can now proceed.

**REFERENCES AND NOTES**

27. This work was supported in part by the Office of Health and Environmental Research, U.S. Department of Energy, under contract DE-AC03-76SF00098 and by NIH research grant PO1-GM36884. Polyethylene specimens were kindly provided by D. Vesely, PhoE porin by B. Jap, light-harvesting complex by W. Kuhlbrandt, TMV by D. L. D. Caspar, and polyisoprene by A. J. Heeger.
Abbreviations for the amino acid residues are A, Ala; C, Cys; D, Asp; E, Glu; F, Phe; G, Gly; H, His; I, Ile; K, Lys; L, Leu; M, Met; N, Asn; P, Pro; Q, Gln; R, Arg; S, Ser; T, Thr; V, Val; W, Trp; and Y, Tyr.

31. P. A. Karplus and J. R. Herriott, in Flavins and Flavoproteins, V. Massey and C. H. Williams, Jr., Eds. (Elsevier/North-Holland, New York, 1982), pp. 28–31. Figure 2 of this paper shows electron density for enzyme-bound NADPH.
38. G. L. Ulrich and J. L. Markley, paper presented at 9th International Conference on Magnetic Resonance in Biological Sciences, Bendor, France, 1980. Actually two phosphate or sulfate ions appear to be bound in the crystal, one near His98 and one near Arg238 where the 2'-phosphate of 2'-phospho-AMP binds.

Many readers will be aware that research on the squid giant axon provided the foundation for our current understanding of many roles played by ion channels in regulating activities of living cells. Few life scientists, including squid specialists, however, are likely to appreciate the range and number of basic discoveries that also have stemmed from research on squid and its cephalopod cousins, the octopus and the cuttlefish. Much of this work has utilized the giant axon system to provide insights into active transport of ions and metabolites across cell membranes, microtubule-based organelle transport, and synaptic transmission, but there have been numerous contributions in other areas as well, such as heme-cyanin-based oxygen transport.

This broad body of work is emphasized in a unique way in the 22 papers that constitute Squid as Experimental Animals, the long-overdue follow-up to Guide to Laboratory Use of the Squid published in 1974 by the Marine Biological Laboratory at Woods Hole. Each chapter is written with two goals: to review the scientific results in a particular area of research and to provide a concise, practical summary of the relevant experimental techniques. Thus, this book is intended to serve both as an up-to-date information source about cephalopod biology and as a sophisticated laboratory guide.

In both of these capacities, Squid is a success. Divided into six major sections, the new book covers a broad spectrum of squid biology, with major emphasis on nervous and cell-biological aspects of the giant axon and sensory systems. Most of the chapters hit the intended mark and are well written, comprehensive, and richly documented with references. As in any collection there are, of course, both highlights and disappointments.

In Evolution, History and Maintenance (part 1; four chapters), a fine chapter on maintenance, rearing, and culture discusses important problems involved in ensuring a supply of healthy animals and the advantages of alternative cephalopod species for particular research needs. The two chapters that make up Mating Behavior and Embryology (part 2) add little information beyond that appearing in the 1974 guide. Neural Membranes (part 3; five chapters) includes a wealth of detailed technical information for those interested in pursuing classical approaches (internal perfusion/dialysis and voltage clamp) to giant axon and synapse physiology. One chapter introduces the "cut-open axon" to modern patch clamp techniques in an elegant way. Cell Biology (part 4; five chapters) features some solid chapters devoted to the cytoskeleton and axoplasmic transport, lipid metabolism in the nervous system, and isolation of synaptosomes from the brain. Sensory Systems (part 5; three chapters) provides a nicely balanced treatment of structural, functional, and developmental aspects of the visual and statocyst systems. Finally, Integrated Systems (part 6; three chapters) sports the chapter "Squid as elite athletes: locomotory, respiratory, and circulatory integration," an intriguing account of the squid's high-speed, jet-propelled life style and the challenges it imposes.

The only real problem with Squid is the seemingly arbitrary choice of topics. Obviously, all areas of squid experimental biology could not be covered, and the editors excuse the omissions with "lack of space." Judicious editing could have generated a good bit of space, however. For example, some experimental methods are described in unnecessary detail and some appear redundantly—there are no fewer than four treatments (15 pages total) of how to remove the giant axon from Loligo pealei. More significantly, several chapters do not seem appropriate for a work of this sort. While it may be amusing to learn the details involved in the naming of L. pealei, this information could have been profitably replaced by material designed to increase the utility of the volume to new students of the squid, such as a good basic description of internal anatomy. One must also question the inclusion of a chapter (on tissue culture) based entirely on unpublished work when rich areas like learning in cephalopods are excluded.

Despite its shortcomings, this book is an important contribution. These chapters go a long way toward putting what we know about squid and their use as experimental animals into one accessible volume for the researcher or advanced student. This is a valuable accomplishment, not only because it will stimulate new work on many aspects of squid biology, which is of intrinsic importance, but also because it will point the way to additional possibilities of using these animals as model systems for problems in vertebrate physiology. In today's biomedical research world, where studies on mammalian systems are predominant, it is important to remember what squid, and other invertebrates, have taught us and to retain vision enough to sense what secrets they still hide.

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