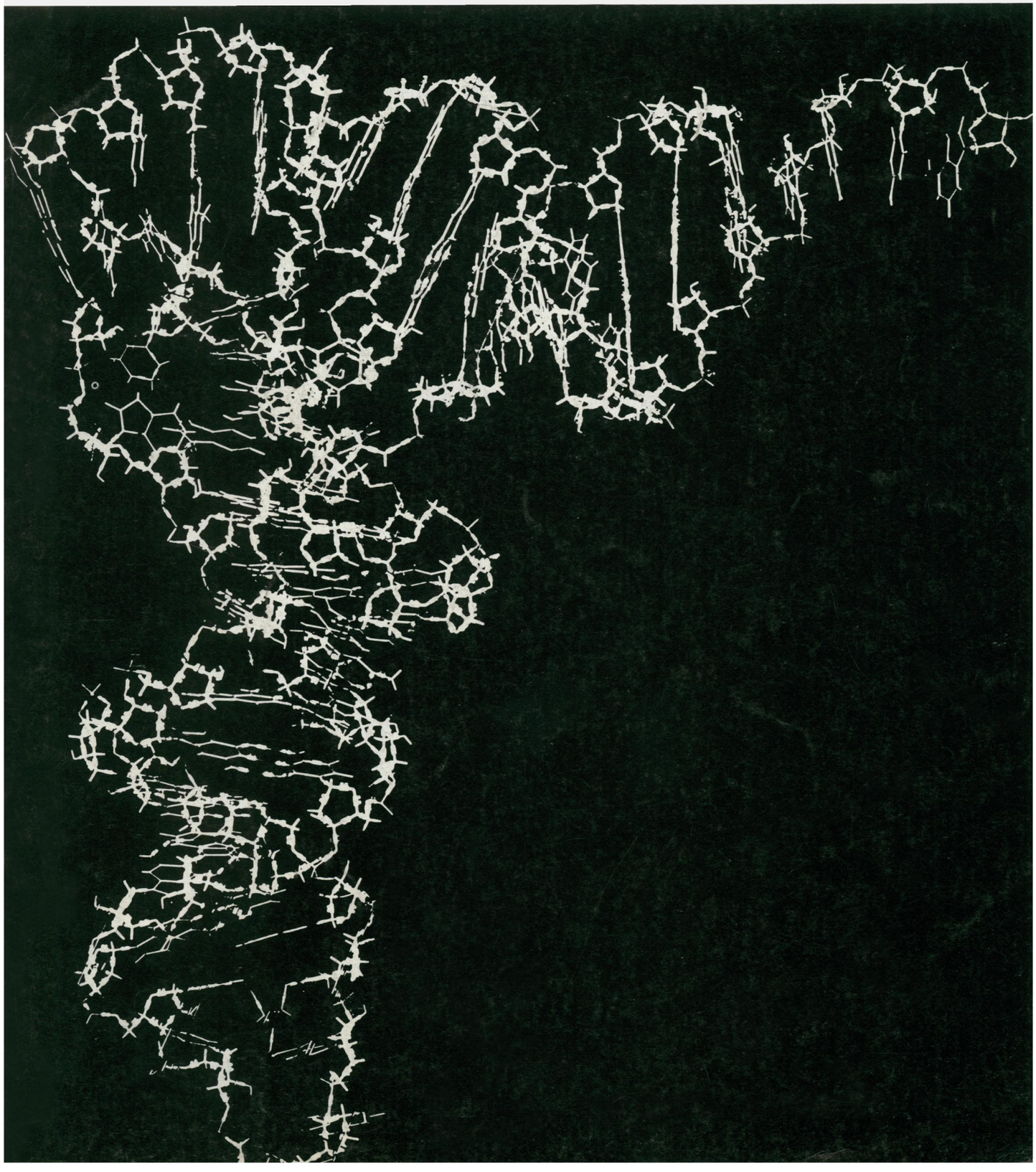
SCIENCE

2 August 1974

Vol. 185, No. 4149

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE



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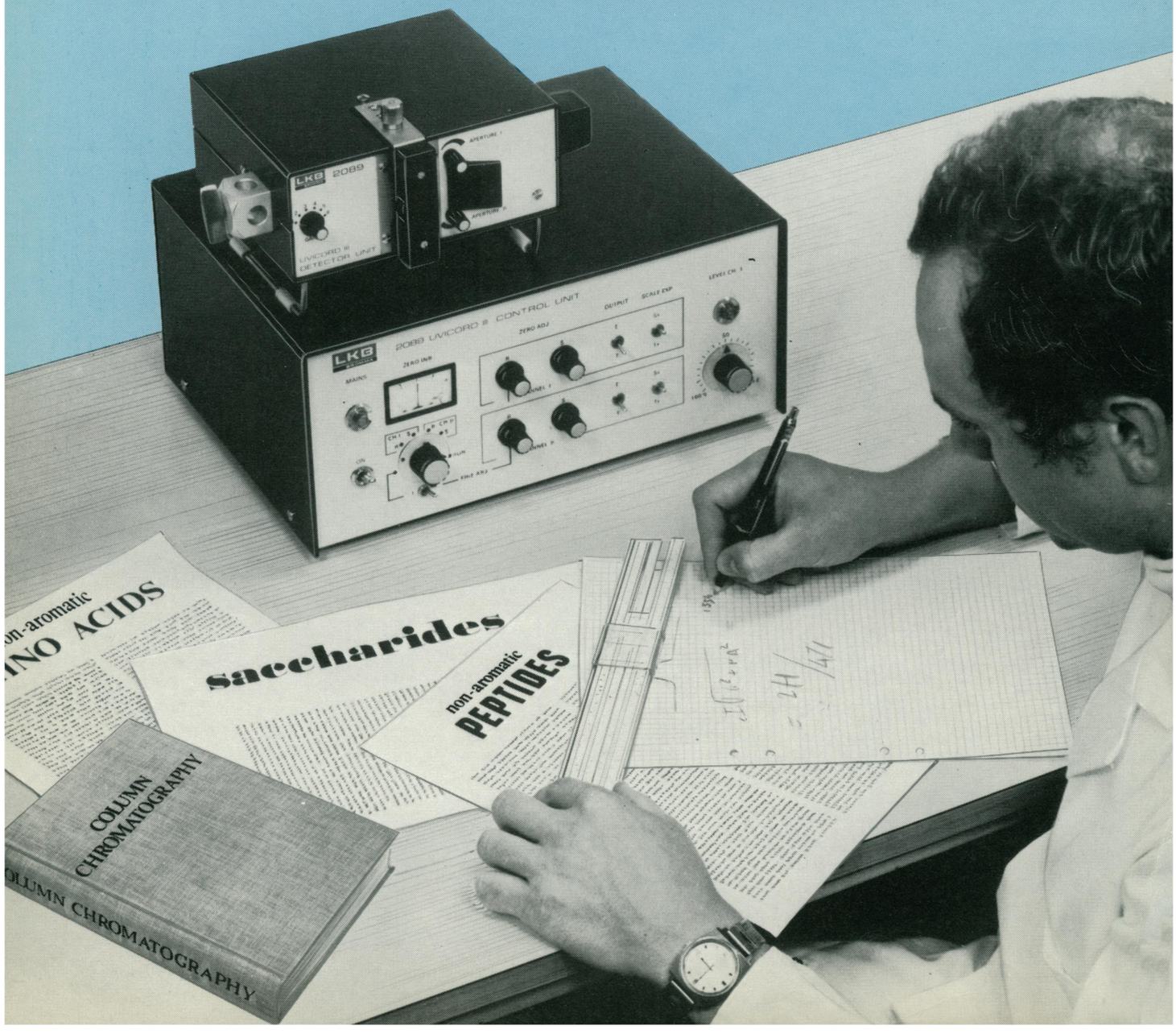

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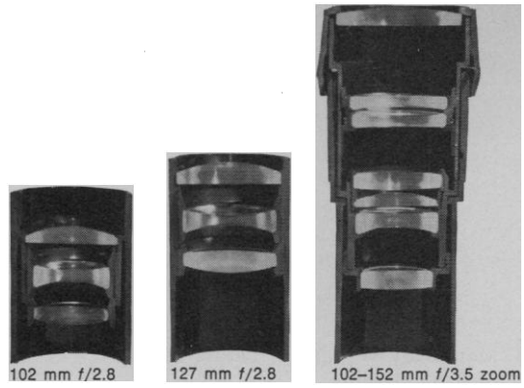
The American Association for the Advancement of Science was founded in 1848 and incorporated in 1874. Its objects are to further the work of scientists, to facilitate cooperation among them, to improve the effectiveness of science in the promotion of human welfare, and to increase public understanding and appreciation of the importance and promise of the methods of science in human progress.

COVER

Molecular model of yeast phenylalanine transfer RNA. Kendrew skeletal wire models. See page 435.



What's inside KODAK Projection EKTANAR C Lenses

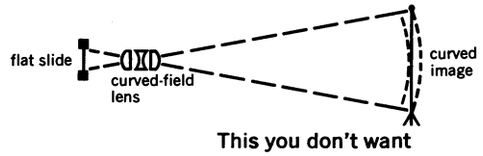
Better educational technology

or

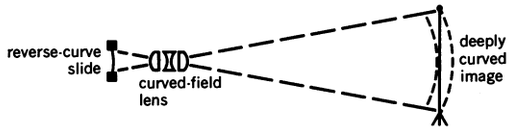
Let $\sum \frac{n'-n}{nn'r} > 0$ on purpose

KODAK CAROUSEL Projectors for 135 slides now come from the factory with KODAK Projection EKTANAR C Lenses. "C" indicates "curved field." Most Carousel projectors are used for screening family slides in the cardboard or plastic open mounts from the processing laboratory—mostly camera originals, some duplicate slides. "Kodak is putting a better lens on them," shoppers will be told. Details would be of scant interest.

KODAK EKTAGRAPHIC Slide Projectors are for audiovisual use. "Audiovisual" means "not for mere enjoyment." They are sold by audiovisual dealers, have a grey finish, and a few additional features. There is a choice of the new curved-field lenses or a flat-field lens. For certain audiovisual applications, "curved-field" may give worse results instead of better, e.g., slides mounted in glass, glass slides, "super slides" (38 mm square), ordinary open-mounted slides reversed to read right for rear projection, certain teaching slide sets on the market that have been produced by contact printing so that when you hold them up they read right with the dull side toward you. "Worse results" means that unceasing efforts to get everything readably sharp at the same time unfocus the mind from the subject of the slide. Admirably simple educational technology stumbles over itself.



This you don't want



. . . and certainly not this.

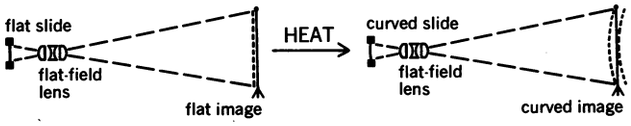
Details:

Take two identical open-mounted 135 slides that carry sharp, fine detail over much of the image area. Screen side by side, focusing very carefully. One is very definitely the sharper all the way from center to edge. Interchange the slides. The same projector is again just as definitely the sharper. It has a better lens than the other. It might fetch a little something extra in price if claimed to have been ground by the skilled hands of a follower of Spinoza's craft, apprenticed at 14.

Baloney. Lens performance is a matter of correcting the aberrations: longitudinal and lateral chromatism, spherical, coma, astigmatism, distortion, field curvature. These are mathematically inherent in any axially symmetrical surfaces that separate media of differing refractive index. For the lens speed required, the angular field to be covered, the number of elements economically permissible, the kinds of glass available, an applied mathematician must balance off effects at the various surfaces to minimize the overall aberrations. The outcome is a sheet of paper bearing the radii, thicknesses, spacings, and glass selections. Then the skilled hands can make themselves useful.

Still a slight aroma of baloney lingers. The high-speed digital computer has been invented. An optimization program shrinks years of design time to weeks or days. The program runs; there is little computational artistry to admire.

So the designer faces up to realities that had once been considered the concerns of other departments. Even the magical hands of the long-gone old craftsman could not have compensated for the fact that what's being projected is no flat surface but a small sheet of plasticized cellulose ester coated with layers of dyed gelatin and now being cooked with a high-intensity lamp.

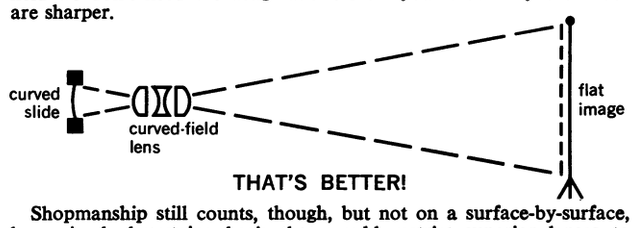


The first step in designing the Ektanar C lenses was not the turning on of the computer. It was an exhaustive statistical study of the shape assumed by open-mounted 135 slides from many different processors in all Carousel and Ektagraphic slide projectors, and how optical density affects the curl. A usefully consistent value of curvature emerged.

Early last century a man named Petzval proved on paper that when astigmatism is corrected so that sagittal and tangential foci coincide, they lie on a surface whose radius of curvature, R, at the axis is given by

$$\frac{1}{R} = \sum \frac{n'-n}{nn'r}$$

A zero Petzval sum being no cinch in a working lens, one leaves in some astigmatism so that the best compromise between sagittal and tangential focus lies on a flat plane. But since we now want a curved field we don't need the astigmatism. Now you know why the slides are sharper.



THAT'S BETTER!

Shopmanship still counts, though, but not on a surface-by-surface, brass-ring-by-brass-ring basis that would restrict superior lenses to families that can also afford "his and her" airplanes. Today top-grade craftsmanship is amplified many thousandfold by working on tooling instead of production.

Design of machines that grind, polish, and center the glass lens elements occupies whole Kodak careers. Design of other machines that squirt one plastic here and another kind of plastic there to hold the elements in place occupy other Kodak engineering careers. The properties of the plastics and the statistics of spacing and centering tolerances enter into the optical computations themselves. The outcome demanded is a bright, sharp image to look at, not a formula on a sheet of paper.

Kodak

2 August 1974, Volume 185, Number 4149 **SCIENCE**

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Medical School Admissions Matching

The experience of applying to medical school is an unhappy one. Quite aside from the fierce competition which prevents admission of many qualified applicants, the student is confronted by the bewildering array of examinations, interviews, and tedious application forms utilized by admissions committees in their evaluations. Applicants currently perceive it to be advantageous to apply to as many schools as finances permit. Consequently, the pool of applications has so dramatically increased that admissions committees have become inundated by a volume of paperwork they cannot realistically be expected to handle. Attempts to centralize the application system have resulted only in more paperwork, lack of cooperation among institutions, and increases in the amount of money applicants must pay. From these applications, applicants experience a variable response. About two-thirds receive no offers. Other applicants are so fortunate as to be accepted by four or five schools. When they procrastinate about making a choice and then about informing the various institutions involved, they slow the process for others. It is small wonder that the admissions process, bordering on unworkability, has been extended to the very first day of class for some individuals.

The present system for evaluation might be changed to parallel more closely the internship matching program. In such a system, notification of acceptance could be made on early, uniform dates by an independent agency. This agency would be advised confidentially by the applicants, in advance, of their order of preference for the schools to which they applied. The medical schools, in turn, would select classes by their own procedures, and inform the agency of their decisions. *Students would be informed only of their most highly preferred school to which they had been accepted.* Although several "rounds" would be needed to fill all medical school classes, the entire process could probably be completed by February.

This accomplishment would diminish the need for waiting lists and would not permit applicants to hold acceptances in several schools at once. As all students would be apprised of their futures well in advance, much would be done to eliminate the frustrating wait and attendant fears of failure so common to many aspects of premedical education. It is possible that such a system, by virtue of its rationale and unity of response, would serve to minimize the number of applications generated per student. Faculty members would accordingly spend less time on admissions committees and be freed for more desirable and rewarding activities.

The success of this system would rely heavily on improving the quality of premedical advising and on the degree of cooperation extended by medical schools. If the unworkability of the present system continues to grow, along with the number of applications, it should not be necessary to coerce people into change. The medical schools must now themselves be aware of this, for there has been instituted a procedure to aid in making difficult decisions and expediting the task of the committees. Lists are made available to medical schools detailing where each applicant has been accepted. They evidently find it advantageous to know what is going on in their neighbor's yards. Whether this is ethical or fair to any student is unclear. What is clear is that we must start planting seeds if the grass is ever to be any greener.—NORMAN A. MARCUS and CHARLES E. RIGGS, JR.

Norman A. Marcus received his B.A. degree from The Johns Hopkins University in May 1974 and will matriculate in the Stanford University School of Medicine in the fall. Charles E. Riggs, Jr., is a fourth-year student at The Johns Hopkins School of Medicine.

Skepticism

Skepticism is a stock trade of science. Thus, the promise of the green revolution is weighed against its actual costs . . . the potential of geothermal energy is squared against problems, environmental and political . . . confident 20th-century conceptions of prehistory are critically examined . . . our understanding of natural phenomena — volcanoes, earthquakes, hurricanes — is questioned. This third volume of *Speaking of Science* offers a wide ranging sampling of skepticisms — from population policy to views of man's violent behavior. Knowledgeable people take a sharp-eyed look at twelve different problems involving science and technology. An insight is gained into current attitudes toward some familiar problems . . . and a few new ones.

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