SCIENCE

5 March 1971

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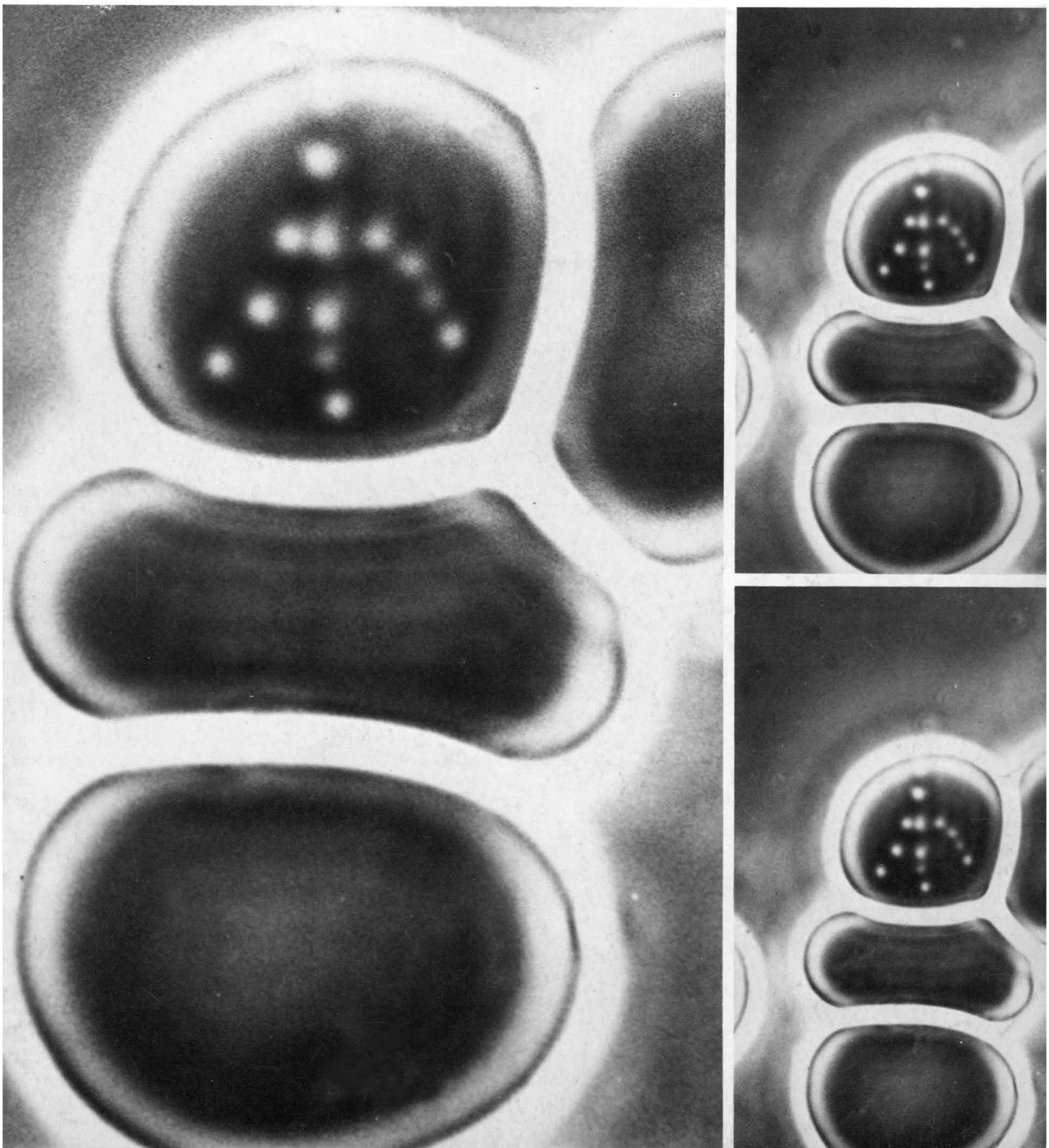
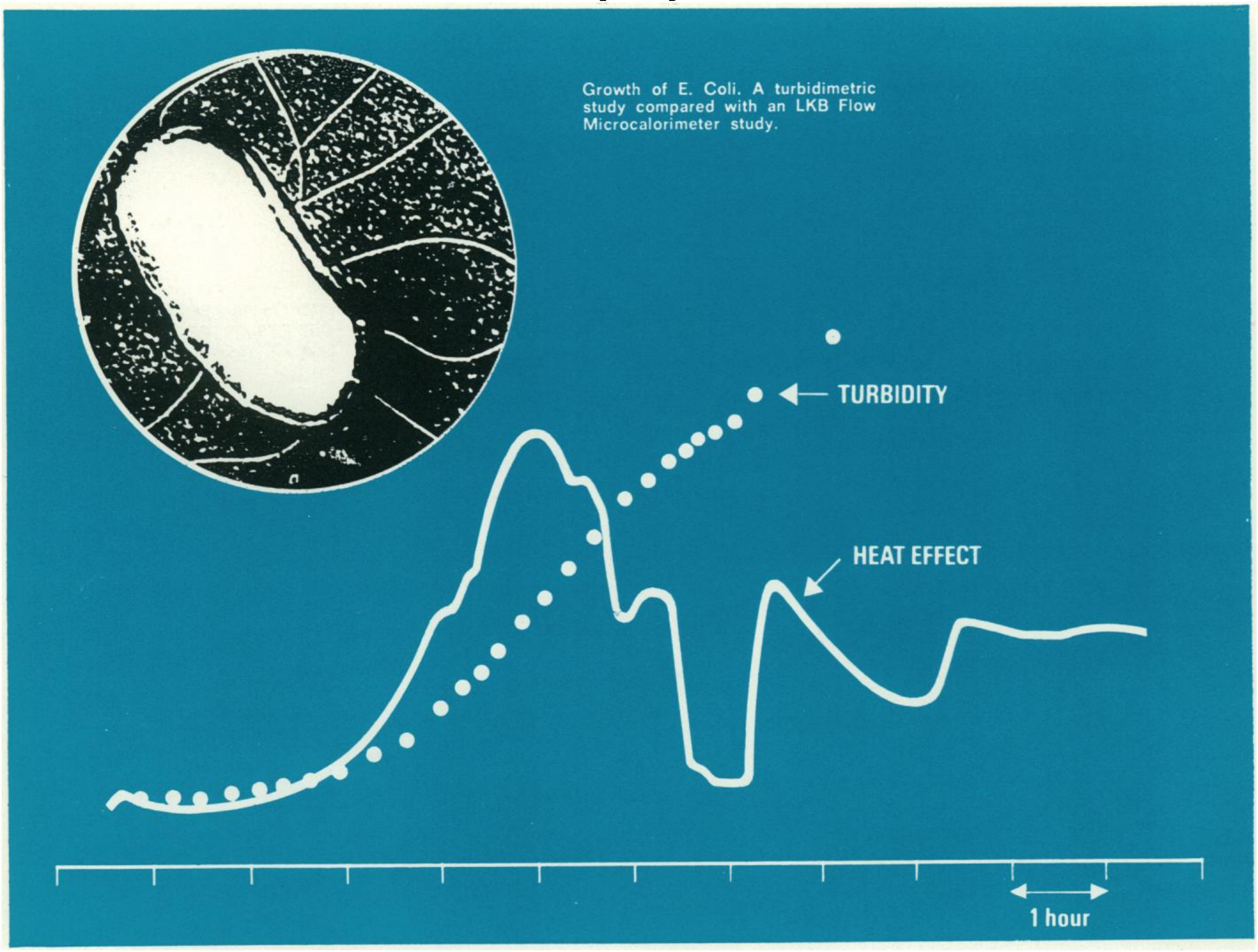
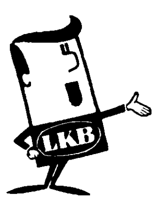
AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE




Growth of E. Coli. A turbidimetric study compared with an LKB Flow Microcalorimeter study.
TURBIDITY
HEAT EFFECT
1 hour


LKB

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COVER

Human red blood cell irradiated 13 times with a pulsed argon laser microbeam. Diameter of the cell is about 7 microns. Lesions range in diameter from 0.25 to 0.75 micron. See page 903. [Michael W. Berns and Louis P. Martonyi, University of Michigan, Ann Arbor]

Abridging Medical Education

My reaction to Walsh's article "Medical education: Carnegie panel urges expansion, acceleration" (13 Nov., p. 713) is that such expansion and acceleration may produce unexpected advantages. The demand that a larger amount of knowledge be acquired in a shorter period of time could foster a change in the attitudes of physicians toward continuing education. On the other hand, there is the danger that it will only further increase the current resistance of the physician to expose himself to future learning. Physicians too often assume a facade of omnipotence today as a defense against the unrealistic public and professional expectations that they should have a command of the vast total spectrum of medical knowledge. An obligation to continue one's education would threaten this facade by requiring a confrontation with deficient areas of knowledge. There must always be a lowering of defenses if new knowledge is to be accepted. It is certainly questionable whether continuing education can be acquired simply by attending symposiums at medical conventions and by following the literature in specialty journals.

One need in medical education is to instill the continuing spirit of inquiry in every student. This spirit has frequently been lacking in the exchange between professors and students because the faculty is required to encapsulate knowledge and deliver the final unassailable truth. There is often a general atmosphere of grandiosity, fostered by the public's needs, accepted by the teachers, and transmitted to the students in the medical schools.

This atmosphere may be changed if the students are to be given less time for preparation without the goal of acquiring total knowledge. The shorter training period may reveal to the students gaps in their preparation which will encourage them to obtain continuing (throughout life) education—a step that is necessary if one is to use his potential to the maximum. These changes may not only increase the number of physicians, but they may continue to improve the breed.

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The Carnegie Commission's report calls for increasing medical school enrollment by 50 percent in 7 to 8 years, and an even greater increase in paramedical personnel—a very big order. In 1910 the Flexner Report led to improved medical education, and specialization and research orientation in academic medicine. If this Carnegie report is heeded seriously by medical educators, it should lead to a better system of health care.

One recommendation—shortening the period of medical training from 4 to 3 years should probably not be combined with another recommendation that the internship be eliminated. I would suggest that a medical student might consider either a 3-year medical school *or* skipping the internship, but not unless, of course, he does not plan to practice medicine.

Further, the Carnegie Commission proposes the creation of a "midpoint degree," after which the student could pursue the M.D. or Ph.D. curriculum or take employment as a teacher or as a medical assistant or associate. The last options would be better named research assistant or associate rather than medical, since one learns science and biology early in medical school, not medicine. An appropriate title for the "midpoint degree" might be master of science (M.S.) in human biology.

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Industry and Academe: Closer Ties

This may be an opportune time to consider closer integration between industrial requirements for research and development and academic or institutional basic research programs. Federal funding is no longer adequate to support a normal rate of growth of the basic research structure in universities built up over the last 15 years. Also, there are several advantages in forming closer ties between basic research and industry. The selection of basic research problems (from an otherwise infinite range of choices) can be made more directly in the public interest. Also, basic research will have available a very large addition to its funding sources apart from the usual federal agencies (Department of Health, Education, and Welfare, National Science Foundation, Atomic Energy Commission, and others). To achieve this integration of goals, some federal funding, administered possibly through the National Academy of Sciences, will be required to provide lists of cooperating industries and to circulate grant proposals to relevant industries. Also, the possibility of cost-sharing (say, one-third federal funding) should be considered.

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La Porte Precipitation Fallacy

I was pleased to note that Landsberg in his admirable survey "Man-made climatic changes" (18 Dec, p. 1265) recognized the controversial nature of the La Porte precipitation anomaly which too many meteorologists, without close scrutiny of the record, have accepted as a proven case of man-made climatic change. The La Porte rainfall record is a celebrated but specious example of man's inadvertent modification of climate.

During the years 1928–1963 the precipitation for La Porte, Indiana, located some 30 miles east of the Chicago industrial complex, was higher than that recorded at surrounding stations. Meteorologists have been puzzled by this precipitation anomaly. Changnon suggested that the increased precipitation might be due to inadvertent man-made cloud modification resulting from nucleation debris ejected by the industrial activities to the west (*1*). Air pollution in any form is bad, but to blame the Chicago industrial complex for the change of climate at La Porte is most unfair.

The precipitation record at La Porte can be shown (*2*) to be spurious, statistically invalid, and physically unacceptable. (A most ludicrous outgrowth of the belief that the La Porte anomaly is true was the award of a government research contract to a fine university to study the presumed ecological changes in the environs of La Porte because of fictitious excesses of rainfall.)

The rainfall anomaly began in 1927 when a new cooperative climatic observer was appointed and ended in 1964 when an automatic rain gauge installed at La Porte replaced him. Prior to 1927 many of the surrounding stations reported more annual rainfall than La Porte and after 1964 many of the nearby stations also reported more rain than La Porte. However, in the intervening 37 years except for one instance, La Porte always reported the highest rainfall amounts. . . .

A study was also made of many synoptic weather situations, especially in those years which had unusually high rainfall amounts. Trajectory analyses demonstrated that when a west-northwest flow brings effluent nucleation debris to La Porte, either of two events occurs: (i) if it is raining at La Porte, the rain stops, and (ii), if it is cloudy at La Porte, the weather clears. These easily explainable occurrences are hardly conducive to causing excess precipitation. . . .

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References

1. S. A. Changnon, Jr., *Bull. Amer. Meteorol. Soc.* **59**, 4 (1968); *ibid.*, **50**, 411 (1969).
2. B. G. Holzman and H. C. S. Thom, *ibid.* **51**, 335 (1970).

Last Word on Yogurt-Making

Being an Armenian by ethnic origin and also a microbiologist, I should perhaps be in a more advantageous position to comment on the making of yogurt than the previous letter writers (Segal, 31 July; Goodman, 9 Oct.; and Bagdikian, 6 Nov.).

Yogurt (*yoghurt* in Turkish; *mādzun* in Armenian; *leben* in Arabic) is curdled or coagulated milk resulting from the fermentation of sugars in the milk by two microorganisms, *Lactobacillus bulgaris* and *Streptococcus thermophilus* (*1*). Both these microorganisms are capable of multiplying at temperatures between 20° and 50°C (*2*) and, with acid formation, ferment a number of sugars including lactose which is the main sugar present in milk. As a result of acid formation the proteins in the milk are curdled or coagulated and the milk attains the yogurt consistency.

Any kind of milk can be used to make yogurt but whole fresh cow's milk often gives the best results. The optimum temperature for the growth of yogurt-forming microorganisms lies within the range of 40° to 50°C. At this temperature range growth is rapid and yogurt formation takes only a few hours. If the temperature falls below 40°C the growth continues but at a slower rate and consequently yogurt formation delays. Multiplication of yogurt-forming microorganisms is minimal or stops below 20°C. If growth is rapid and acid coagulation is extensive, souring of yogurt results. Thus, as soon as yogurt is formed it should be refrigerated to prevent further souring of the product. All this is learned by experience.

In brief, to make yogurt the milk is brought to its boiling point to kill inborn and other microorganisms present in the milk and allowed to cool down to a temperature slightly above the body temperature. This can be determined by the touch of the little finger. Dipping the elbow into the milk is unnecessary. It is then inoculated with yogurt and mixed. Two tablespoonfuls of yogurt per liter of milk should be adequate as starter. Next, it is covered with a dish and wrapped in a woolen material to minimize heat loss until yogurt consistency is obtained. This will commonly take 5 to 10 hours depending upon the temperature of the room. It is advisable to use crockery or glass bowls for processing yogurt as metal containers may get eroded by the acidity contained in the yogurt.

When equal parts of yogurt and ice-cold water are mixed together and the mixture is homogenized by means of a fork or an electric mixer, it forms a delicious and refreshing beverage known as *tān* in Armenian or *āyrān* in Turkish. Some salt may be added to it. It goes well with any kind of steak, hamburger, or *shish-kebab*. Yogurt also can be emptied into a bag made of cheesecloth and hung overnight from a faucet over a sink to drain the excess fluid. The part that remains in the bag has a pasty consistency and is known as *lebneh* in Arabic. In Lebanon it is eaten with bread. The addition of olive oil and some spices makes it more palatable. It is a Lebanese national food product and is sold in any grocery store. Incidentally, the yogurt and cucumber salad described by Segal is known as *jājek* by the Armenians and the Turks. In my opinion and in the opinion of many others this salad does not necessarily require pepper as one of its ingredients.

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References

1. W. C. Frazier, *Food Microbiology* (McGraw-Hill, New York, 1958).
2. R. S. Breed *et al.*, *Bergey's Manual of Determinative Bacteriology* (Williams & Wilkins, Baltimore, Md., ed. 7, 1957).

Expertise at Land Grant Colleges

The mechanism for relieving Iza Goroff's search for safe reliable pesticide information (Letters, 18 Dec.) has been in existence for many years at land grant universities located in every state in the United States. There is at every such institution at least one extension entomologist, plant pathologist, and agronomist well qualified to handle questions regarding pesticide registration, safe usage, effectiveness, and disposal. In 1964 the U.S. Department of Agriculture used newly appropriated federal funds to support a pesticide coordinator at each land grant university. He performs a liaison role between the several federal agencies dealing with pesticides (USDA, HEW, EPA, and so forth) and agricultural college personnel and county agents using and recommending pesticides and herbicides. As American merchants, farmers, and homeowners we must immediately utilize such specialists to advise us in the use of agricultural chemicals that are so essential to our food and fiber supply as well as to community health.

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Australia: Equal Pay in 1972

The letters of Kennedy, Rothman, and Graubard (25 Dec.) commented on the salary differential between men and women described in the advertisement in *Science* (11 Sept., p. 1115) for research positions in the Division of Land Research, Commonwealth Scientific and Industrial Research Organization (CSIRO) of Australia. The ad should have included the additional sentence: "The differential between male and female salaries will be eliminated by 1 January 1972."

The principle of paying men and women equally for equal work has been adopted throughout Australia and is being brought into effect by stages. It will be fully effective by 1972. Since its inception, CSIRO has followed a policy of advertising its research positions internationally in order to recruit the best qualified applicants from around the world.

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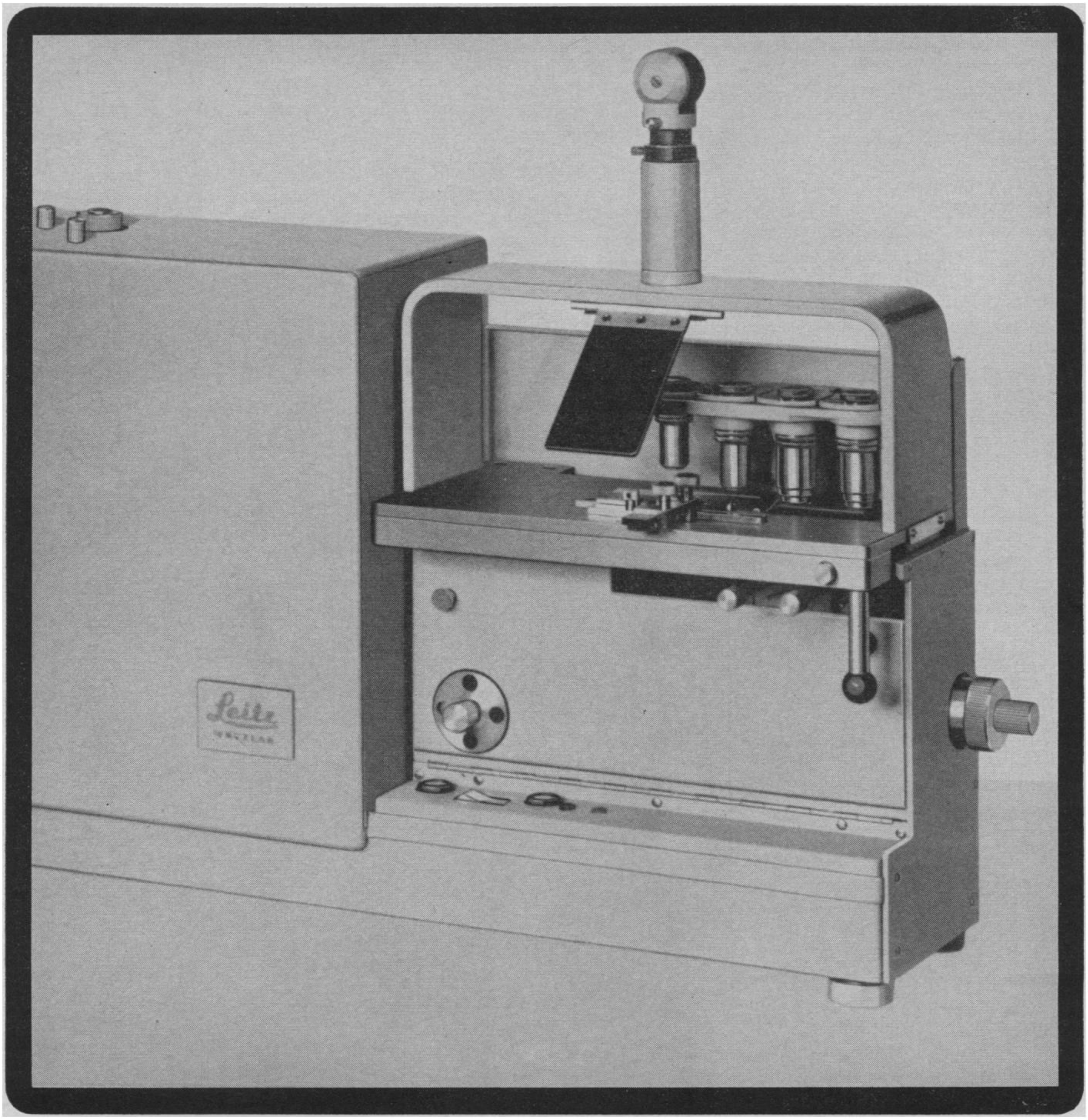

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SCIENCE

Science Education—Process or Content?

It is undeniable that our science curricula have in part failed, even the newest and the best of them, to deal sufficiently with the role of science in the making of human culture, with the problems of the present world and the fair or dread vision of the future of man.

Nothing that man grasps for as betterment is unalloyed. Our old folk and fairy tales knew this full well. In our latter-day faith in progress it has been forgotten that the reward and the disillusion are intermixed. Should not our science courses avoid both the siren song of progress toward a perfect technological culture and the horrendous fear of unavoidable technological doom?

In problem after problem we find that only a total analysis of effects—physical, chemical, biological, psychological—can define the risk or militate against the danger. It may be that the most needed new type of agency in all countries is one that would apply the fullest possible systems analysis to each and every new technological discovery prior to its introduction. Why do our science curricula fail to deal with such questions? Why is the future public not acquainted with the grave issues it must face?

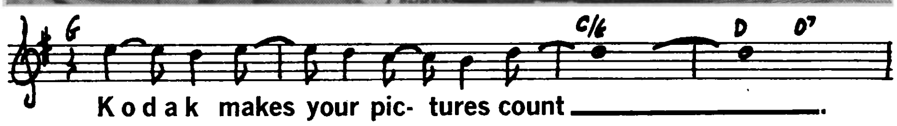
The benefits and risks of our scientific and technological developments cannot be appreciated except in the context of sufficient understanding of both the nature of science as process and the nature of science as content. Here investigation, inquiry, and organized knowledge and conceptual schemes go hand in hand. After all, there are two primary functions of science education: the one, the technical or empirical, being to transmit and extend the knowledge requisite to human power; the other, the philosophical, being to develop an understanding of man's place in the universe. The former, which no one has delineated better than Carl Becker in *Progress and Power*, is the basis of all cultural development, the fundamental thread of human history. The latter has enabled man to conquer superstition and fear, to open his eyes to an illimitable vision. If man's hope for progress is not to prove a delusion, if his fear of malign external forces is not to be replaced by an even greater fear of man himself, the study of the sciences must be bent to the task.

We live, it may be said, in a crisis of conflicting values. That is not new for man. Always his own desires have in some measure found themselves opposed to the family, the tribe, or the state. The submergence of the individual in the enormous populations and national cataclysms of our times is a mere climax or aggravation of the unending struggle, at least in Western lands, to prize and safeguard the rights and worth of the individual. The natural sciences have played a great part in this historic drama. As John Dewey said, already in 1903, "Science has become incarnate in our immediate attitude toward the world about us, and is embodied in that world itself"; and even more pertinently, "Any scene of action which is social is *also* cosmic or physical. It is also biological. Hence the absolute impossibility of ruling out the physical and biological sciences from bearing upon ethical science."

There may yet be hope for mankind, since from the perspective of a geneticist the present conflicts of human racial groups appear evanescent, and from the perspective of a psychologist the motivation of nations to war seems conquerable. What is necessary is insight, and insight may come through learning, if we study the right things in the right way.—BENTLEY GLASS, *Vice President for Academic Affairs, State University of New York, Stony Brook*

Adapted from *The Timely and the Timeless* (Basic Books, New York, 1970, by permission).

We want to be useful ...and even interesting

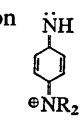


This form of communication works. This spring and summer the sound of the message will be everywhere. If it bothers you, flick it off. Many millions prove with their own shekels for batteries, car radios, and TV repair service that they want such communication. "Kodak makes your pictures count." If the meaning of that message evades you, perhaps the following background will clear it up:

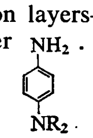
Clerk Maxwell pioneered color photography. His idea of additive projection wasn't nearly as good as his concept of electromagnetic radiation. Use of subtractive primaries was proposed in 1869. Forty-three years later a patent was issued on forming the subtractive dyes as needed, *in situ* in each of three emulsions, by condensing reacted developer with three different couplers. Twenty-three more years passed before a pair of musicians with a very strong interest in photography reduced this coupler idea to commercial practice. KODACHROME Film the world learned to call their accomplishment, and for helping to teach the lesson to the world at the 1939 New York World's Fair another chap got himself off on a course that led only last year to the presidency of Kodak.

That job might not amount to much but for the fact that KODACHROME Film and another embodiment of the coupler principle in KODACOLOR Film (plus some newer ones just now coming out) deliver such satisfactory color pictures at such a modest cost.

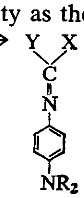
"Satisfactory" means more than just getting a principle to work. "Satisfactory" seems to require, a century after Clerk Maxwell, some study of fundamentals, even as that Scot is better remembered for his equations than for his proposals on color photography. Therefore, men like our Karl Tong and our Charles Bishop and a woman like our Carol Glesmann devote their time and thought to entities like the quinone-diimine cation



formed in those 2μm-tall chemical reactors—the emulsion layers—by oxidation of the developer



After a while, certain subtle manipulations lose some of their subtlety as the ion is routinely led this way→



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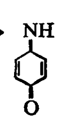

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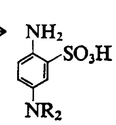

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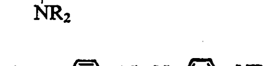

If the gap from ditty to ion seems too wide, permit us to send you a reprint of an article in American Scientist, *"A Chemist's View of Color Photography," based on a Sigma Xi National Lecture. Address request to Dept. 55W, Eastman Kodak Company, Rochester, N.Y. 14650.*

For alma mater

We are now preparing the list of colleges and universities that will be getting money from us this year. Nothing new. It has been going on for many years.

How a college gets on our list is no secret. Sentiment has nothing to do with it. We'd be in even hotter water if we presumed to sit in judgment. The operation is very businesslike. Can be handled by computer.

Any accredited institution which has conferred a baccalaureate or graduate degree on a person who joined Kodak within five years of that award and who is completing his fifth year with us—that institution, if privately supported, receives $750 for each academic year he or she completed there. ($250 for each academic year if publicly supported.)

A college or university that sets out with the mission of preparing people to work for the likes of Kodak would have little claim to benefactions or to the respect of scholars. Yet to the extent that an institution has educated capable people who choose to cast their lot with us, we figure it has earned not only respect and our gratitude but also a bit of our cash with which to keep striving.

What's fair is fair.

Be of good courage

If a computer is trying to drown you in information that could turn out to be important, go to the Yellow Pages and look under "Microfilm Service" for Kodak. We can point you toward firms who work out a system whereby you send them tapes and get back microfilm in a format for your special needs. Or we can sell you a computer-output microfilmer for your very own.