

SCIENCE

30 August 1963

Vol. 141, No. 3583

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE



CLOUDS IN LINE

IBM computers, science and you:



Digital trouble shooter for Titan

At Martin Company, systems engineers help assure success in operational missiles by continually checking product performance with the help of an IBM 7090 system.

Martin engineers have processed 200 miles of paper and 2 million punched cards through the 7090—a complete and continuous case history on the performance of every part in every missile built at Martin's Denver Division.

Take the Titan for example.

Once a month, the manager of systems engineering receives an 8-month record of Titan performance. A curve drawn by the computer pinpoints potential trouble areas, alerts Martin engineers

to parts that have started to drop in reliability.

The "trouble" might be just a loose wire, a minor drop in voltage or just a tired resistor. The point is they find and correct trouble before it aborts a mission.

That's pretty important—Titan II will boost Project Gemini into orbit, with a couple of astronauts aboard.

Reliability is pretty important in your product, too. It is to your customers anyway. And you can perform this type of quality control in your products, if you have an IBM computer handy. It doesn't always take a big 7090. Sometimes an inexpensive 1620 system is all you need.

Automatic maps help find oil

Geologists and geophysicists collect core samples and pressure readings and seismic data and dipmeter readings and other technical data.

Then what? That's the rub.

Like most scientists, their problem is finding time to sift through it all...analyze it...and make it useful.

But not any more.

Now, a set of new IBM computer programs helps them process and analyze their data. The programs are tailored to oil exploration and production problems and the capabilities of the small, low-cost IBM 1620 computer.

The programs automatically stamp out quick contour maps that help petroleum experts avoid unpromising



fields and concentrate on fields that look like winners.

The new IBM programs also guide economic forecasts, casing design, water-flooding patterns and other activities.

You can handle all these problems on a 1620 with 20K core storage and automatic divide, a card read-punch and a paper tape reader adapter to handle an X-Y plotter (for the contour maps).

The programs, of course, are free. And so is the help of our petroleum industry specialists.

Our programs help cut the cost of operating the computer.

This is worthwhile if it helps geologists and geophysicists eliminate just one million-dollar dry hole a year.

Computer programs speed lens design

If you've ever designed a lens system—even a simple one—you know it's no snap assignment.

It can take several months if you're working on a complex system and doing all the work by hand.

But you can cut this to a few days and increase precision at the same time, with an IBM 1620 computer and a set of four IBM lens design programs.

The first program in this package does two things. First, it traces individual meridional and skew rays and fans of sagittal and tangential rays (up to 99 per fan). It also calculates third or-

der aberrations for the system and for individual surfaces.

The second program computes the vignetted aperture of the lens system, constructs a grid across this area and traces selected light rays through the system from this grid. This enables the designer to check the total usable path of light through the system. He may specify up to 999 rays.

The third program evaluates the output of the second program. It computes the radial distribution of light energy and provides focus and origin shifting, if desired.

The fourth program compares third order aberrations in the system with desired values. It automatically computes changes in system parameters and recalculates third order aberrations until the lens system performs within specified tolerance limits.

These lens design programs improve accuracy, help the designer improve lens system performance and make it possible for him to devise more sophisticated designs.

You can get these easy-to-operate lens design programs through your local IBM branch office.

IBM
DATA PROCESSING



ICN MIMICS EFFECTS OF THYROXINE ON ISOLATED LIVER MITOCHONDRIA

Cyanogen Iodide (ICN) has been found to mimic in most respects Thyroxine's effects on isolated liver mitochondria ⁽¹⁾. It is stable in water and serves as a donor of I⁺.

ICN behaves like Thyroxine in these respects:

1. A quantity as small as 10⁻⁶M produces substantial water uptake and swelling in rat liver mitochondria. As with Thyroxine, ICN-produced swelling is inhibited by serum albumin and strong sucrose (0.75M).
2. Antimycin A, Amytal and Cyanide also inhibit ICN-produced swelling. Thyroxine has been reported to display similar properties. ^(2,3)
3. EDTA is effective against ICN-produced swelling. It is also effective against thyroxine ⁽⁴⁾.
4. ATP causes rapid shrinking of ICN-swollen mitochondria. It behaves exactly the same with Thyroxine-caused swelling. ⁽⁵⁾

25-gram bottle, \$1.50 gm. 5-gram bottle, \$1.90 gm.
1-gram bottle, \$2.25 gm.

⁽¹⁾ J. E. Rall, J. Roche, R. Michel, O. Michel, S. Varonne, *Biochem. Biophys. Acta.* 62, 622, (1962). ⁽²⁾ A. L. Lehninger, B. L. Ray, M. Schneider, *J. Biophys. Biochem. Cytol.* 5, 97, (1959). ⁽³⁾ A. L. Lehninger, B. L. Ray, *Biochem. Biophys. Acta.* 26, 643, (1957). ⁽⁴⁾ D. F. Tapley, *J. Biol. Chem.* 222, 325, (1956). ⁽⁵⁾ A. L. Lehninger, *Ibid.* 234, 2187, (1959).

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4 Dimethyl Amino-N-Methyl 2, 2 Diphenyl Valeramide HCl was recently reported to be four times as potent as tolbutamide in lowering blood sugars.

It appears to act through a different mechanism than hypoglycemic agents which increase the oxidation of glucose.

Dulin, et. al. conclude that 4 D.M.D.V. appears to act by inhibiting liver glucose output—not by glucose oxidation or inhibition of metabolic effect of adrenal hormones. ⁽¹⁾

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⁽¹⁾ W. E. Dulin, F. L. Schmidt, M. C. Blanks, G. H. Luna, *Proc. Soc. Exptl. Biol. Med.* 109, 729, (1962).

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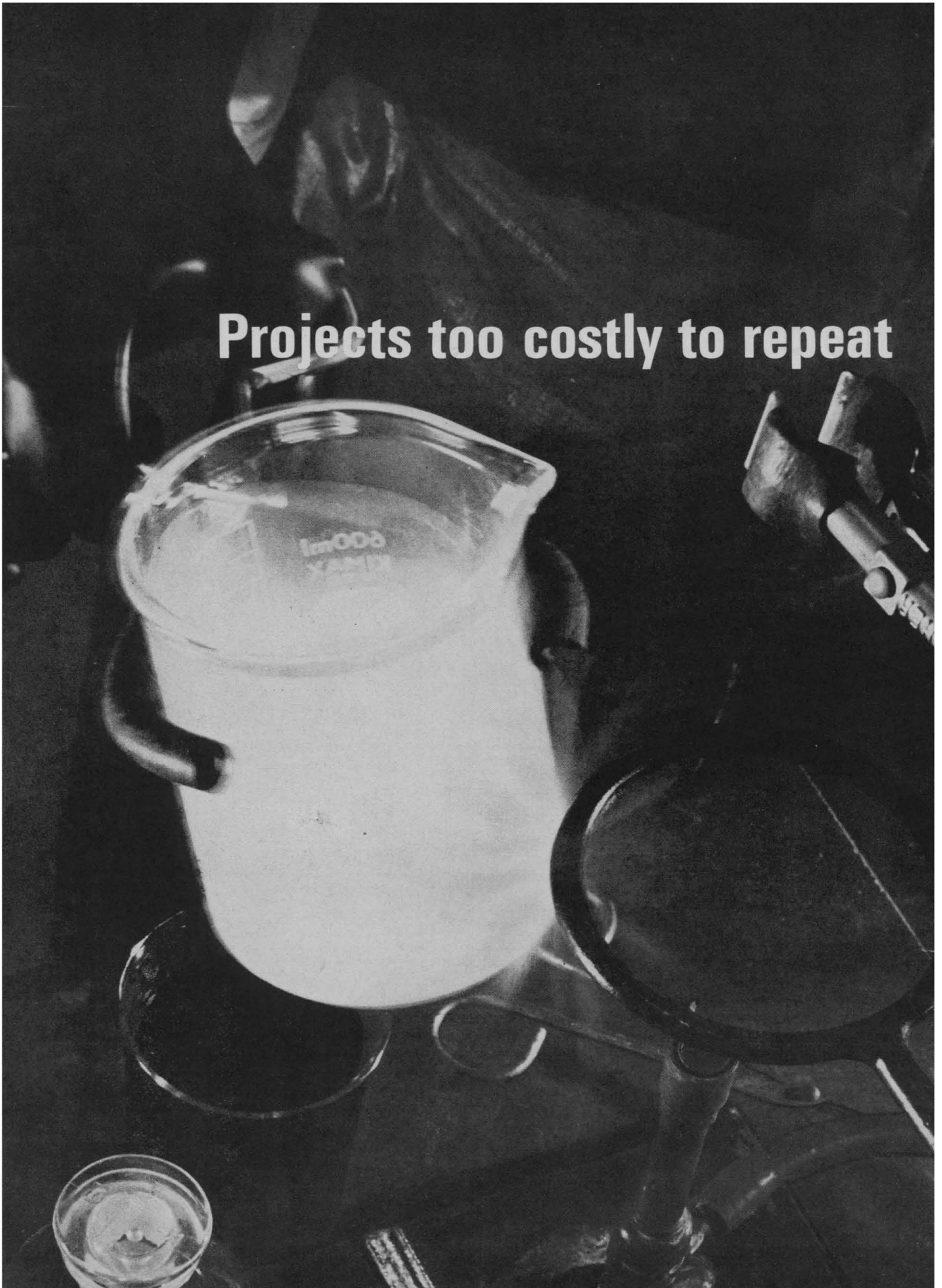
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COVER

Cumulonimbus cloud towers in an anticyclonic disturbance over the Pacific Ocean just east of Wake Island, 0637 G.C.T., 17 August 1957. The line of towers extends southwest or west-southwest, with a maximum height of 9000 meters. The disturbance, which was part of a large trough extending from middle latitudes to the tropics, later developed into a tropical storm. Camera aimed south; aircraft altitude, 2400 meters. See page 767. [Claude Ronne, Woods Hole Oceanographic Institution]

Projects too costly to repeat

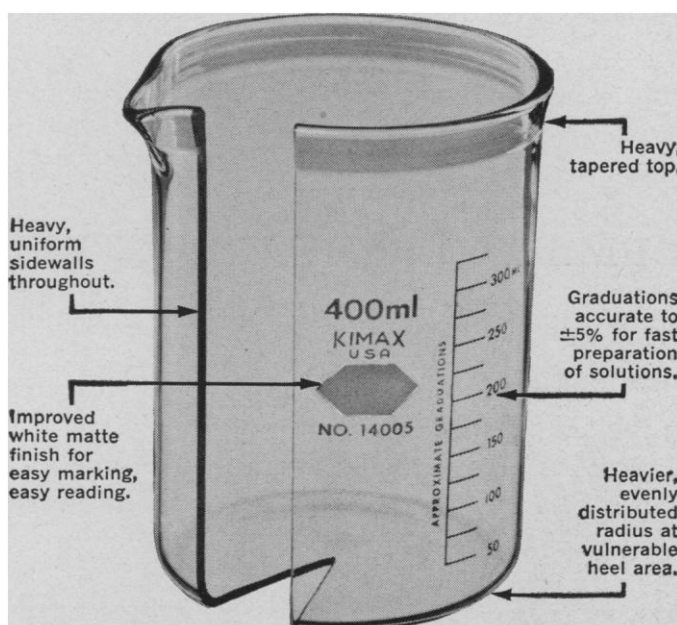


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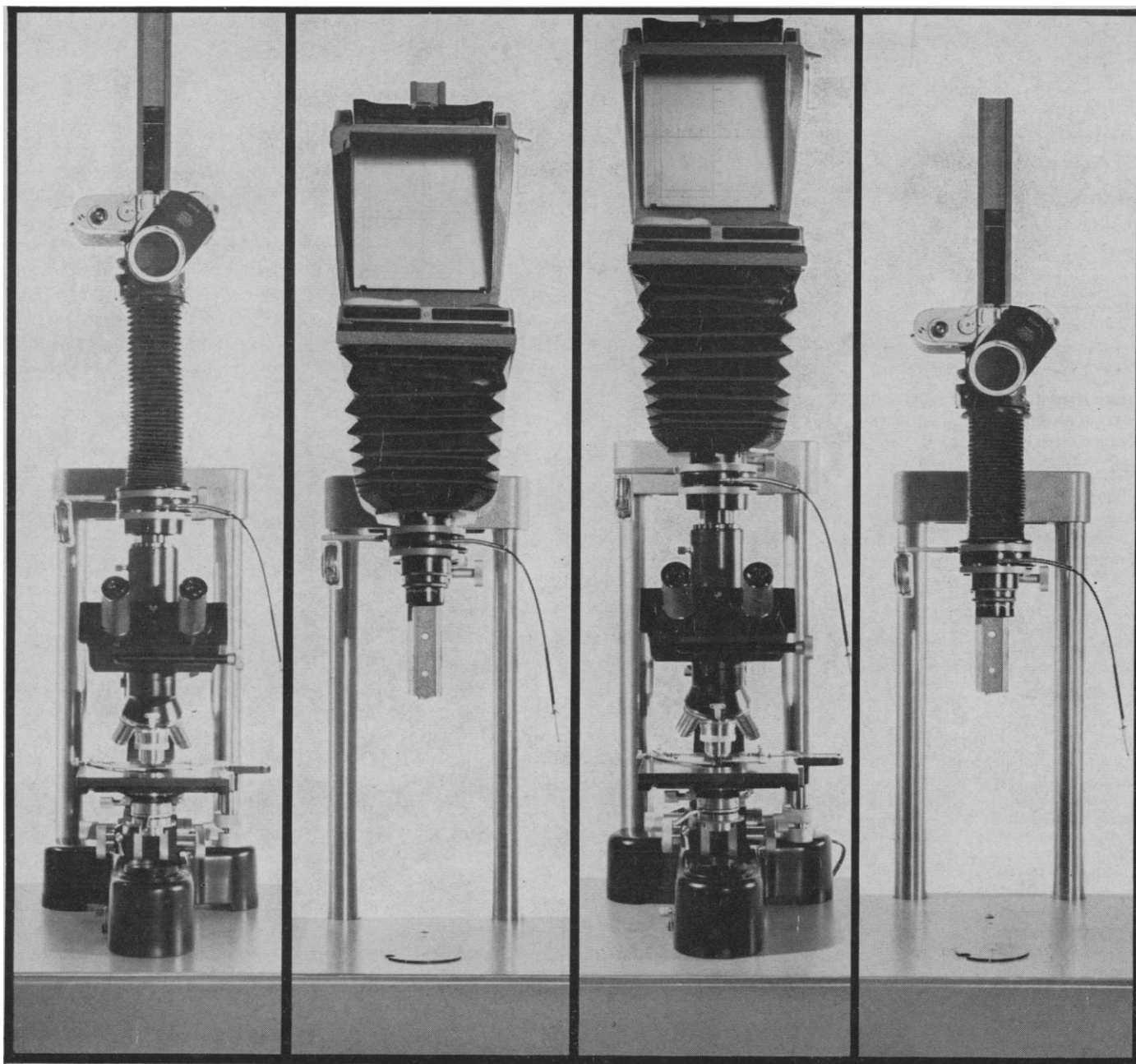
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The American Association for the Advancement of Science was founded in 1848 and incorporated in 1874. Its objects are to further the work of scientists, to facilitate cooperation among them, to improve the effectiveness of science in the promotion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

The New versus the Classical in Science

There long has been a bandwagon tendency in American science, but today it seems particularly rampant. This seems true of the physical sciences and particularly of the biological sciences. In addition, there is an inclination to equate "classical" with "old-fashioned" and "passé."

We Americans worship the new: Madison Avenue bases its approach on this weakness of ours. This is why car manufacturers bring out new models each year. Somehow the word *new* has acquired the meaning of "better." Even scientists have succumbed to this psychology. Whenever there is a new breakthrough we tend to abandon the previously active areas. A massive follow-up of new discoveries is normally highly productive, and no damage would be done if it were not for the fact that the abandoned fields are rarely exhausted. When talent is diverted from them, science suffers an irreparable loss of know-how in the form of specialized information and methodology.

At this very moment, in some classical branches of science it is impossible to find a single expert. In others, the number of well-trained and intelligent specialists is smaller than the number of available hard-money positions. Invertebrate zoology (in its various subdivisions) is now in this position, and probably most specialists could name other fields.

This development is accompanied by other trends. The most imaginative workers are those who have been attracted to the new efforts and have thus automatically left the more orthodox workers in command of the classical fields. Bright young students quite naturally look for the greenest pastures. Recruitment thus becomes a serious problem. This is aggravated by the attitude of the Young Turks in the new areas. They tend to regard the more classical branches of their science with unconcealed contempt. At worst, this intolerance leads them to attempt to cut off funds from the more classical fields. The situation is further aggravated by the attitude of some foundations and science administrators. They are justified in fostering exploitation of breakthroughs, but it seems unwise for them to pour most of their funds into the glamor fields. The follow-up of breakthroughs rarely requires large foundation support. The bandwagon tendency takes care of this automatically.

Far more important, for the general well-being of American science and the attainment of a healthier balance between classical and frontier fields, is more financial and moral support for the classical areas. We should not place unnecessary obstacles in the path of the bright, imaginative youngster who, for reasons of his own, wants to go into an unpopular, classical field, because precedent shows that he is quite likely to make a spectacular success of it. The total *Zeitgeist* of science, together with new models and new techniques, moves ahead so rapidly that someone who has grown up with these new ideas very often finds unexpected new approaches in the "old" field and helps to rejuvenate it. The new systematics, and other, similar developments, show that this can be done, and that such rejuvenation has beneficial effects that go well beyond the focus of the renaissance. This would happen oftener if the principle were accepted more broadly that the new should supplement the classical and not totally displace it.—ERNST MAYR, *Museum of Comparative Zoology, Harvard University*



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Lively and continuing discussions took place as the delegates joined in the exploration of the highly involved interactions of plant roots, soil, saprophytic soil microorganisms, and plant pathogens. The ultimate objective of the symposium was the subjugation by biological means of soil-borne pathogenic viruses, bacteria, fungi, and nematodes. In essence, this was a search for new approaches and new ideas on how to attain control of such groups of soil-borne plant pathogens through biological techniques and an attempt to define the areas where additional research is most needed.

The underlying encouragement which motivated the symposium has come from instances of biological control which have proven successful and, more than this, sometimes spectacular. This has been especially true where chemical control has not been economically feasible and suitable resistant varieties of plants have not been available.

One of the oldest biological approaches to control disease on pathogen-infested land has been to resort to different crop successions or to turn under various green manure crops to allay damage from diseases anticipated in a succeeding crop. This technique has met with notable success in certain regions against specific diseases. For example, it is reported that phymatotrichum root rot of cotton in the Southwest is being successfully combated by disking into the soil an immature crop of peas in the spring, prior to planting cotton. Ophiobolus root rot ("take-all") of wheat may be controlled by rotating a crop of oats with the wheat.

In California streptomyces scab of potato is effectively kept in check where the crop is grown on the same land year after year by growing a crop of soybeans in the fall after the potato harvest and turning it under before the crop matures. Sclerotium rot of peanuts is prevented in the South by avoiding the presence of undecomposed organic litter in the top few inches of soil. A serious Fomes rot of rubber tree crowns and roots in the tropics is being kept under control cheaply and rather spectacularly by biological means. A particular variety of legume is grown as a ground cover in rubber plantings where the disease has appeared. The pathogen appears to dissipate its energy on the legume without doing any real damage to either the legume or the rubber trees.

On the other hand, many crop rotation and cover-cropping systems either

fail in disease control or actually make the disease worse.

An objective of the symposium was to seek out the mechanisms involved in biological control in soil and to understand the circumstances which make for success on one hand and failure on the other. Knowledge of the mechanisms involved in the soil-pathogen-host relationships would enable a more intelligent approach to the control of soil-borne diseases through biological means.

Several aspects were selected for greater research emphasis. It was brought out, for instance, that the behavior of the host plant in terms of root diseases may be manipulated to some extent by sprays, fertilization, time of planting, and so forth. Since root exudates are known to be important in initiating the activity of root parasites, it follows that cultural practices which influence the amounts and quality of these exudates are important in the inception of disease and in its avoidance.

Since most pathogens in soil are in a resting rather than a vegetative condition, it is clear that the manipulation of soil likewise may be important. More information is needed on the factors which influence the survival, multiplication, and parasitic activity of the pathogens in soil. Stimulation of the pathogen into activity in the absence of its host may waste the reserves of the organism and decrease its population in soil. Certainly it became clear that the specific roles of plant exudates and plant residues in nature need clarification.

Many discussions centered about the role of natural openings in roots in relation to pathogen entry. Ruptures at the point of root emergence, the senescence of transient roots, and certain features of the root surfaces themselves were considered as possible portals of entry. It is surprising how little information is available on root anatomy and physiology in relation to pathogen entry and development.

Investigators from different disciplines were made aware of the overall problems in the biological control of root diseases and most had valuable suggestions to offer.

Critically deficient lacunae in our knowledge of the interactions of soil, plant, and soil microorganisms in relation to the activity of root pathogens were pinpointed.

It became apparent that although biological control, as treated here, could be and at times is accomplished by di-