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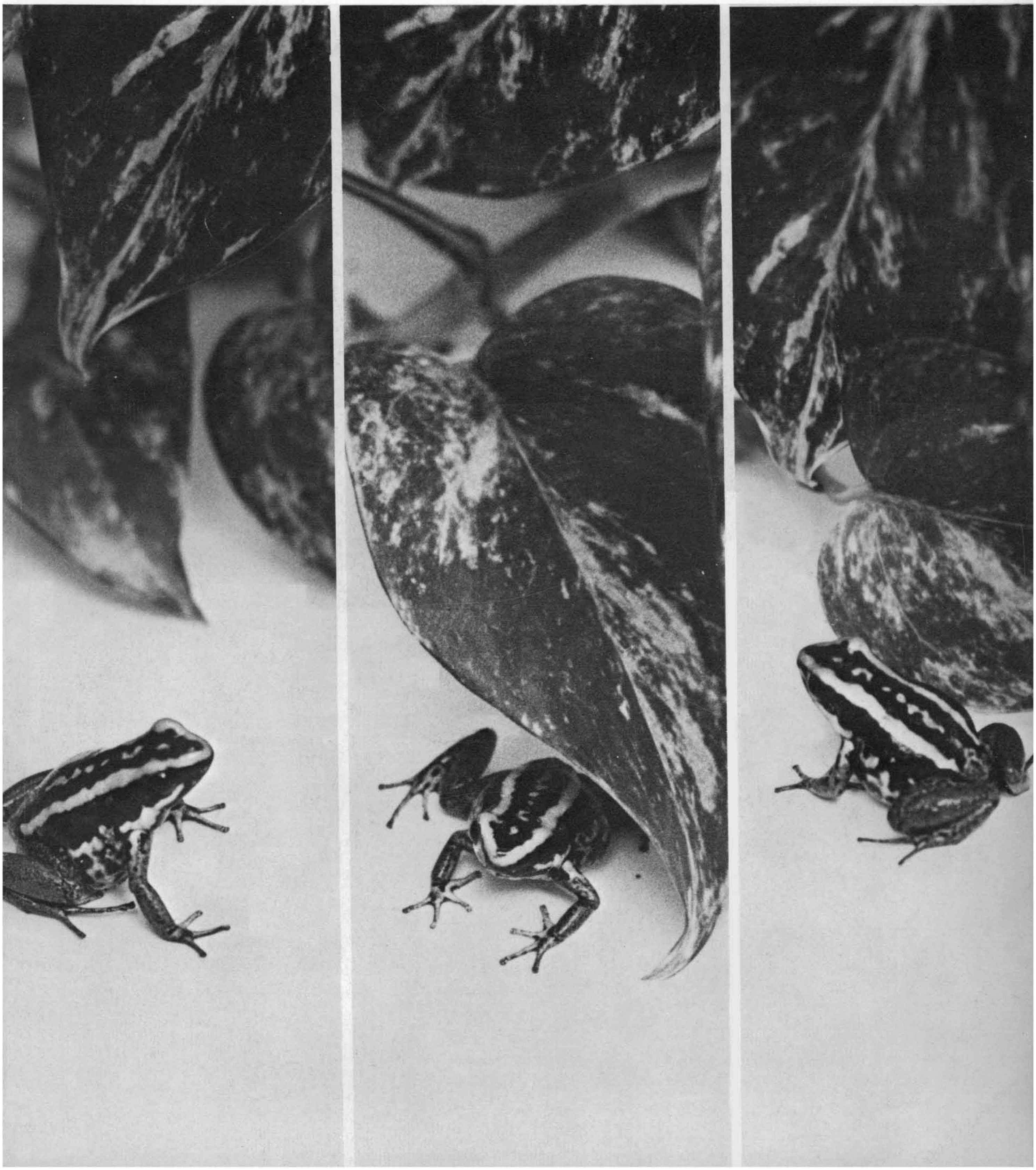
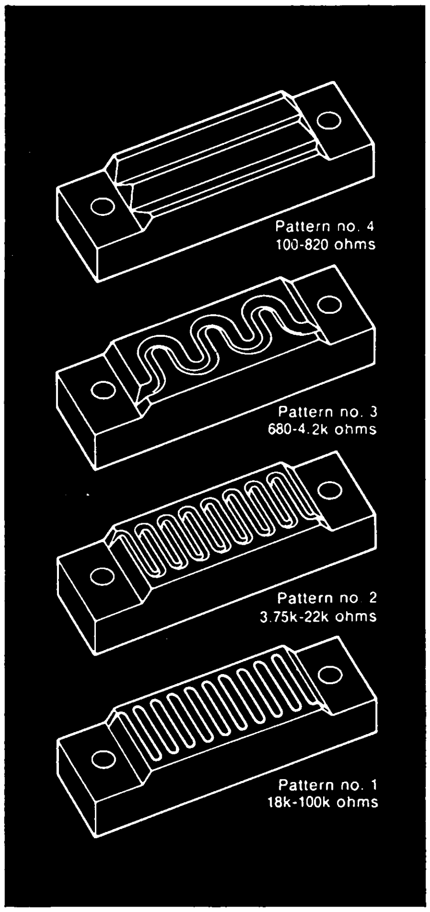
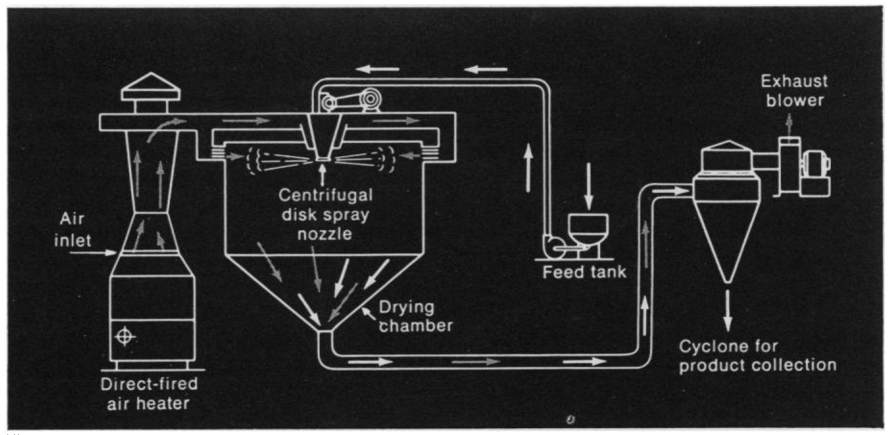


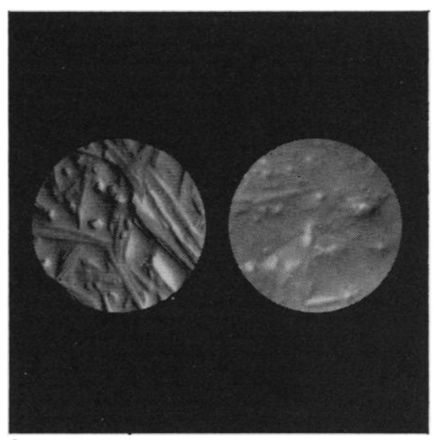
Putting resistance into new grooves.



The new resistors with the four groove designs and the range covered by each.



The spray-drying process that turns the wet ceramic into a fine powder with spherical granules.



Surface of original ceramic (left), and, (right), with finer grade of silica.

Everybody knows the virtues of tantalum for resistors in thin film circuits. Could these virtues be transferred to discrete resistors that would cover a wide range of values, and also be easy and economical to make?

That would involve, essentially, finding a way to deposit a resistor path — i.e., a strip of tantalum — on a ceramic substrate so that its length and width could be closely controlled.

The problem was given to engineers at Western Electric's Winston-Salem plant, and they solved it by designing a small ceramic rectangle which had a V-shaped groove on one surface. Coat that surface with tantalum and then grind it off: tantalum will be left in the groove, giving us our resistor path. Continued grinding keeps narrowing the resistor path. Hook the grinder up to an ohmmeter and it can be made to stop automatically at the desired resistance. With four groove designs we could cover the entire range from 40 to 100,000 ohms.

So far so good. But actually making these little ceramic rectangles with their little grooves presented another problem: what to make them out of. The most promising ceramic had two drawbacks. First, it developed needle-like crystals, giving it the surface you can see on the left of the picture, and tantalum sticks best to smooth, glassy surfaces. Second, the only way anybody had ever made anything out of this ceramic before was by a wet extrusion process. We couldn't extrude these little rectangles because of those wavy grooves.

Our engineers solved the first problem by changing the formulation of the ceramic, and the second by spray-drying it in a blast of hot air. Spraying broke it up into tiny droplets which were formed — by surface tension — into spheres, and that's the way they dried. So now we had a powder made up of spherical granules, which flowed almost like a liquid. That made it easy to get it into individual molds where each resistor substrate, complete with grooves, could be stamped out individually.

Development of even so homely a device as a new resistor is important to us at Western Electric because most of the electronic equipment we make is so complex—and because we make so much of it. Even a slight increase in long-range stability, and fractional reductions in initial cost, result in savings big enough to help the Bell telephone companies keep down the cost of your phone service.

Western Electric

We want to be useful ...and even interesting

Kodak

The pumpernickel looks better in color

Bakers not only outnumber astronomers but are more widely appreciated. Astronomers study the stars while undermining their own position by denying that the stars should be consulted about important matters like love affairs and investments. Pumpernickel and kuchen are more digestible than pulsars and quasars. It's a wonder astronomy has survived at all.

* * *

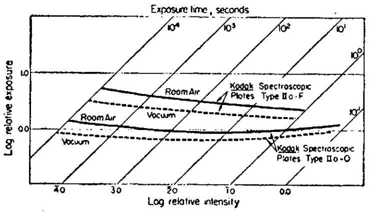
Astronomers make terrible customers for photographic manufacturers. Financially insignificant as consumers, they wheedle incessantly for better than the best that can be done. And you give it to them. Otherwise they'll crawl right into your emulsion kettles. What goes on therein may not long stop minds that can deduce the chemistry of stars.

* * *

The astronomer Schwarzschild noted that photographic response was not strictly the mere product of intensity and time but tended more toward It^p, where p seemed to be a constant other than unity. The late Emery Huse and colleagues at the Kodak Research Laboratories thought they'd better look into that. When the time scale was extended from days down to split milliseconds, p proved dependent on t. Microseconds were hard to come by in 1925. Later Huse went to Hollywood, where for many years he did glorious work selling our film to the motion picture industry.

* * *

We still study the failure of time and intensity to maintain reciprocity. This very year a paper* by T. A. Babcock, W. C. Lewis, and T. H. James—successors in interest to Huse *et al*—reports that an exposure requiring 2¾ hours on KODAK Spectroscopic Plates, Type IIa-F, takes only 1⅔ hours if room air is evacuated down to 10^{-6}–10^{-7} torr. Other than astronomers, only a small part of our market will thrill at this news from Rochester.



* * *

The speed advantage of evacuating the plateholder diminishes at more popular exposure times. Yet our scientific attention to reciprocity failure remains undiminished. We pour man-years into our vacuum sensitometer. We note that in certain experimental emulsions, the vacuum that prevents low-intensity reciprocity failure actually increases high-intensity failure, i.e. the microsecond is devalued. We note that dry O_2 restores some low-intensity failure. (Failure restored, hooray!) Masters of photosensitizing dyes, we note that the *desensitizing* dye phenosafranine may act as a good sensitizing dye in vacuum! Such dyes appear to act as transient traps for photoelectrons. This interference in the combination of electrons with silver ions increases the probability that oxygen will intercept those electrons and permanently remove them from participation in latent-image formation. Perhaps the process of electron trapping, silver atom formation, and silver atom dissociation is cyclic. It may take many cycles to form a stable product.

Theory and practical results continue to vitalize a product brewed from old bones. (Where else would the gelatin come from?)

* * *

Modern color film contains three different emulsions, each with its sensitizing dyes, each with its reciprocity effects. The people who have to get the film on the cable by 6 p.m. need know nothing about reciprocity. Not that kind.

* * *

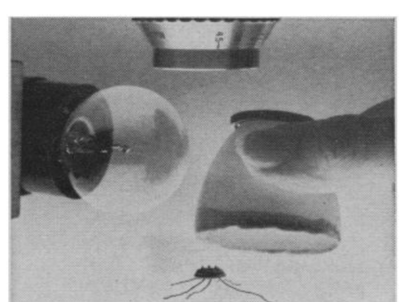
For TV, extreme localization impends. Hollywood is no longer the only place to sell professional motion picture film. Local entrepreneurs are getting on local cable systems, showing their neighbors their wares. The pumpernickel should look attractive.

Those who explore the universe may also help sell kuchen.

**Photographic Science and Engineering 15*:75 (1971)

Modest photography

When a picture is to be seen by 50 million people beyond the immediate neighborhood, one doesn't begrudge the shooting of an extra piece of film for good luck, or even the cost of potent equipment, or even, for that matter, the cost of rare skills long in building. That kind of photography is not covered in the new Kodak data book, "Basic Scientific Photography." Emphasis on "basic." As a good diffuser for photomacrography, for example, it recommends an eggshell, an inexpensive product not of our manufacture. That's the spirit of the book. Photographic dealers sell it.



The egg must be raw. A boiled egg will crack.

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COVER

Brightly colored frog (*Phyllobates vittatus*) of Costa Rica measures approximately 23 millimeters. It is closely related to the Colombian poison arrow frog (*Phyllobates aurotaenia*). Skin secretions from both frogs contain a potent cardio- and neurotoxic substance, batrachotoxin. See page 995. [Gary Laurish Photography, Washington, D.C.]

peat these specific rebuttals. However, it is somewhat surprising that the Holzman letter contains no attempt to answer any of the questions or points raised in the published reply (*3*), and which are so pertinent to assessment of the credibility of his findings and conclusions. For example, how many synoptic weather situations were investigated by Holzman and Thom, and how were they able to determine reliably air trajectories into convective storms with the relatively sparse synoptic data in Illinois and Indiana?

I also recommend that interested readers examine the recent article by Hidore (*4*) which deals with a thorough study of the streamflow data from river basins encompassing the La Porte area. This independent study verifies the existence of the La Porte rainfall increase through increases in runoff that are highly correlated with the La Porte rainfall. Whether this streamflow anomaly can be shown to be "spurious, statistically invalid, and physically unacceptable" (Holzman's terms for the rainfall anomaly) is an interesting question. Data on crop hail insurance loss in the La Porte area also corroborated the increase in hail-day frequencies shown at the La Porte weather station (*3*). Any reader interested in the subject of inadvertent urban modification of precipitation is encouraged to review the longer article by Holzman (*2*), my reply (*3*), and other pertinent publications (*5–8*).

Several major research proposals have been funded as a result of the recognition engendered by the La Porte results and the subsequent interest in inadvertent precipitation modification. For instance, the Illinois State Water Survey was awarded a 2-year grant to make climatological-statistical studies of precipitation conditions at eight major American cities. Furthermore, four atmospheric science groups (Argonne National Laboratory, University of Chicago, Illinois State Water Survey, and University of Wyoming) have joined together to plan a comprehensive 5-year field project to study urban effects on precipitation in the St. Louis area where downwind precipitation increases also exist. This funded project begins operations in 1971. Thus, several sizable funded proposals have been examined and approved by a wide variety of atmospheric scientists and funding agencies. Their judgment as to the validity of the results and the desirability of our studies of this phenomena is most gratifying and indicative of the fact that the La Porte precipitation anomaly is not a fallacy in the minds of most knowledgeable scientists.

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7. H. E. Landsberg, in *Man's Role in Changing the Face of the Earth* (Univ. of Chicago Press, Chicago, 1956), p. 584.
8. P. A. Kratzer, *Das Stadtklima*, vol. 90 of *Die Wissenshaft* (Vieweg, Braunschweig, 1956) (translated by American Meteorological Soc., as *The Climate of Cities*).

. . . It is possible that the La Porte anomaly is not real, but there has been considerable work done by some competent researchers that suggests that it is real. The fact that researchers have supported both sides of the issue suggests that the problem has not been resolved. A very important environmental problem is under investigation. If the anomaly is real, there may be far wider implications than is apparent in this individual case. A major problem in investigating this particular phenomenon is the difficulty in isolating the relevant variables and a lack of data with which to work. Unfortunately, however, analysis is limited to the data available.

Since the station data are suspect, perhaps the question can be resolved by using other environmental variables. A change of the magnitude suggested in the data should be exhibited in other aspects of the environment. If other avenues of testing the anomaly can be pursued, such as growth rates of trees or other ecological variables, they should be followed, whether aided by federal funds or not. It is through continued investigation from a variety of approaches that the question of the validity of the La Porte anomaly will be resolved. . . . A study is being carried on by William C. Ashby of Southern Illinois University involving a tree-ring analysis of white oak in the area of La Porte. It must be remembered, however, that in view of the complexity of interrelationships between environmental variables, changes in other variables may not be nearly so great as those in the precipitation.

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Unrealistic Demands on Science and Medicine

To serve the public most effectively, scientists, engineers, and physicians need a friendly, sympathetic environment and one in which their limitations are understood. Until recently such an environment prevailed, but the last few years have brought changes in the public's attitudes. Many adverse changes are involved, but one of the most important is the public's inaccurate estimate of what can be achieved. The public has come to expect miracles from engineering and medicine.

Today medical scientists and physicians are particularly subject to pressures produced by unrealistic demands from the public. Failure to produce miracles is taken as proof of a refusal to be interested in meeting the public's desires. One indignant correspondent wrote me in part as follows:

"It would certainly seem from the record to date, that basic research scientists are so preoccupied with the exquisiteness of their protocols and the refinements of their research approaches that they have missed entirely the objective and intent of we taxpayers who are funding their 'ivory tower isolationism.' . . . we as taxpayers expect something more in return than scientific dialogue between the scientists at seminars and in medical journals."

During recent discussion concerning the new cancer program, similar remarks were made. If the critics are unwilling to grant humane motives to medical scientists, the critics should at least recognize the power of self-interest. Anyone responsible for a dramatic advance in the fight against cancer will receive recognition and undying fame.

In some aspects of medicine, physicians can perform today what would have been impossible 40 years ago. Yet there are other aspects in which the practice of medicine has not changed much. For example, little can be done to halt the aging process. Neurological disorders are another area in which the medical profession cannot deliver as much as people wish.

Physicians find that many patients have unrealistic ideas of what doctors can do for them. Many people seem to think that they can carelessly expend physical resources in any way they wish and that the doctor can always cure them. Patients give no cooperation in the matter of exercise, diet, or abstinence from heavy smoking and yet expect the doctor to make up for their neglect. They want a drug to substitute for self-control and their own efforts. That kind of miracle is not yet available, nor is it likely to be.

Expectations for magical cures are partly responsible for the growing frequency of medical malpractice suits. If a cure is not forthcoming, the patient assumes the doctor must be at fault. Sometimes he is at fault, but often too much is expected of him. So common have malpractice suits become that fear of them is adversely affecting the practice of medicine and is raising the cost of medical care. Today many doctors find it necessary to practice medicine defensively—that is, instead of concentrating only on the well-being of the patient, they must also order a large number of unnecessary tests and examinations to answer questions they may be asked in court.

Scientists, engineers, and physicians cannot realistically hope that the favorable climate of 10 years ago will soon be restored. They can foster an improved climate, however, by persistently reminding the mass media and the public of the many limitations of science, technology, and medicine. We are neither witch doctors nor magicians.

—PHILIP H. ABELSON