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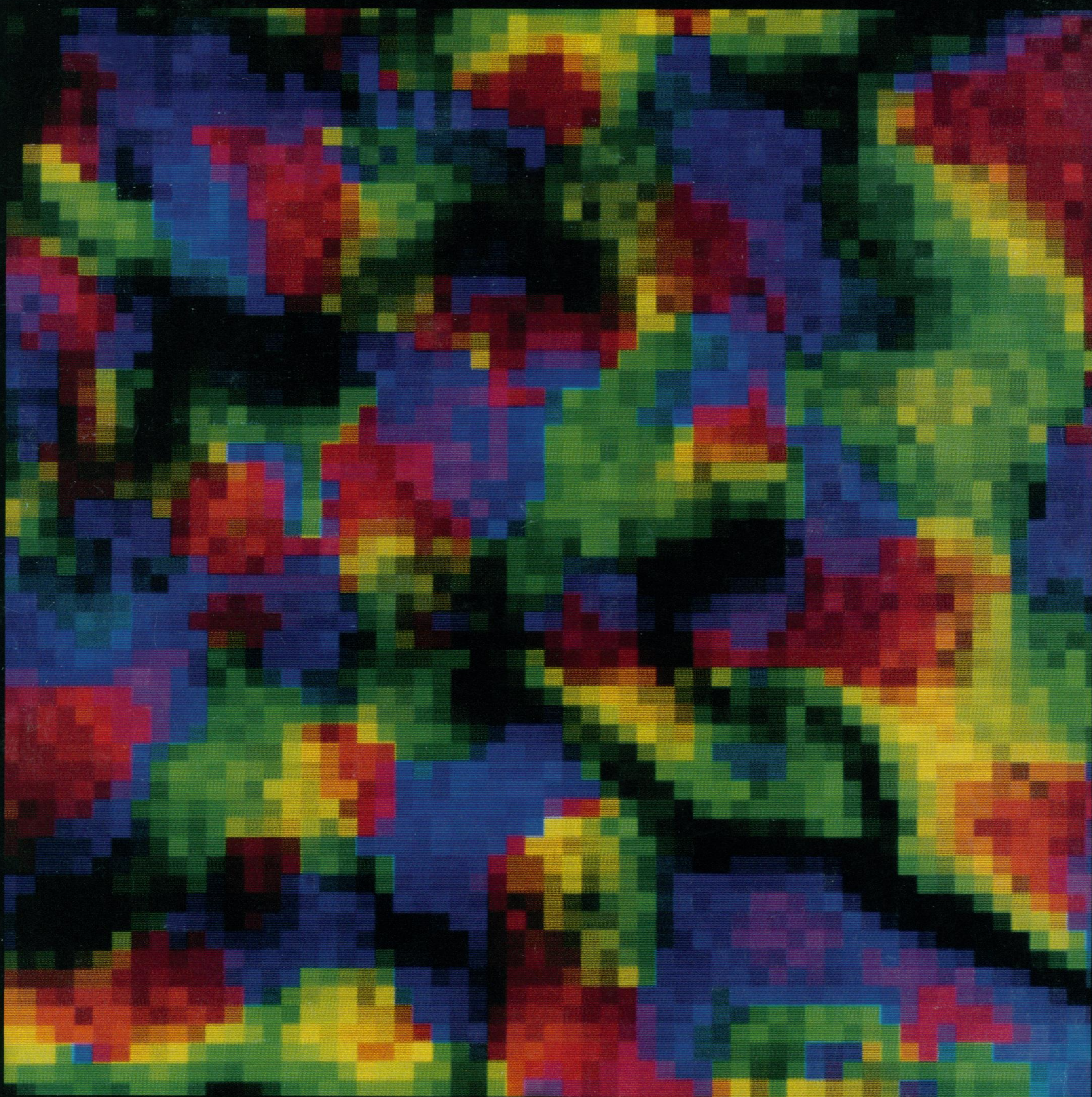

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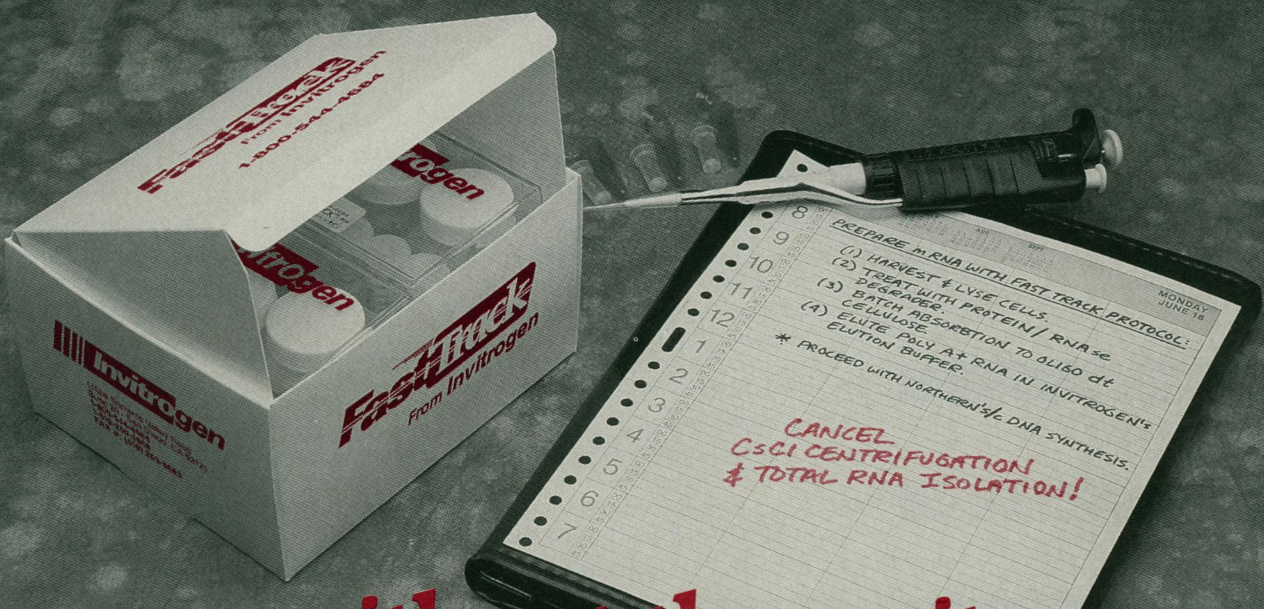

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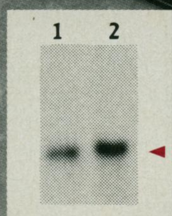

Lane 1. [illegible]NA isolated using guanidinium, CsCl centrifugation and oligo dT column selection. (30 hrs).

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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 Optical imaging of primate visual cortex based on the intrinsic, activity-dependent signals. An overlaid image of the orientation columns (cortical regions that respond preferentially to visual stimuli containing borders of a particular angle, indicated by a particular color) and the ocular dominance columns (cortical regions prefering left eye stimulation coded by a darkening of color). See page 417. [Field of view: 6 millimeters by 3.5 millimeters. Imaged by Daniel Y. Ts'o, Ron D. Frostig, Edmund E. Lieke, and Amiram Grinvald, The Rockefeller University, and IBM Research Division]

Reports

Book Reviews

Products & Materials

This Week in SCIENCE

Seeding life on Earth

How plausible is it that life on Earth got its start from organic materials brought here by comets or asteroids (page 366)? In a relatively thin atmosphere like that of today's Earth, even small comets would have hit Earth with such velocity that a great percentage of their organic constituents would have been lost en route or would have burned up on impact. But in a thick carbon dioxide atmosphere that may have existed some 4.5 to 3.8 billion years ago (when heavy bombardment was occurring and when life may have just begun to evolve), the thick atmosphere would have slowed comets, and their organics (some 25% of their mass) would have arrived at Earth intact. Chyba *et al.* discuss the likelihood of a cometary-source scenario for the origin of life and calculate how much organic material—some 10^{20} kilograms—could have been delivered to Earth in this way. The best estimate is that during the time of heaviest bombardment, 10^6 to 10^7 kilograms of cometary organics would have accreted on Earth per year.

Cellobiohydrolase II

There is tremendous interest in how cellulase enzymes work because they digest one of the most abundant organic compounds on the earth, the major polysaccharide of plants—cellulose. Cellulases are not only important in this continuing and naturally occurring process but are increasingly being used commercially, in such products as detergents and in such processes as the manufacture of paper. Cellobiohydrolase II is known to work synergistically with cellobiohydrolase I; these enzymes break cellulose into cellobiose disaccharide units. Rouvinen *et al.* (page 380) crystallized the active core protein of cellobiohydrolase II from a filamentous fungus and assessed the molecule's three-dimensional structure at high resolution. The crystallographic analysis included 365 amino acids and indicated which ones play major roles in enzyme action; this information helps to explain how the enzyme works and why cellobiose is its degradation product.

Critical behavior

At high pressures, insulators can be transformed into metals; the transformation occurs because pressure induces the redistribution of electrons in the material. The most fundamental example of this is the case of solid molecular hydrogen (H_2): the material is an insulator at ambient pressure; as the pressure rises, the material first transforms to a molecular metal and then is thought to dissociate to become a monatomic (H) metal. Hemley and Mao have studied the insulator-metal transition of hydrogen spectroscopically at pressures above 150 gigapascals over the temperature range of 77 to 295 K (page 391). At 77 K, a discontinuous transition occurs: there appears to be little change in the crystal structure of the molecular solid, but as molecular bonding is altered there is an electronic change and the frequency of the vibron (the intramolecular stretching mode) jumps between two discrete values. At higher temperatures, vibron frequency jumps between values that are closer together; at the highest temperatures examined all values between the two frequencies are observed (continuous behavior). These measurements have led to identification of a critical point for transition, that temperature below which transition is discontinuous and above which it is continuous.

Actin-myosin interactions

Muscle contractions and the workings of nonmuscle contractile systems depend on the interactions of filaments of actin and myosin. It was long thought that actin slid along the myosin filaments in only one direction, toward the center of the myosin filament. Video images of the interactions of these filaments show that actin can in fact slide both toward and away from the myosin center (page 406). Thick myosin filaments from clam muscles were used; they are very long and they could interact simultaneously with several fluorescently labeled filaments of actin. Sellers and Kachar speculate that flexibility in myosin heads may account for the bidirectional movement that takes place. The orientation of the actin molecule as it attaches to a myosin filament apparently determines in which direction the filament will move. Speed is apparently governed by myosin: actin moves quickly toward the center but as it passes over the center and moves away its speed is greatly reduced.

Vaccine strategy

Long after an individual has been vaccinated, an immunologic memory of the experience remains. At some later time, renewed exposure to the material in the vaccine can induce either an active immune response or immune suppression depending on the type of memory that the first exposure induced. Considering the mixed nature of immune responses, can prior immunizations ever be helpful in immunizing individuals to new materials? Successful exploitation of memory responses for inducing new responses appears to depend on selection of those materials that previously did not induce suppressor cells, and the early attempts to use prior vaccines may have failed precisely because focus was not directed toward separating enhancing from suppressing materials in the original vaccine. Etlinger *et al.* have identified a small portion of a large molecule—tetanus toxoid (TT), which is a widely administered vaccine—that apparently elicits helper immune responses and not immune suppression (page 423). When this material was attached to a small nonimmunogenic polymeric peptide, an immune response was induced in mice. Because humans around the world are exposed to TT, this material has the potential to be of use in vaccines to a range of low immunogenic substances. ■ RUTH LEVY GUYER