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<table>
<thead>
<tr>
<th>Page</th>
<th>Content</th>
</tr>
</thead>
<tbody>
<tr>
<td>1419</td>
<td>This Week in Science</td>
</tr>
<tr>
<td>1421</td>
<td>Synthetic Membranes</td>
</tr>
<tr>
<td>1423</td>
<td>The Basic Defect in Cystic Fibrosis: I. B. Levitan</td>
</tr>
<tr>
<td>1430</td>
<td>Fighting Cancer with Designer Cells ■ The Rocky Road to Remission</td>
</tr>
<tr>
<td>1434</td>
<td>Fusion Plan Ignites Controversy at DOE</td>
</tr>
<tr>
<td>1435</td>
<td>Support Offered for Fang Lizhi Soviets Admit 1957 Nuclear Mishap</td>
</tr>
<tr>
<td>1436</td>
<td>USGS Reports a Fraud IOM Elects New Members</td>
</tr>
<tr>
<td>1437</td>
<td>NIH: The Good Old Days Monkey Euthanasia Stalled by Activists</td>
</tr>
<tr>
<td>1438</td>
<td>Is It Real, or Is It Cray?</td>
</tr>
<tr>
<td>1440</td>
<td>Putting the Squeeze on Hydrogen</td>
</tr>
<tr>
<td>1441</td>
<td>Did the Roof of the World Start an Ice Age? ■ How to Stir Up a Climate Change</td>
</tr>
<tr>
<td>1143</td>
<td>NASA Racing the Sun to Save a Satellite</td>
</tr>
<tr>
<td>1445</td>
<td>The Decision to Modernize U.S. Intercontinental Ballistic Missiles: J. M. Deutch</td>
</tr>
<tr>
<td>1450</td>
<td>Optimum Chemical Sites and Techniques for Searches for Negatively Charged Rare Particles: R. N. Boyd, K. Takahashi, R. J. Perry, T. A. Miller</td>
</tr>
<tr>
<td>1457</td>
<td>DNA Looping Generated by DNA Bending Protein IHF and the Two Domains of Lambda Integrase: L. M. de Vargas, S. Kim, A. Landy</td>
</tr>
</tbody>
</table>
23 June 1989 SCIENCE

Cover: Thin section of a 2-centimeter garnet that rotated as it overgrew mineral grains in a deforming schist matrix. View is northerly on steeply dipping west limb of a large anticline in southeastern Vermont. Rubidium-strontium isotopic measurements on similar garnets nearby yield the growth rate of the garnets and therefore the deformation rate of the matrix. See page 1465. [Positive by Colortek, Culver City, CA, directly from this section and 575-nanometer retarder sandwiched between crossed Polaroids]

1465 Rates of Tectonometamorphic Processes from Rubidium and Strontium Isotopes in Garnet: J. N. Christensen, J. L. Rosenfeld, D. J. DePaolo
1475 Regulatory Role for GTP-Binding Proteins in Endocytosis: L. S. Mayorga, R. Diaz, P. D. Stahl
1480 Degradation of Proteins with Acetylated Amino Termini by the Ubiquitin System: A. Mayer, N. R. Siegel, A. L. Schwartz, A. Ciechanover
1487 Protection Against Streptococcal Pharyngeal Colonization with a Vaccinia: M Protein Recombinant: V. A. Fischetti, W. M. Hodges, D. E. Hruby
1490 Plant Hybrid Zones as Sinks for Pests: T. G. Whitham
1493 Transfer RNA Genes: Landmarks for Integration of Mobile Genetic Elements in Dictyostelium discoideum: R. Marschalek, T. Brechner, E. Amon-Bohm, T. Dingermann

Book Reviews

1497 Effective Social Science, reviewed by I. Berg ■ Novel Aspects of Insect-Plant Interactions, J. N. Thompson ■ Eukaryotic Transposable Elements as Mutagenic Agents, D. L. Hartl ■ Stylistic Boundaries among Mobile Hunter-Foragers, M. W. Conkey ■ Books Received

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Table of Contents 1417

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Search for exotic particles

ASSIVE, negatively charged particles may have been among the elemental entities that formed in the Big Bang (page 1450). So far, however, these so-called $X^-$ particles have remained elusive: no attempts to find them or to generate them through high-energy interactions have succeeded. Were they really produced and if so can they now be detected as embedded components of chemical elements? Boyd et al. consider where 10 billion years of chemical evolution (the time from the Big Bang to the formation of the earth) might have left the $X^-$ particles. They propose to search with laser spectroscopy for $X^-$ particles in diatomic molecules containing elements with certain masses (the best being boron and fluorine). Interactions of $X^-$ particles with nuclei would be electromagnetic. The discovery of $X^-$ particles would have implications for particle theories, for explanations of how the chemical elements of the periodic table formed, and for models of the evolution of the galaxy.

Garnet growth

GARNETS are common minerals in metamorphic rocks; because garnets grow during metamorphism (the pressure- and temperature-induced changes in rocks that often are associated with tectonic and deformation events), they contain a record of the physical conditions that pertained during their growth. Through a study of the strontium (Sr) and rubidium isotopes in garnets and of how $^{87}\text{Sr}$ increases from the core to the rim in individual samples, it has been possible to determine the length of time the garnet was growing, the rate at which it grew, and approximately when it grew (page 1465). Christensen et al. analyzed three large garnets from southeastern Vermont. The garnets formed some 380 million years ago during an episode of deformation and metamorphism that produced part of the Appalachian Mountains. The garnets formed during a 10.5-million-year period, and their rate of growth was calculated at 1.4 millimeters per million years. The growth interval provides a means for estimating the rate at which the rocks were deformed and heated.

Ubiquitin actions

UBIQUITIN, so called because it is ubiquitous, binds to proteins inside cells and marks them for degradation; various enzyme activities occur, the protein is broken down, and the ubiquitin is released. Previous studies indicated that proteins with free amino-terminal residues could be degraded in this way but that those in which the amino terminus was blocked with an acetyl group could not. However, Mayer et al. show that this is not the case; both blocked and unblocked proteins can be degraded by the ubiquitin system (page 1480). There appears to be a conjugating enzyme that links ubiquitin to the blocked proteins at a site distinct from the amino-terminal residue; it may have been lost during purification of preparations that were used in earlier studies. The majority of cellular proteins are blocked at their amino termini, and thus the ubiquitin system, which is involved in their turnover, appears to play an important role in normal cell physiology.

Streptococcal immunity

ROUP A streptococci can cause painful sore throats, "strep throat." There are 25 to 35 million cases of streptococcal infections diagnosed each year in the United States. If the infection is not effectively treated, rheumatic fever, which has become a significant problem in developing countries, can result. What makes these streptococci so virulent is their surface M protein. The M protein consists of a conserved end and a variable end. Hosts that resist infection produce antibodies to the variable end, but the tremendous variability in it (some 80 different variable ends have been identified) makes it unlikely that a vaccine could be made using variable end determinants. Fischetti et al. have prepared a recombinant vaccine in which the conserved end of the M protein was expressed in a vaccinia virus vector (page 1487). Mice were immunized intranasally with this vaccine and subsequently resisted a challenge infection with streptococci; they made antibodies to the conserved region, and throat swabs indicated that the bacteria were then unable to colonize the pharynxes. The approach of using a conserved region of a protein to provide cross-protection against related strains may have broad applicability for pathogens besides the group A streptococci.

Plants for pest control

BSERVATIONS of the distribution and survival of aphids on cottonwood trees in northern Utah may have important spin-offs for pest management (page 1490). Female aphids attack the tree’s developing leaves in springtime. If the attack is successful, galls form on the leaves, and, inside the galls, hundreds of progeny are produced. If the attack is unsuccessful, a telling scar remains on the leaf. Surveys of galls and scars indicated that most of the aphids—from 85 to 100%—attacked and formed galls on hybrid cottonwood trees rather than on the two pure species of which the hybrids are a mixture, even though one of these is a natural host of the aphid. Only 3% of all the trees were hybrids, but the preference of the aphids for the hybrids remained firm year after year. Whitham suggests that, by providing the aphids with a ready and highly susceptible host, the hybrid trees act as “ecological sinks”; furthermore, because the aphids are not adapting to survival on the more resistant pure hosts, the hybrids may be impeding evolution and thus are serving as “evolutionary sinks” as well. One form of aphid control might therefore involve the use of small numbers of aphid-supporting hybrids on which these pests can live.
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CV: coefficient of variation, a statistical measurement of variation of reproducibility strongly dependent upon column, method and system performance.
Synthetic Membranes

The level of R&D activity devoted to synthetic membranes has risen rapidly during the past several years. Great progress is being made both in separative capabilities and in the scope of practical applications. The trend is especially marked in the field of gas separations, in which at least 20 major companies worldwide are now active. Their membranes are being used in a host of important processes ranging from food preservation to natural-gas processing, refinery operations, and enhanced oil recovery.

A key event in the technology of gas separative membranes was the development by Monsanto of a method of producing tiny hollow polymer fibers, first used practically in 1979. Gases under pressure dissolve in the fiber walls and diffuse through the membrane at different rates. For example, the rates for methane and nitrogen are low, whereas those for moisture, oxygen, carbon dioxide, and hydrogen sulfide are rapid. There is an interesting contrast between barriers that have open tiny holes and those that present a continuous wall. The separation through a barrier with small holes is dependent on the ratio of the square roots of the masses. Thus the separation factor of nitrogen and oxygen is only about 1.07 through the holes, whereas some of the synthetic membranes have a separation factor of more than 7. The synthetic membranes are usually composed of such polymers as cellulose derivatives, polysulfone, polyamide, or polysiloxane. The structure of the polymer chain has a dramatic effect on separating characteristics. Bulky side groups create excess free volume within the wall. Moreover, large improvements in separative capabilities are being achieved by altering polymer formulations. Between 1985 and 1988, separative capabilities were increased from 200 to 400%. A recent product announcement by Generon, a subsidiary of the Dow Chemical Company, indicates further substantial progress.

In many instances membrane technology is in competition with existing methods. For example, cryogenic equipment for separations of gases is well established. However, in comparison to other methods membrane equipment often has low capital costs, ease of operation, low energy consumption, operational cost effectiveness, and good weight and space efficiency.

Membranes alone cannot achieve perfect separation of gases, for example, nitrogen from the oxygen of air. However, in one pass through the fibers, the gas is changed from 21% oxygen to a gas containing 2 to 5% oxygen or less. This product is excellent for many applications such as preservation of fruit and grain and for safely blanketing highly inflammable liquids. In grain elevators, a low oxygen content safeguards the grain against rodents and other pests while eliminating danger of dust explosions. Fruit can be maintained in excellent condition much longer in the presence of a low oxygen content than with ordinary air present. At locations distant from a cryogenic plant membrane separation is the simplest, most cost-effective method of achieving the low oxygen content.

Installations of gas separative membranes are increasingly occurring in energy production activities. An initial application was to isolate hydrogen from other components in refinery streams. What may become more important is the processing of gas mixtures that contain methane, moisture, carbon dioxide, and hydrogen sulfide. Such mixtures are present in much of petroleum production, non-associated natural gases, and gas produced in connection with enhanced oil recovery attained through injection of carbon dioxide. Some natural gas contains a quite toxic level of hydrogen sulfide. Both this compound and carbon dioxide are corrosive to pipes, and their level and that of water must be reduced before injection into major pipelines. In the past, many discoveries of natural gas were capped because of excessive content of non-methane gases. Cheaper membrane technology is changing the economics. Carbon dioxide has become valuable in enhanced oil recovery so that gases that were worthless now have two useful components—carbon dioxide and methane. Another situation in which membrane technology is especially helpful is in offshore production of petroleum with its associated gases. The older technology for cleaning the gases is heavy, cumbersome, space demanding, and not entirely free of hazard. Membrane separation is preferable in many instances.

Prospects are excellent for further improvements in the selectivity and performance of membranes and for their energy and cost-effective use in a growing number of large-scale applications.—PHILIP H. ABELOSON

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Synthetic peptides VH(G7-68) and VH(XG-68) of the myeloma immuno-globulin M603 heavy chain and their association with the natural light chain.
chain to form an antigen binding site. Biochemistry 26:24 (1987) 7849-7855
Kubai, T. et al.


Phenotype determination of human erythrocyte acid phosphatase in 30 minutes. Protides of the Biological Fluids 34 (1986) 811-813, Engaras, H., Jagersten, C.


Purification and some characteristics of a beta-galactoside binding soluble lectin from amphibian ovary. FEBB Lett. 233 (1987) 330-334, Fink de Cabutti, N.


introduced worldwide.


HIV-infected cells are killed by rCD4-ricin A chain. Science 242 (1988) 1166-1168, Till, M.A.

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USGS Reports a Fraud

With a neat guillotine chop, the U.S. Geological Survey (USGS) on 14 June disclosed and terminated a case of alleged scientific fraud within its ranks. In a brief announcement, the agency revealed the apparent misdeeds of Robert L. Houghton, a hydrologist assigned to headquarters in Reston, Virginia, formerly a brilliant figure in the USGS district office in Bismarck, North Dakota.

After an inquiry by a three-member panel in January that charged him with fabricating data and forging peer-review letters, Houghton resigned from USGS. The agency is scouring its files for work that may have been tainted, and a North Dakota official reports that “nearly every project” Houghton worked on in that state was affected, causing a waste of over $2 million.

Phone calls placed to Houghton’s residence by Science went unanswered.

Houghton, age 38, made his reputation in North Dakota, according to William Schuh, the state-employed scientist who accused him of passing off false data, as a “bright, hardworking, articulate person” who cultivated the image of “the consummate scientist.” Schuh and Robert Shaver, staff hydrologists at the North Dakota Water Commission, worked with Houghton on water chemistry research related to the Garrison Diversion Project, a major irrigation plan funded by the Bureau of Reclamation.

“We might never have had a hint of all this—because Bob was so quick and good—except that we were hooked up with him on this research.” Data had to be passed from one member of the team to the next before it could be submitted, and in this process the state scientists found that there was no evidence that data for water samples taken in 1986 had ever been produced in a laboratory.

When they began asking for backup information and original lab sheets, they say they were turned aside with “strange excuses.” For example, Schuh claims he was told he could not have some numbers because they were “buried awfully deep in the computer.” They began to suspect that something was wrong, but, says Schuh “we had no idea how far it would go.” In the end they say they discovered that the data were completely fabricated.

When they felt the evidence against Houghton was overwhelming, they demanded a meeting with him in front of the district USGS chief in Bismarck. The meeting took place in January 1988, but led to no punitive action. Instead, Houghton received a promotion to headquarters, and the two state scientists resolved to let the matter drop. But then, Schuh says, he found that more spurious data from Houghton were given to project researchers, and “that just heaped too many coals on the fire.” Schuh began demanding written documentation for a variety of reports and, in doing so, uncovered more problems.

Houghton, whom many knew as Dr. Houghton, had been removed discreetly from a doctoral program before graduating from the Massachusetts Institute of Technology because the data in his dissertation were falsified. Later, he was quietly let go from a postdoctoral program at the University of Alberta because data and letters of recommendation were forged.

Because the North Dakotans demanded it, USGS director Dallas Peck ordered a review by a panel chaired by James Cook, chief USGS hydrologist of the Southern Region. It confirmed the charges and recommended unanimously that Houghton be dismissed. — Eliot Marshall

IOM Elects New Members

The Institute of Medicine has elected 40 new active members, 5 senior members, and 5 foreign associates. This brings the total active membership to 483, the senior membership to 332, and the foreign associate membership to 13. The new active members are:

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ing a single-copy probe isolated from the 3' flanking region of the tRNA$_{{\text{Glu}}}$ (GAA)1 gene, we were able to identify two corresponding polymorphic fragments of 2.9 kb in strain AX2 while the same gene resides on a 5.0-kb Eco R1 fragment in strain HU1628 (Fig. 3A). This result can be explained if one assumes that the tRNA$_{{\text{Glu}}}$ (GAA)1 allele resides on a 5-kb genomic Eco R1 fragment in HU1628 and is not associated with DRE1/ DRE2 elements. The corresponding allele in D. discoideum strain AX2 is known to contain these elements 54 nucleotides upstream of the tRNA gene. Since the DRE2 element contains an internal Eco R1 site at a distance of about 1.6 kb from the integration site, digestion of genomic AX2 DNA with Eco R1 generates a fragment of 2.9 kb (Fig. 3C).

Results obtained from hybridizing the same filters containing size-fractionated genomic Eco R1 fragments from AX2 and HU1628 with a probe that recognizes DRE2 elements and tRNA$_{{\text{Glu}}}$ (GAA) genes, respectively, strongly support this interpretation. According to this analysis, a 2.9-kb Eco R1 fragment from AX2 hybridizes as well with the tRNA$_{{\text{Glu}}}$ (GAA)-specific probe as with the DRE2-specific probe (Fig. 3B, lanes b and d), while the 5.0-kb Eco R1 fragment from HU1628 is only recognized by the tRNA-specific probe but not by the DRE2-specific probe (Fig. 3B, lanes a and c).

Our observations described here provide a plausible explanation for the relative ease with which tRNA genes from D. discoideum were mapped from restriction fragment length polymorphisms (6, 8). Clearly tRNA genes in D. discoideum are preferentially targeted by mobile genetic elements.

Our results are analogous to those obtained in yeast and may therefore implicate more general mechanisms for transposition or retrotransposition. In yeast, sigma elements are almost exclusively associated with tRNA genes, located at position −19 to −16 relative to the 5' end of different tRNA coding regions (3). Although most sigma elements characterized to date are isolated insertions, a few of these elements occur relatively closely spaced to a Ty3 and function as an LTR of this element (4). Another repetitive element termed tau (10) has been encountered in yeast that is so far exclusively associated with tRNA genes (11). It remains to be determined for yeast as well as for D. discoideum whether the association of a tRNA gene with a mobile genetic element may interfere with the expression of the tRNA gene.

REFERENCES AND NOTES

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6 December 1988; accepted 21 April 1989

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