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COVER Cross section of a serpentine superlattice (100 angstrom period) and its three lowest energy electron wave functions as an example of fabrication on a small scale (see page 1326). The cross-sectional view (far right) shows the aluminum-rich regions (dark) that confine electrons to the gallium-rich regions (light) in the segregated aluminum-gallium-arsenic alloy. The most colorful portions of the wave functions (in sections to the left) are regions of maximum electron density; the reddish-brown areas indicate zero density. See the editorial on page 1277 and the special section beginning on page 1300. [Simulations by J. C. Yi of the University of California, Santa Barbara]
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The topic for this first survey is intriguing, important, timely and to be revealed, with survey results, in February 1992.

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If you have questions or topics to suggest for future Member Opinion Polls, please call Kathleen Markey, Member Research Manager at (703) 448-7862.
Room at the Bottom

Scales and magnitudes are part of the stuff that scientists love. Cosmology and megascopes on the one hand, and atoms (or subatomic particles) and microscopes on the other, give us a sense of how grand nature is and how consistent our physical pictures are.

In 1959 Richard Feynman gave a lecture, later reprinted, entitled “There’s Plenty of Room at the Bottom” (see Research News, p. 1300). In his usual prescient way, Feynman suggested a variety of experiments and technologies that might be achieved at very small scales. This is an area that is currently getting a lot of hype. Some recent suggestions sound like science fiction, although we are not yet seeing articles titled “Honey, I Shrank the Factory.” Nevertheless, terrific advances have been and are being made. In this issue, we explore some progress in manipulating matter on very small scales. The technology and science range from manipulating individual atoms to manufacturing macrostructures such as sensors.

Whitesides et al. deal with the problem of molecular self-assembly and nanotechnology. “Nanostuctures” have dimensions of about 10 to 1000 angstroms, a size that is small by engineering standards, common by biological standards, and large to chemists. Many biological structures are formed by molecular self-assembly. The spontaneous aggregation of molecules using noncovalent bonds to form a well-defined structure is a critical component of biological systems. Self-assembly is discussed as a strategy in chemical synthesis with the potential of generating nonbiological structures of this size.

Stroscio and Eigler discuss atomic and molecular manipulation with the scanning tunneling microscope. Until recently, we depended on the collective behavior of molecular systems to understand their structure. Diffraction and absorption experiments reveal much about molecular structure by simultaneous study of a large number of similar or identical molecules. Now, scanning tunneling microscopy allows us to look at individual atoms and has become a critical tool for exploring structure at the atomic level. One of the most recent exciting developments in this field is the ability to move single atoms, place them at selected positions, and build structures atom by atom.

Sundaram, Chalmers, Hopkins, and Gossard describe new advances in quantum devices. In particular, quantum wires and quantum wells, in which electrons are confined to potential wells in one and two dimensions, will lead to new electrical and optical properties. Using epitaxial deposition, one can readily make two-dimensional artificially quantized structures. By means of atomic steps on single-crystal surfaces it is possible to make very small (less than 100 angstrom diameter) wires. Electrons can also be released and controlled in the third dimension. For example, a parabolic potential can be realized by synthesizing a graded Al_xGa_1-xAs alloy with a parabolic mole-fraction profile. This article and a related Research News article by Graft (p. 1306) discuss important and interesting progress in this area.

Finally, Wise and Najafi describe microfabrication techniques for integrated sensors and microsystems. This technology provides the interface between very large scale integrated circuits and non-electronic monitoring and control. Using photolithography to provide a mask, followed by etching, one can produce various kinds of sensors, most recently flowmeters and accelerometers. Owing to high-volume production, the costs of these sensors and actuators can be exceedingly low, and they are already beginning to revolutionize much of the complex control machinery that we deal with every day. Biomedicine and automated manufacturing are areas in which these devices will be especially important.

Much of what we see here was foretold by Feynman, although the techniques that are actually in use today were not apparent at the time of his lecture. It is clear that he would have been gratified by the progress that has been made and the promise of more to come. There is, indeed, room at the bottom, and we are beginning to move in.

—JOHN I. BRAUMAN
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unwanted senescence was causing me to see double, that some antisense RNA had mucked up my optic nerves. When a second look detected no second Science, my worry was replaced with the thought that antisense RNA cloning was being practiced on these homozygous fruits. Have the National Institutes of Health approved this practice? Could Congressman Dingell’s staffers be investigating at this very moment? Perhaps the congressional subcommittee that funds the National Endowment for the Arts can come up with a reason to investigate. Or maybe the General Accounting Office will be asked to determine whether agency libraries that subscribe to Science have been shortchanged six tomatoes.

Al Duba
341 Lincoln Avenue,
Livermore, CA 94550

Reply: The image provided by the authors was of six tomatoes. Our art department duplicated the image for the cover of Science for the sake of design. This shows that we will publish only results that can be duplicated.—Eds.

Jellyfish Aloft

In his article “Space may be bad for your health” (Research News, 27 Sept., p. 1491), Eliot Marshall states that the “2000 jellyfish lofted into space aboard the space shuttle in June swam around placidly, much as they do on Earth.” Many of the 2478 jellyfish swarm, but not as they do on Earth. The tiny jellyfish (ephyrae) are immune neither to microgravity in space nor to gravity on Earth when they swim. Indeed, on Earth, they tend to sink when they stop swimming. Therefore, Marshall’s reference to NASA’s budget being as “immune to gravity” as the “lofted” jellyfish is inappropriate.

Dorothy Spangenberg
Eastern Virginia Medical School,
Norfolk, VA 23501-1980

Ynes Mexia’s Legacy

Ynes Mexia was indeed a remarkable woman (Book Reviews, 23 Aug., p. 917), even more remarkable if any of her plant collections “went to Asa Gray,” since Gray had been dead for 33 years when Mexia began her botanical activities in 1921.

Robert Ornduff
Department of Integrative Biology,
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Science, Vol. 254
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SATURDAY, 8 FEBRUARY

Information Processing in the Nervous System: Molecular Basis (8:30am–11:30am)
Experience, Impulse Activity, and Gene Expression, Ira Black, Robert Wood Johnson Medical School
+ Signal Transduction in the Nucleus of Neurons: Role of Inducible Proto-Oncopeptide Transcription Factors, Thomas Curran, Roche Institute
+ Signal Transduction in the Brain: Role of Phosphoproteins, Paul Greengard, Rockefeller Univ.
+ Molecular Basis of Neuronal Function, Charles Stevens, Salk Institute

Conscious and Unconscious Processing of Sensory Information (2:30pm–5:30pm)
Unconscious Synthesis of Different Sensory Information, Barry Stein, Medical College of Virginia
+ Blindsight, Larry Weiskrantz, Univ. of Oxford
+ Dynamic Aspects of Visual-Cortical Function, Torsten Wiesel, Rockefeller Univ.
+ Conscious and Unconscious Processes Following Brain Lesions, Michael Gazzaniga, Dartmouth Medical School

SUNDAY, 9 FEBRUARY

Selective Attention (8:30am–11:30am)
Organization and Development of Attentional Computations, Michael Posner, Univ. of Oregon
+ Cognitive Neuroscience View of Selective Attention in Object Identification, David LaBerge, UC-Irvine
+ Cellular Studies of the Circuitry of Visual Selective Attention in Primates, Robert Desimone, NIMH
+ Separating Mechanisms of Awareness and Attention: A Cognitive Neuropsychological Approach, Mary Jo Nissen, Univ. of Minnesota

Finding Our Way: Neuronal Processing for 3-D Motion (1:15pm–2:15pm)
Topical lecture by Robert Wurtz, NIH

Memory (2:30pm–5:30pm)
High-level Representations in the Cerebral Hemispheres, Stephen Kosslyn, Harvard Univ.
+ Priming and the Organization of Visual Object Memory, Daniel Schacter, Harvard Univ.
+ Object Recognition in Mind and Brain, Irving Biederman, USC
+ Probing the Nature of the Mental Representation of Visual Objects, Lynn Cooper, Columbia Univ.
+ Visual Memory Circuits, Mortimer Mishkin, NIMH

MONDAY, 10 FEBRUARY

Computational Models (8:30am–11:30am)
+ Mechanisms of Visual Development: Ocular Dominance and Orientation Selectivity, Kenneth Miller, CalTech
+ Sparse Coding, Orthogonalization, and Pattern Completion in Theoretical and Real Hippocampal Networks, Bruce McNaughton, Univ. of Arizona
+ Computational Model of Semantic Memory Impairment: Modality Specificity and Emergent Category Specificity, Martha Farah, Carnegie Mellon Univ.

Computations Underlying the Execution of Movement: A Biological Perspective (1:15pm–2:15pm)
Topical lecture by Emilio Bizzi, MIT

Biology of Language (2:30pm–5:30pm)
Rules of Grammar: Linguistic, Psycholinguistic, and Neurolinguistic Evidence, Steven Pinker, MIT
+ Genetic Disorders, Myrna Gopnik, McGill Univ.
+ Genetic Variation and the Differentiation of Cognitive Processes, Thomas Bever, Univ. of Rochester
+ Brain Damage and Aphasia, Alfonso Caramazza, Johns Hopkins Univ.
+ Studies of Language Comprehension with the PET Scan: Processing of French and Tamil Stories by Monolingual French Subjects, Jacques Mehlert, CNRS

Advance registration fees: Regular members, $265; regular nonmembers, $315; student members, $125; student nonmembers, $150; postdoc members, $155; postdoc nonmembers, $180. Deadline for advance registration is 10 January 1992. On-site fees are $25 higher for all others. Fee includes access to the seminar and to all AAAS'92 general sessions. For a registration form and a complete AAAS'92 meeting program, see the 15 November 1991 issue of Science or call 202-326-6450.
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Synchrotron Radiation Laboratory. The films were digitized with a drum scanner (Optronix Corp.), and the data were processed with computer programs originally written by Rossmann (19). The native and the Hg data were merged and scaled with the crystallographic program package PROTEIN (20), and the Au data were merged and scaled for anomalous scattering data with programs from the CCP4 package. (S.E.R.K. (U.K.) Collaborative Computing Project No. 4 (Daresbury Laboratory, Warrington, U.K., 1979)).

20. W. Steigemann, PROTEIN: A Package of Crystallographic Programs for Analysis of Proteins (Max Planck Institute for Biochemistry, Martinsried, Germany, 1982).
21. In order to determine the correct space group enantiomorph, phases from the Au derivative anomalous scattering data were calculated in the space groups P6_32 and P6_52 and tested in difference F_{Au} - F_{Hg}. Fourier syntheses. The two Hg sites emerged as the two strongest peaks in the electron density maps when the data were treated in the space group P6_52, whereas the map calculated in P6_32 had much weaker Hg peaks, thus confirming the former as the correct space group.
43. Abbreviations for the amino acid residues are: G, Gly; K, Lys; M, Met; N, Asn; Q, Gln; S, Ser; and T, Thr.
44. We thank N. Sakabe, A. Nakagawa, and N. Watanabe of the National Laboratory of High Energy Physics, Tsukuba, Japan, and J. Farrar of Molecular Structure Corp., the Woodlands, Texas, for use of their data collection facilities. G.G.P. thanks the American Cancer Society, California Division, for a postdoctoral fellowship (J-15-89). Supported in part by NIH grants AI 30725 to S.H.K. and DK 09768 to D.E.K., DOE (Director, Office of Energy Research, Office of Biological and Environmental Research, General Life Sciences Division under contract DE-AC03-76SF00987 to S.H.K.), and the William M. Keck Foundation. Atomic coordinates will be deposited with the Brookhaven Protein Data Bank.

19 August 1991; accepted 21 October 1991

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