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**How do plants know which way to grow?**

**Discovery may explain plant behavior**

Picture a Venus’s-flytrap doing what it does best: feeling a wandering insect and snapping the trap shut faster than anyone else. "How do plants know which way to grow?" says Pickard. "The central focus of our work is fairly simple: How do plants know which way to grow? But, just as NASA is eager to see spin-offs from research on gravity, so are we. And we believe that these channels are constantly monitoring a huge range of signals important for growth and development of forms.

Using a technique called "patch clamping" — in vogue for researching membranes and ion fluxes — Pickard and Ding have studied the action of individual calcium channels in cell membranes, observing tiny characteristic electrical currents as they stretch and relax the membranes. Controlling the concentrations of ions as well as the voltage on either side of a small "patch" of membrane, they have been able to show that the ions moving across the membrane are calcium.

Over the past year, Pickard and Ding have been testing the theory that the calcium channels are involved in modifying transport of the growth-controlling hormone auxin. They are also working to identify specific proteins that are responsible for control of channel action. The real significance of their findings is that Pickard says, is the opportunity it provides scientists to work with a relatively straightforward question: What goes on when a plant responds to the internal stresses that guide its development and to the environmental forces to which it must adapt to survive.

Pickard and Ding reported their discovery of the calcium channels at the August 1990 meeting of the International Congress of Biophysics in Vancouver and most recently at the November meeting of the American Society for Gravitational and Space Biology. In addition, they have contributed a chapter, "Gravity Sensing by Higher Plants," to Comparative Aspects of Mechanoreceptor Systems, a book edited by Fazio R.tto be published by Springer-Verlag in 1991.

The response from the plant science community to Pickard and Ding’s discovery has been enthusiastic, according to Lewis Feldman, Ph.D., professor of plant biology at the University of California, Berkeley. "Barbara Pickard has been the plant world’s leader in stretch-activated calcium channels, and because of her work many individuals are showing an increased interest in calcium channels," says Feldman, a plant physiologist who works with Pickard and Ding.

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**ROTIC committee releases report**

Following six months of research and deliberation, the report and recommendations of the Committee to Study the Relationship Between ROTIC and Washington University have been presented to the provost of Washington University, according to James F. Jones Jr., Ph.D., committee chair and head of the Department of Romance Languages and Literatures.

The report is a thorough study of ROTIC (Reserve Officer Training Corps), its history, its relationship to and its role at Washington University, and the inconsistencies that exist between disciplinary Department of Defense (DOD) policies and Washington University anti-discrimination policies regarding sexual orientation.

Since August 1990, Jones and his six-member committee made up of faculty and students met more than 30 times to compile information and testimony on the relationship of ROTIC to the University. Their charge from Provost Edward S. Macias, Ph.D., was: "To propose options for possible courses of action to the University administration, to give arguments for and against each option, and to give the committee’s recommendations from among these options."

In preparing its report, the committee reviewed ROTIC-university relationships at other institutions, and they also corresponded or met with a large number of Washington University students and faculty, all of whom were invited to comment to the report. The committee’s recommendations will focus on ROTIC policies concerning recruitment of students and faculty, ROTIC programs on campus, ROTIC’s role in the relationship between ROTIC and Washington University, and ROTIC’s relationship to ROTIC at other universities.

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The Acting Company will stage two plays

The Acting Company, the touring arm of the John F. Kennedy Center for the Performing Arts, will present Shakespeare’s “The Two Gentlemen of Verona” at 8 p.m. March 22 and 23 at Edison Theatre. The troupe also will present “Romeo and Juliet” at 8 p.m. March 25 at Edison Theatre. Both plays are part of Edison’s “OVATIONS!” series.

“The Two Gentlemen of Verona” is a comedy about the betrayal of brotherly friendship by romantic love. Directed by Charles Newell, former resident director at Minnesota Guthrie Theatre, “Two Gents” is an exuberant production using the elements of commodity doll art and set in a stylized Old West. The production employs broad physical comedy and live music and explores the spiced humor found in the Shakespearean text.

“Romeo and Juliet” is a new production of the most famous romantic tragedy in the Western world. The central figures, two young “star-crossed lovers,” have symbolized romance and dire fate for centuries. In this production, set in the Romantic period, humorous elements of the text are developed as an affecting balance for its tragic aspects. Leon Ruben, director of this production of “Romeo and Juliet,” was formerly the artistic director of the Bristol Old Vic and the Warfield Palace theatres in England and the Lyceum Theatre in Belfast.

Founded in 1972 by Margot Harley and the late John Houseman, The Acting Company is America’s only permanently touring professional repertory theatre company. As its official touring arm of Washington, D.C.’s, Kennedy Center, it gives talented and well-trained young American actors the opportunity to develop their craft and build ensemble skills, while bringing the world’s great theatre classics to audiences across the country. To date, they have traveled more than 200,000 miles, performing 77 plays in 46 states for almost 2,000,000 theatre-goers. Late last year the company toured the Soviet Union and Eastern Europe. They also have played throughout Australia and done an extended residency at the Old Vic Theatre in London.

Among The Acting Company’s best-known alumni are actor John Lithgow and Academy Award winner Kevin Kline and Tony Award winner Patti LuPone. While the underemploy-ment rate among American actors in general hovers around 80 percent, even lesser-known former touring members of The Acting Company are consistently in demand for television, film and theatre work.

Tickets for each performance by The Acting Company are $18 for the general public; $14 for senior citizens and Washington University faculty and staff; and $9 for students. For more information, call 888-6754.
Kathleen F. Briceley, J.D., George Alexander Madill Professor of Law, has received the John VanOrder Award from the Transportation Research Board of the National Academy of Sciences for his work in the field of transportation law. Briceley was cited for her 1990 paper titled "Civil RICO: Backlash or Catalyst for the Government?" Applications in the Highway Construction Industry Board is a division of the National Academy of Sciences. She was also recently invited to attend an annual meeting in Washington, D.C.

Terry Clements, women's volleyball coach, has been selected by The Olympic Festival Committee to coach one of the four women's volleyball teams for the 1992 Olympic Festival next summer in Los Angeles.

Larry E. Davis, Ph.D., associate professor of social work and adjunct associate professor of psychology, presented the opening address for the 36th Annual Juvenile Officers Institute, which was sponsored by the Minnesota State Juvenile Officers Association. The institute, titled "The Minnesota Mix: Cultural Influences on the Juvenile Justice System," examined the intersecting cross-currents, traditions and family systems of the African-American, Hispanic, Native American and Southeast Asian communities in Minnesota.

Philip E. Korenblat, M.D., clinical professor of radiology at the School of Medicine, was program chairman of the 114th Annual Seminar on Clinical Alleges and Practicing Physicians held in St. Louis.

Paul Michael Lützeler, Ph.D., professor of German and comparative literature and director of the Western European Studies Program, will give the keynote lecture for the international Hermann Broch Symposium at London University in May. He will also give lectures at international conferences on European culture in Frankfurt, Germany, and in Chicago at the European Studies Program at the American University.

Paul M. Pollina, M.D., assistant professor of radiology at the School of Medicine, presented "The Role of Computed Tomography in Bronchogenic Carcinoma," at the Third Annual Lung Cancer Symposium. He spoke on computed tomography and magnetic resonance imaging in New Zealand, and at the Third International Immunotherapy Symposium. He has also discussed various applications of these diagnostic tools.

Neal Ngard, M.D., senior research fellow at the School of Medicine, received the American College of Rheumatology Senior Scholar Award for developing a technique to directly detect the cell surface protein complex instruments to triggering immune responses.

Patricia E. Robinson, a staff nurse in the Department of Obstetrics and Gynecology, was included in the 1990-91 edition of Who's Who in America. The listing is based on significant accomplishments and leadership. A member of Phi Theta Rho, Robinson works with Catherine Dean, M.D., instructor in the department.

George I. Zahalak, S.D., professor of mechanical engineering, received the bioengineering division of the American Society of Mechanical Engineers (ASME) as the best journal paper of 1990. The paper, titled "Muscle Activation and Connection: Constitutive Relations Based Directly on Cross-Bridge Kinetics," was selected from those appearing in the journal Biomechanical Engineering over the last year.

The paper will now be nominated by the ASME constitutive division for the 1991 Medley Medal, which is for the best paper published by all divisions of the ASME.

Have you done something noteworthy?

Have you: Presented a paper? Won an award? Been selected as officer of a professional organization? The Washington University Office of College Communications will help spread the good news. Contributions regarding recognized awards and experiences — such as trapping insects or isolating a gene — may provide new varieties of plants or new ways to manage disease. Contributions regarding other significant experiences are also encouraged.

Beachy receives national prize

Roger N. Beachy, Ph.D., professor of biology and director of the Center for Plant Science and Biotechnology, is one of six exceptional individuals to receive the 1991 Common Wealth Projects Distinguished Service. Beachy, who won the Science and Innovation Award, will share a $120,000 cash prize given for outstanding achievement in various kinds of human endeavor.

"Beachy was chosen in recognition for leading a team of researchers who produced the world's first genetically engineered food crop — tomatoes — to be resistant to insects," said Dr. Calvert A. Morgan Jr., chairman, Bank of Delaware. "By winning the Common Wealth Awards recognize and encourage and the best of human performance worldwide. As trustee and sponsor, Bank of Delaware is proud to present this award. We applaud the remarkable talent of California's second messenger.

The award winners will be honored at the Commonwealth Wealth Awards celebration banquet on March 16 at the Hotel du Pont, Wilmington, Del. To recognize Beachy's achievements, the Bank of Delaware said that Beachy "has opened new research avenues with his pioneering experiments. His work is the cornerstone of our understanding of the most rapid and pest- and disease-resistant crops for the world's population of the late 20th and early 21st centuries."

"We have known for some time that calcium functions in animals as a second messenger that binds to and activates specific proteins, in turn leading to phosphorylation of cell, specific enzymes that initiate cascades of molecular events that then lead to such a widespread mechanism that we had to imagine that it occurred in plants. Calcium had to mediate a lot of mechanical signals, and it had to enter the cells by way of calcium channels. Over the years, evidence for the role of calcium as a second messenger in plants has been building."

Pickard has extended his research to include a study of proteins making up the channels and the proteins and carbohydrates that control ions through the channels. The proteins associated with calcium channels could bring new insights into the aging process in the next decade, Pickard believes.

"Gravity sensing is the ultimate, most basic type of a wonderful focus for studying mechanosensitive calcium channels," Pickard says. "I think that we don't know a great deal about the detailed biochemical information about this kind of physiological control system, and molecular biologists will then capitalize on it.

Discovery — continued from p. 1

some kinds of tissue systems as Pickard. "Her work has been visionary. Her latest theories are opening new doors."

The emerging theory in plant science is that mechanical signals lead to growth and development of plants from birth to death. For instance, the little bumps that develop at the tips of stems to make leaves may be positioned simply by the stem created in the outer layer of cells by the slightly older, outgrowing bumps. And, shifting patterns of calcium and mechanical stress in the surface of the bumps control the three-dimensional, time-varying pattern by which plants expand into mature leaves.

Pickard offers a colorful way to visualize cellular stress and strain: Think of the plant cells as little rubber bands, filled to the bursting point with water and prevented from blowing up any more by the cell walls. When a cell needs to grow," she explains, "the walls have to be loosened and then the water balloons inside will press it and cause it to expand. The walls of neighboring cells are glued together with what has been termed intercellular cement. Thus, when cells grow, they tend to tug on each other. If a plant is to grow in an orderly way, the cells must have a general message about how much they should expand and in what direction. And, they are able to get back of what their neighbors are doing so they don't pull and tug the other excessively and shred the tissue."

"Given that we have observed mechanosensitive calcium as a representative kind of cells, it seems highly likely that there are specific proteins directing the disparate processes of leaf formation, growth, differentiation and movements — such as trapping insects or alignment in the gravitational field — are produced by opening these channels to let calcium into the cells.

Calcium is a universal trigger for a host of biological activities in diverse organisms, critical as the common denominator, and the regulator for many cellular pathways. A number of years ago, Pickard explains, additional experiments began to realize that a host of environmental signals were transduced by calcium channels in cell membranes, giving the plant biologist hope that a similar system could be found in plants.

Poetry contest is on

All Washington University students are invited to participate in the annual Dance of Elyx Poetry Contest. Deadline for entries is 3 p.m. March 15 in Room 116 Doncker Hall. "These entries, each at least 1,000 words, will be awarded. They are The Norma Lowry Memorial Fund Prize, The Robert Conant Hatch Fund Prize and The Academy of American Poets Prize. "Contest entrants are not eligible for the Hatch prize.

Entries are limited to three poems per person. Poems should be typed on 8 1/2 x 11 paper. Entries should not exceed 1,000 words. Students are not eligible for the Hatch prize. "Contest entrants are limited to three poems per person. Poems should be typed on 8 1/2 x 11 paper. Entries should not exceed 1,000 words.

For complete contest rules, please contact the Office of Student Life in 114 Doncker Hall.
Wednesday, March 14
12:10 p.m. Gallery of Art Talk, Steinberg Hall. Gallery hours: 10 a.m.-5 p.m. weekdays. For more info., call 889-5690. 
2-10:30 p.m. George Warren Brown School of Social Work, 100 Broadway Hall. For more info., call 889-5690.

Thursday, March 17
11:45 a.m. Filmboard Foreign Series Presentations "Celine and Julie Go Boating," a silent movie directed by Dziga Vertov. Room 210 Ridgley Hall.


Friday, March 18
11:45 a.m. Dept. of African and Afro-American Studies Colloquium, "Science Policy in Developing Countries: The Case of Mexico," Robert P. Mandel, Littauer Professor of the History of Science and Technology, University of California, Santa Barbara. For more info., call 889-6726 or 889-6797.

6-6:30 p.m. and 6:30-9:30 p.m. Filmboard Foreign Series Presentations "Lettre et Julie Go Boating," a French film with English subtitles. Room 210 Ridgley Hall.

Saturday, March 19
11:45 a.m. Dept. of Medical Genetics Seminar, "The Genetics of Pancreas Development," Anthony V. Proto, Dept. of Radiology, Medical School of Architecture. Steinberg Hall Aud. Gallery hours: 10 a.m.-5 p.m. weekdays. For more info., call 889-6543.

2:10 p.m. George Warren Brown School of Social Work, 100 Broadway Hall. For more info., call 889-5690.

6:30-9:30 p.m. Filmboard Feature Series Presentations "The Man With the Movie Camera," a silent movie directed by Dziga Vertov. Room 210 Ridgley Hall.

7 p.m. Dept. of Physics Colloquium, "Fundamental Observations in Chest Radiology," with Pearlie Evans, administrative assistant, Harry J. Hurst Lounge, 201 Duncker Hall.

Sunday, March 20


11:30 a.m.-2:30 p.m. Women's and Gender Studies Colloquium, "Intracellular pH Regulation of K+ Channel Gating," Richard Aldrich, U. of Illinois-Urbana. Room 210 Ridgley Hall.

1-10:30 p.m. George Warren Brown School of Social Work, 100 Broadway Hall. For more info., call 889-5690.

Wednesday, March 27
1:10 p.m. George Warren Brown School of Social Work, 100 Broadway Hall. For more info., call 889-5690.

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