

CALS researchers specializing in plant-based research also make discoveries relevant to human medicine. In the Department of Microbiology, Stephen Winans studies *Agrobacterium tumefaciens*, a bacterium that causes crown gall tumors in certain plants. These bacteria only carry out certain functions when their numbers are high enough, which researchers detect by measuring the concentration of a chemical the bacteria secrete, a phenomenon called quorum sensing. "It has turned out that this phenomenon is important in several pathogens, including *Pseudomonas* in cystic fibrosis patients, and it is therefore a target for designing antibacterial drugs," according to Stephen Zinder, department chair.

Another example of plant research paving the way for human medical breakthroughs comes out of CALS efforts in genomics, one of the most significant areas of scholarship in which the college is currently engaged. While studying the evolutionary changes that caused fruits and vegetables to evolve over time from tiny, wild species to the large and bountiful specimens associated with modern agriculture, Steven Tanksley, Plant Breeding, and Plant Biology, discovered a direct genetic connection between the processes involved in plant growth and the processes involved in the growth of cancerous tumors in humans and other mammals. With the help of the Parallel Processing Resource for Biomedical Scientists at the Cornell Theory Center (CTC), Tanksley's group used a computational biology program, developed at the CTC, to create a three-dimensional structure from the protein sequence in domesticated fruits and vegetables. As a result, the research team found the connection between the way in which plants make edible fruit and the way in which humans become more susceptible to cancer. This may have significant implications for future cancer treatments, among other areas of research. "In this era of genomics, many people are looking at divergent organisms, and we're starting to realize connections we never imagined," Tanksley says.

This is just a small sampling of CALS research projects currently underway that stand to impact understanding of human health and the prevention, detection, and treatment of human diseases. In addition to projects within specific departments, CALS biomedical research often crosses departments and colleges, and it is partnered with extension staff, other universities, and government programs.

Susan Henry  
Dean, College of Agriculture and Life Sciences

Nicole Neroulas and Esther Baker  
Public Relations, College of Agriculture and Life Sciences

## From Human Development to Policy Analysis and Management, the College of Human Ecology Breaks New Ground in Medical and Medical-Related Research

The College of Human Ecology responds to human needs by improving nutrition and health, advancing design and technology, promoting development throughout the life course, and securing economic and social well-being for individuals, families, and communities. The college's multidisciplinary academic departments and programs conduct research that addresses complex societal issues including the cross-cutting theme of human health. Some faculty conduct medical or medical-related research.

### Human Development

Steven Robertson studies fetal and infant development. With Peter Nathanielsz, formerly at Cornell's College of Veterinary Medicine, and William Smotherman at the University of Massachusetts, he has demonstrated in fetal sheep that contractions of the uterus, long before the onset of labor, influence an important source of behavioral complexity also present in humans. Assessments of fetal behavior can indicate the clinical status of the fetus and predict neonatal outcome. His research with infants has revealed a tight link between general motor activation and visual attention. This link is likely to be mediated by the same sub-cortical brain structures that have been implicated in the pathophysiology of attention deficit hyperactivity disorder (AD/HD).

Elise Temple's work has implications for dyslexic children. Temple and her collaborators at Stanford University have used functional magnetic resonance imaging of the brain to analyze disrupted neural responses to phonological and orthographic processing in dyslexic children. During letter matching, normal-reading children showed activity throughout the extrastriate cortex, especially in occipito-parietal regions, whereas dyslexic children had little activity in the extrastriate cortex during this task. Thus, dyslexia may be characterized early in childhood by disruptions in the neural bases of both phonological and orthographic processes.

Richard Depue conducts research on the neurobiology and neurochemistry of personality, emotion, and cognition. He studies dopamine, serotonin, norepinephrine, and opioid function in relation to the traits of extraversion, emotional stability, fear-anxiety, and affiliation, as well as cognitive functioning. These personality traits define major dimensions of temperament in children. The work has direct implications for personality disorders and disorders of affect, as well as to the etiology and maintenance of substance abuse. Further, Depue studies the manner in which these systems come to be controlled by environmental context.

Jeffrey Haugaard investigates the mental health and development of female adolescents, who have exhibited high levels of physical violence and verbal aggression, in juvenile corrections facilities. He analyzes the effect of this aggression and the staff members' counter-aggression that



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# From Personality Disorders to Biomaterials to Ergonomics

Robert Barker/CU



Steven Robertson, Human Development, studies fetal and infant development with implications for the clinical status of the fetus and predicting neonatal outcome.

Robert Barker/CU



Liam O'Neill, Policy Analysis and Management, specializes in the strategic and operational use of quantitative methods and information systems in health care with implications for issues such as hospital bed scheduling, surgical scheduling, materials management, and the effect of surgeon age and experience on health outcomes.

Bob Kausner/CU



Elise Temple, Human Development, uses functional magnetic resonance imaging of the brain to analyze disrupted neural responses to phonological and orthographic processing in dyslexic children.

Garrick Goh



Alan Hedge, Design and Environmental Analysis, studies workplace design and ergonomics in relation to health, comfort, and productivity of workers.

Adriana Rovers/CU



Richard Depue, Human Development, conducts research on the neurobiology and neurochemistry of personality, emotion, and cognition, with implications for personality disorders and for substance abuse.

Richard Killen/CU



Donald Kenkel (l.) and Alan Mathios (r.), Policy Analysis and Management, focus on youth cigarette use and smoking cessation with a goal of understanding the impact of government regulation and legislation on human well-being.

Nicola Kountoupes/CU



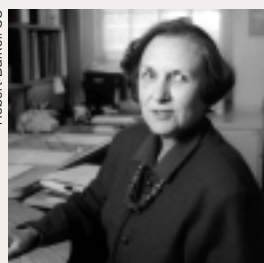
Jeffrey Haugaard, Human Development, investigates the multifaceted mental health environments of female adolescents in juvenile correctional facilities in relation to violence.

Robert Barker/CU



Gary Evans, Design and Environmental Analysis, researches the effects of the physical environment in concert with psychosocial conditions on health and well-being over the life course.

Robert Barker/CU



Kay Obendorf, Textiles and Apparel, demonstrates that clothing can spread *Aspergillus* spores, a fungal pathogen that is a major threat to hospital patients who are immunocompromised due to chemotherapy and drugs taken for organ or tissue transplants and AIDS.

CU



Fungal spores on cotton fibers

**“It is known that infectious diseases can be spread by contaminated clothing. [cornell researchers] have demonstrated that clothing can also spread aspergillus spores.”**

can heighten the impact of a violent institutional environment on the development of the adolescents and on their behavior upon release from the institution. Of particular concern is that their violence may spread into relationships with their current or future children and continue the cycle of violence. This multifaceted approach, based on Cornell University's Therapeutic Crisis Intervention Program, is unique in its integration into the mental-health services offered at the juvenile corrections facility.

## Textiles and Apparel

Biomedical materials is the focus of C. C. Chu's work. He develops novel biodegradable polymers and fibers for tissue regeneration (like vascular graft wound closure) and for drug control and release purposes. He has synthesized biodegradable polymers and hydrogels that have unique biologic functions. These new biomedical materials have better mechanical properties and provide the capability to tailor biodegradation while developing a wide range of hydrophilic and hydrophobic characteristics. Potential applications of these new biomaterials is controlled drug release, artificial skin, wound dressing, the coating of surgical implants and tissue culture wells, and carriers for gene therapy.

Airborne spores of *Aspergillus* pose a potentially deadly threat of infection to hospital patients who are immunocompromised due to chemotherapy, drugs taken to accommodate organ or tissue transplants, or AIDS. The death rate for bone marrow transplant patients who become infected with this fungal pathogen exceeds 90 percent. It is known that infectious diseases can be spread by contaminated clothing. Kay Obendorf and graduate student Betsy Dart have demonstrated that clothing can also spread *Aspergillus* spores. When staff or visitors enter a patient's room, fungal spores from the outdoor environment can be dislodged, exposing the immunocompromised patient. Hospitals can address the situation through policy and facility management practices that consider clothing as a route for fungal contamination even in spaces using HEPA-filtration.

## Design and Environmental Analysis

Issues of design and workplace ergonomics can affect the health, comfort, and productivity of workers. This is Alan Hedge's arena. He investigates carpal tunnel syndrome risk factors for workers and alternative keyboard system designs. He evaluates chair, workstation, and product designs and the performance and health effects of postural

strain. He also studies the effects of flooring materials on pesticide contaminants in residences. His related research includes studies on the effects of indoor air quality on sick building syndrome complaints among office workers, the effects of two-component office lighting on eyestrain problems among computer workers, the development of tools for visualizing information on behavior in buildings, and evaluation of the effects of novel ventilation solutions, such as breathing-zone filtration technology and under-floor task-air ventilation.

Gary Evans is an environmental and developmental psychologist interested in how the physical environment in concert with psychosocial conditions affect human health and well-being over the life course. His specific areas of expertise include environmental stress, children's environments, and the study of developmental consequences of poverty. In a collaborative project with Peter Lercher, Medical School, University of Innsbruck, he evaluated the long-term health effects of changes in ambient noise levels on children's development. The establishment of a national health surveillance system is underway to monitor relations between environmental change and children's health.

## Policy Analysis and Management

Youth cigarette smoking is a major health threat. Research by Donald Kenkel and Alan Mathios examines youth cigarette use and smoking cessation. Their goal is to understand the impact of government regulation and legislation on human well-being. Large increases in the price of cigarettes have been imposed to deter youth from starting to smoke. This is a crucial public policy tool used to prevent young adults from starting to smoke. However, Kenkel's and Mathios's research questions the efficacy of this policy tool, since they found that the policy has not deterred as many youth from starting to smoke as previously thought.

Liam O'Neill specializes in the strategic and operational use of quantitative methods and information systems in health care. His recent research has focused on process improvement, including hospital bed scheduling, surgical scheduling, and materials management. Among other projects, he examines the effect of surgeon age and experience on health outcomes for stroke-prevention surgery. His research shows that older surgeons with more than 20 years of experience have greater mortality rates for CEA, a particular neurological procedure. This was one of the first studies to link detailed data on more than 500 surgeons to patient outcomes. Numerous empirical studies on bypass surgery have resulted in state minimum volume standards for bypass surgeons. Further research may lead to similar policy measures.

*Kay Obendorf*

Associate Dean for Research, College of Human Ecology



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