



# Greater Than the Sum of Its Parts: The Human Cognition Enhancement Program

Gestalt psychology argues that the whole is greater than the sum of its parts. This theory vividly describes the dynamic and prolific synergy at work in Drexel University's Human Cognition Enhancement Program (HCEP), a new educational and research collaboration involving most of the University's colleges and schools.

In her research as professor of psychology, Maria Schultheis, Ph.D., also the scientific advisor of HCEP, employs a driving simulator to test people's cognitive abilities and reaction times. In his research as professor and chair of Family, Community and Preventive Medicine, Eugene Hong, M.D., studies adolescents with sports-related concussions. HCEP has brought their interests together in a truly innovative and productive way. Drs. Schultheis and Hong are collaborating on an NIH grant that, if funded, will pair Dr. Hong's concussion patients with Dr. Schultheis' driving simulator – potentially addressing many unanswered questions about recovery of function after concussions and other forms of brain injury.



"The opportunity to bring strengths from multiple different areas together is what's really exciting about this program," explains Barry Waterhouse, Ph.D., College of Medicine professor of neurobiology and anatomy and HCEP scientific director. "We have a broad representation of people with diverse interests. What emerges is a unique blend of expertise and perspective that leads to new ideas and new applications."

This wide intellectual net distinguishes HCEP from similar endeavors at other institutions. Indeed, its breadth is a valuable asset. Kenny J. Simansky, Ph.D., interim vice provost for research and vice dean for research at the College of Medicine, says, "What I think separates [HCEP] from most of the other programs is just that it isn't so focused on a particular problem or a narrow theme. Instead, this initiative is directed at pushing the boundaries outward, in order to capture the diverse settings in which training, drugs, devices and other strategies are needed to improve cognition. So by creating a very large box to play in, [HCEP has] really enabled some interdisciplinary interactions and connections among faculty that I don't think ordinarily occur when you go into more restrictive types of programs.... That's a real benefit."

In May of 2009, after five years of planning, a series of workshops provided a venue for faculty to present their academic interests in this area. Sreekant Murthy, Ph.D., professor of medicine and HCEP administrative director, says this "show and tell" gave faculty members from across the University the opportunity to see where their research interests might overlap. This forum proved to be a fertile opportunity for innovative multidisciplinary work. As HCEP has evolved,

the program has focused on six areas of interest: ADHD and autism, aviation and aerospace, brain injury, decision sciences and pedagogy, neuroAIDS, and technologies.

To return to the concussion patients and the driving simulator – Dr. Waterhouse relates that neither Dr. Schultheis nor Dr. Hong “knew of one another until [HCEP] brought them together. They subsequently submitted an NIH grant application.... Up until that point, [Dr. Schultheis] was investigating performance of *normal* individuals in that circumstance.”

Testing the injured athletes will enable Drs. Hong and Schultheis to gauge “how [injured individuals] perform relative to those who haven’t had concussions,” explains Dr. Waterhouse. For example: “What aspects of driving are compromised following concussion? How long does it take to fully recover driving skills following a concussive injury?” There is currently no treatment for a concussion (other than rest) or diagnostic test to know whether someone has fully healed. The driving simulator may help answer these basic fundamental questions.

Having the College of Medicine as a resource is a great asset to the Human Cognition Enhancement Program. “When it comes to evaluating certain aspects of human performance and recovery, the clinical insight is critically important,” attests Dr. Simansky. Faculty members in the College of Medicine are also involved in research in the areas of blast injury, ADHD, and the aerospace field.

In collaboration with the School of Biomedical Engineering, Science and Health Systems, scientists at the medical school are studying the effects of blast injury on the brain. Combat in Iraq and Afghanistan has made this research all the more important. Dr. Murthy explains that there are “certain innovative, noninvasive technologies available [in biomedical engineering] that can be used for evaluating what is really happening within the brain at the time of brain injury.”

A neuropharmacologist by training, Dr. Waterhouse has recently received an NIH grant to investigate the “neural basis” for the effects of methylphenidate, commonly known as Ritalin®, on sustained attention. In addition to its wellknown clinical use for treating ADHD, an increasing number of people from all age groups and all walks of life are using Ritalin off-label to promote wakefulness and enhance cognitive function. Yet, as Dr. Waterhouse explains, “despite the increasing popularity of this drug, we really don’t know how it affects brain circuits responsible for attention and decision making.” In addition, he describes the emerging debate among clinicians, scientists, and ethicists regarding the use of a drug to augment mental capabilities in otherwise healthy individuals. Under the umbrella of HCEP, Dr. Waterhouse hopes to develop new scientific knowledge that is relevant to this debate.

There is also a concentrated effort in the program to investigate cognitive function under high-stress and high-fatigue situations, particularly in aviation, education, and the workplace. Scientists in the College of Medicine are collaborating with other faculty, as well as outside institutions, to investigate the cognitive dynamics of emergency flight situations. In conjunction with Drexel alum William Mitchell, president and CEO of Environmental Tectonics Corporation, faculty members are developing performance measures training systems to prepare pilots and flight controllers for those emergencies.

“Aircraft upsets and subsequent recovery are not uncommon,” states Dr. Murthy. “How do we actually look into the human factor? Associated with that: how can we actually prevent [upsets]?” According to Dr. Waterhouse, scientists in the HCEP are “looking to create cross-discipline training where human factors are the focal point in engineering designs – ‘human-in-the-loop’ engineering.”

This June, HCEP showcased the nine University projects currently funded by the program. Dr. Waterhouse says they “ran the gamut, from a model of Alzheimer’s in fruit flies to decision making in the board room.” All these examples of HCEP research illustrate the real-world

applications and clear human benefits of the multidisciplinary work being conducted.

As the program continues to evolve, Dr. Waterhouse sees it encompassing four components: research, education, public outreach, and a University seminar series. "The ultimate goal," he continues, "would be to create a nationally renowned academic center that would be a destination for students, scholars, and faculty who in one way or another are interested in studying cognition [Drexel] would be a reservoir of knowledge in this arena and a springboard to translational research and novel applications." As Dr. Simansky summarizes, HCEP is "all about building new academic programs and addressing these issues of human need."

Solving human problems in innovative ways is nothing new at the College of Medicine. Yet the principle that the whole is greater than the sum of its parts really rings true in the Human Cognition Enhancement Program. "We could be something as a College by ourselves, but we can be much greater by interacting with our colleagues from other colleges and schools in novel ways," Dr. Simansky explains. "How [we] collaborate will make a real difference. If we do it by ourselves, we're going to be much less accomplished. This program is a very clear example of that kind of collaboration."

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