Building a Culture of Innovation

David Kelley, the founder of the global design firm IDEO, spoke at the Thayer School of Engineering about building a culture of innovation in higher education, this spring. Kelley’s company focuses on user-centered design for products, services, and environments. In 1980, Kelley was on the IDEO team that created the computer mouse for Apple.

In his talk, Kelley spoke about teaching a methodology to unleash creativity. He explained his four-part design thinking methodology, which combines human-centered design, a culture of prototypes, radical collaboration, and storytelling. Design thinkers should have empathy for people who use the devices and services, so that they can identify the need and respond to it. According to Kelley, creating prototypes is a crucial step in achieving this empathy and replicating the true experience of having a product. Kelley also explained his idea of radical collaboration, emphasizing the importance of team diversity: “None of us is smarter than all of us.”

Kelley also commented on general applications of a design thinking mindset, noting that a design thinker is now on the prerequisite skill list for start-ups. Kelley is hoping to change the way we think about creativity and points out that we can easily apply design-thinking techniques in our personal lives. “As a student, it’s your job to build a passion for something,” Kelley advised. “The only way to build passion is to go out into the world and experience a lot of stuff.”

Kelley emphasized understanding people and creating designs area for the user, not the designer. Everything should be an experiment, he said, and the experimentation has to be transparent and, at the end of the day, fun.

Chemistry

Hybrid Ultrasound and Fluorescent Imaging System Used for Cancer Tumors

Surgical procedures are used to remove cancerous tumors from the body, but are less invasive procedures possible? Sason Torosean, a researcher at Dartmouth College, attempted to answer this question. Torosean, along with other researchers, developed a new ultrasound and fluorescence hybrid system that can be used to monitor drug delivery and distribution in tumor cells.

“We want to understand drug therapy,” Torosean says, “because we don’t think the drugs always reach the tumors.” Although drug treatments are used to treat tumors, it is uncertain whether the drug can effectively reach its target tissue. However, ultrasound and fluorescent imaging can be used to monitor the activity of nanoparticles in tumor cells.

“We used ultrasound to find where the tumor is,” Torosean explained. Using mice as experimental models, Torosean injected fluorescent nanoparticles into induced tumors in the mice. The injected nanoparticle was the drug ALA; when excited with a laser, ALA produces a toxin called PpIX that kills tumor cells.

The laser also induced fluorescence in the nanoparticle, allowing for imaging of the distribution of ALA molecules. Fluorescent wavelengths were taken from samples of both normal and tumor tissues and then compared. The normalized measurements indicated how many nanoparticles were present in tumor tissues, based on their absorbance levels.

Torosean found a linear response between the absorbance of light and the concentration of PpIX, confirming a direct correlation between absorbance and concentration. “The project has some definite clinical applications,” says Torosean. By locating tumors and measuring drug concentration using a novel combination of ultrasound and fluorescent imaging, a safer and more efficient alternative to surgery may soon be introduced.
Butler presented results from ATLAS experimentation that suggest the presence of a Higgs Boson signature in a channel corresponding to its decay into gamma rays at 126 GeV. He acknowledged difficulties in attempting to locate the Higgs Boson due to an excess of background interactions caused by more than one billion proton collisions per second in the LHC. Results from 2011 suggested that the probability of background noise in the 110-150 GeV range fluctuating to the level observed in the 126 GeV channel was roughly seven percent, a first clue that the Higgs Boson may actually exist.

Butler predicted a banner year for the LHC in 2012. The LHC is in the process of increasing the energy of its proton beams to a final collision energy of 14 TeV. Many eyes will be trained on data from the LHC in 2012. Over 3,000 collaborators, including roughly 1,000 graduate students, are currently working on the ATLAS project, which serves as only one of six detectors on the LHC circuit. Butler, who called the collaboration as a “United Nations of Science,” expects the LHC to continue to both pose and answer fundamental questions in physics in the near future.

In a recent publication, Daniel Avesar and Allan T. Gulledge of the Gulledge lab in the Department of Physiology and Neurobiology at the Geisel School of Medicine described their discovery of a subset of cortical neurons that are excited, rather than inhibited, by serotonin. These neurons were found in the layer 5 cortex, which is the layer responsible for the bulk of cortical output.

Serotonin is currently the target of much research because of its ties to diseases such as depression, schizophrenia, eating disorders, and Parkinson’s. Serotonin is also often cited as the neurotransmitter responsible for feelings of happiness.

Researchers found that while 84 percent of the 172 neurons were inhibited, 14 percent were either excited alone or excited as part of a biphasic response (an initial inhibitory response followed by a longer excitatory response).

Avesar and Gulledge were able to demonstrate that excitation in COM neurons was independent of changes in fast synaptic transmission.

The discovery of a subpopulation of cortical neurons excited, rather than inhibited, by serotonin suggests a new framework with which to examine certain psychoses. This finding opens the door to new methods of treatment that target the cellular, rather than molecular, level of disease treatment.