Promoting a culture of collaboration in research

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Great science "happens" when the right people talk to each other.

Sometimes that can occur in conferences or meetings. But, just as often, it takes place by pure chance. The key to promoting collaboration is providing the kind of environment where these chance encounters are likely to occur.

One such encounter took place in the fall of 2011, when a graduate student at the University of Kentucky College of Pharmacy found herself having a corridor conversation with a professor from the UK College of Engineering.

Mo Dan, then a doctoral student in the Department of Pharmaceutical Sciences, was waiting to speak with her mentor, Provost's Distinguished Professor Robert Yokel, about a traineeship with the UK Cancer Nanotechnology Training Center (CNTC). She was specifically interested in the problem of how to get drugs past the blood-brain barrier , the cellular boundary that helps to protect the brain from harmful substances or pathogens in the bloodstream.

The blood-brain barrier poses a challenge in developing drugs to treat diseases of the brain, particularly brain cancer, because it can prevent drugs from reaching their targets in the brain tissue, leaving them in the circulating bloodstream.

Nanoparticles, being very small (measured in nanometers, one-billionth

of a meter), have shown promise as a drug-delivery system that can penetrate the blood-brain barrier. Dan had methods and techniques to test a nanoparticle drug-delivery system, but she needed to work with somebody who could create the nanoparticle .

Waiting with Dan, out in the hallway, was Thomas Dziubla, associate professor in the Department of Chemical and Materials Engineering. The two struck up a conversation.

Dziubla talked to Dan about his idea of targeting PECAM-1, a protein that resides at the borders between the endothelial cells in the blood-brain barrier. Dziubla then put Dan in touch with David Cochran, who at the time was a doctoral student in engineering.

The two students took it from there, ultimately creating and testing an iron oxide nanoparticle coated with a PECAM-1 antibody. The result was a joint publication last November in *PLOS One*, the flagship journal of the *Public Library of Science*, a nonprofit publisher of peer-reviewed, open-access scientific journals.

"This was a collaborative venture, and that's where most biomedical and basically all scientific research is going," said Yokel, who serves on the CNTC mentoring and development committee, along with Dziubla. "As often happens, the graduate students initiated this project, because they're talking among themselves about what they're working on and what another person could bring to the table."

UK excels at creating the type of environment that is conducive to collaboration across disciplines, Yokel says. The university promotes collaboration through the creation of multidisciplinary programs and centers, and encourages it through incentives such as shared equipment maintenance.

Dziubla cites the CNTC as a prime example.

"The CNTC is a great example of having all these chances to meet with people," Dziubla said. "The university provides the environment, and then it's the students who want to do something, who want to make or create something that hasn't been created before—that's the other half of the equation."

Supported by the National Cancer Institute/National Institutes of Health and part of the National Cancer Institute Alliance for Nanotechnology in Cancer, UK's CNTC provides advanced, multidisciplinary training for graduate students and postdoctoral fellows, with the aim of creating "a new type of cancer nanotechnology researcher who will fully appreciate the breadth of disciplines involved in translating novel laboratory findings to cancer diagnosis and treatment."

More information: Dan M, Cochran DB, Yokel RA, Dziubla TD (2013) "Binding, Transcytosis and Biodistribution of Anti-PECAM-1 Iron Oxide Nanoparticles for Brain-Targeted Delivery." *PLoS ONE* 8(11): e81051. DOI: 10.1371/journal.pone.0081051

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