

From humans to plants



Unicamp uses an open innovation model to create a research center to study enzymes found in human and plant cells

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The University of Campinas (Unicamp) has announced the establishment of a new basic research center for the study of kinases, a group of enzymes responsible for regulating metabolic processes in human and plant cells that have potential applications for drug development. In addition to advances in this field, the Protein Kinase Chemical Biology Center intends to learn about plant biology by leveraging knowledge and technology in partnership with the pharmaceutical industry. One goal is to improve the drought resistance of essential agricultural crops. The research center, where activities are scheduled to start in June 2015, is part of the Structural Genomics Consortium (SGC), a public-private partnership created in 1999. The SGC has partnerships with more than 10 pharmaceutical companies and research support agencies, as well as scientists in research centers at Oxford University (UK) and the University of Toronto (Canada).

The consortium embraces open science and open innovation models, which

guarantee that research results will be freely shared. This system also provides open access to molecules, methods, and techniques, enabling researchers from other pharmaceutical institutions and laboratories to develop new products. Most importantly, this system enables them to share solutions that can reduce the time and costs involved in research. The agreement that sealed the partnership was signed in March 2015 at FAPESP headquarters in São Paulo. This agreement calls for FAPESP to invest \$4.3 million through its Research Partnership for Technological Innovation Program (PITE). Unicamp will invest an additional \$1.9 million, and the SGC will contribute \$1.3 million.

At the signing ceremony for the cooperative agreement, FAPESP Scientific Director Carlos Henrique de Brito Cruz said that the initiative will encourage research that could have a great impact on society. “It offers an opportunity to fund research that will lead to results with major intellectual, social and economic impact. It also creates international col-

laboration opportunities for researchers in São Paulo. Last, but not least, it creates an opportunity for researchers in São Paulo to partner with business enterprises,” said Brito Cruz. With the new research center in the city of Campinas (state of São Paulo), the SGC will have more than 230 affiliated researchers at its three units, which maintain partnerships with more than 300 research groups in more than 40 countries in addition to large pharmaceutical laboratories including GlaxoSmithKline (GSK), Pfizer, Bayer, and Novartis.

According to SGC founder and CEO Aled Edwards, the Human Genome Project “revealed the existence of more than 500 types of kinase, but so far, only about 40 have been studied in depth.” According to Edwards, the problem is that figuring out how a kinase works is a lengthy process. “The best way to find out how a kinase works is to invent a chemical probe, a small molecule capable of binding specifically to a target enzyme and inhibiting its activity. You inject it into an animal and see what happens. However, it takes from 18 months to two years to develop each of these chemical probes, and the cost is very high,” he says. The study of kinases is just one example of costly research. In the past decade, researchers affiliated with the SGC have successfully described the structures of more than 1,200 proteins that could improve existing treatments for cancer, diabetes, obesity, and psychiatric disorders. However, the estimated cost of the necessary research to investigate each protein is approximately \$1 million. To share the costs and the risks, the consortium adopted an open science model.

FAPESP President Celso Lafer underscored that this strategy may also help speed up the search for new medications to treat cancer and Alzheimer’s disease. “By dividing tasks among universities and companies, we will make a grand collective effort to advance knowledge,” he said. Bill Zuercher, a representative of GSK—one of the companies that in-



Corn plantation in the city of Serrinha dos Pintos, state of Rio Grande do Norte: the development of drought-resistant crops will be among the goals of the new research center at Unicamp

vested in the consortium—said that the study of approximately 500 human kinases currently depends on collaborative work between companies and research centers. “In our case, the closed, individual research model leads to a waste of resources. Dividing up the different stages of research reduces the risk of failure in the new drug development pro-

cess,” he said. Currently, approximately 96% of molecules for potential drugs fail at the clinical trial stage, which means that they never make it to the market.

The Brazilian arm of the SGC will be the only member of the consortium to study kinases in plants. According to Paulo Arruda, a professor of genetics at Unicamp’s Institute of Biology and

a coordinator of the research center in Brazil, few research groups currently conduct this type of research. “There is something at the Max Planck Institute in Germany and at the University of California in the United States. But the current amount of knowledge about plant kinases is less than 1% of what is known about kinases in humans,” he said. According to Arruda, another positive feature of the open innovation model is that it will put biomedical and plant biology researchers “under the same roof.” He says that the usual practice of creating new drugs based on plant extracts will not be the primary goal in this case. Instead, techniques that were specifically developed to study human kinases will be used to investigate problems in plant biology.

WATER SHORTAGES

One of these problems in plant biology is a lack of knowledge on plant responses to water stress. “As a result of climate change, over the next 30 years water shortages may compromise the supply of food. We need to understand how plants behave when water is scarce,” says Arruda. The idea is to study the mechanism by which plants respond to drought and high temperatures. “These plants have receptors in their cell membranes that modify cell metabolism, helping the plant deal with water stress. And this process involves kinases,” he explains.

According to Arruda, knowing how this process happens will permit the development of molecules that can activate the kinases of drought-sensitive plants. He says that some Brazilian researchers are interested in collaborating in this field of study. The research center will partner with Unicamp’s Institute of Biology and with research groups at the University of São Paulo (USP) and the Federal University of Viçosa, in the state of Minas Gerais. “We want to form an extensive network in Brazil, with the goal of advancing in a field that has few precedents anywhere in the world,” concludes Arruda. ■

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