

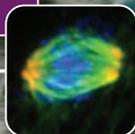
CHICAGO BIOMEDICAL CONSORTIUM

The University of Chicago
University of Illinois at Chicago
Northwestern University

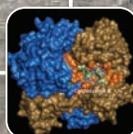


2015 Perspectives

**NORTHWESTERN UNIVERSITY
EVANSTON CAMPUS**

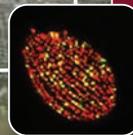


**NORTHWESTERN UNIVERSITY
CHICAGO CAMPUS**



**UNIVERSITY OF ILLINOIS
AT CHICAGO**

**THE UNIVERSITY
OF CHICAGO**



CBC Mission

The mission of the Chicago Biomedical Consortium is to stimulate collaboration among scientists at Northwestern University (NU), the University of Chicago (UChicago), and the University of Illinois at Chicago (UIC) that will transform research at the frontiers of biomedicine.

The CBC works to:

- **Stimulate research and education that bridge institutional boundaries**
- **Enable collaborative and interdisciplinary research that is beyond the range of a single institution**
- **Recruit and retain a strong cadre of biomedical leaders and researchers in Chicago**
- **Promote the development of the biomedical industry in Chicago**
- **Execute a plan capable of improving the health of citizens of Chicago and beyond**

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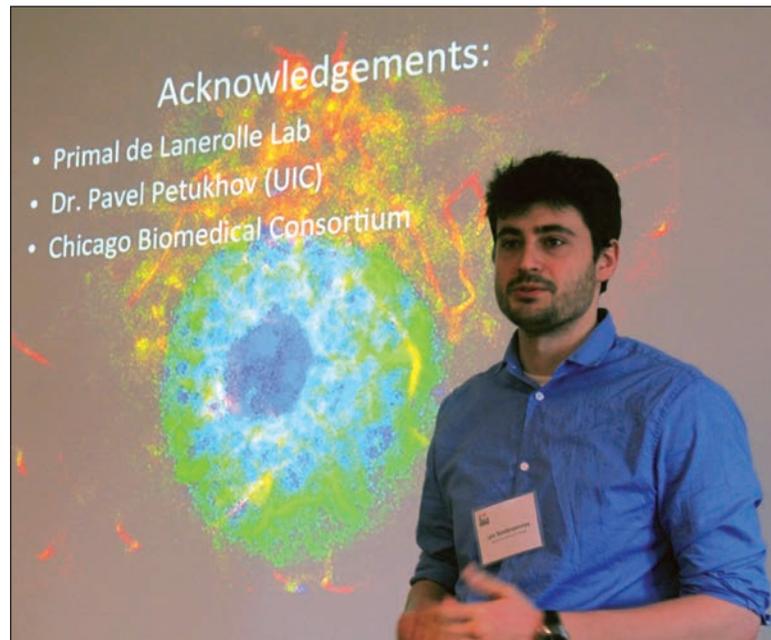
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Front Cover

Scientific images overlaid on a Google earth (©2013 Google) image of the Chicago area.

CBC-affiliated researchers contributed the scientific images.

North: Northwestern University, Evanston campus (Sadie Wignall)

East: Northwestern University, Chicago campus (Teresa Woodruff)

West: University of Illinois at Chicago (Michael Federle)

South: The University of Chicago (Aaron Turkewitz)

Credits

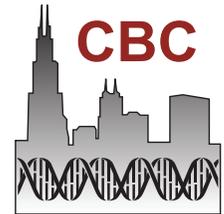
Photos: Corinna Kitcharoen, CBC (CBC Scholar Leo Serebryanny at the 2015 CBC Scholars Scientific Exchange; above); Brian Kay, CBC (Downtown Chicago; back cover); otherwise as indicated in the legends.

Written by: Kathryn Stallcup, CBC. Design and layout: Jola Glotzer, CBC. Printed: 2015, PSD Graphic Arts, The University of Chicago.

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CHICAGO BIOMEDICAL CONSORTIUM

The University of Chicago
University of Illinois at Chicago
Northwestern University



2015 Perspectives

The CBC was launched in 2006 with a generous grant from the Searle Funds at The Chicago Community Trust at the level of \$5 million per year. To date, \$50 million has been invested in the CBC.

The CBC has strengthened the Chicago biomedical community in a variety of ways. In addition to organizing scores of **citywide events**, the CBC has made over **200 awards**, supporting:

- **Innovative research projects** on subjects ranging from the genetics of diabetes and mental health disorders, to antibiotic resistance, to brain mapping,
- **Acquisition of transformative scientific instruments** for Centers of Excellence that are available to the CBC community *via* a unique “open-access” policy,
- **Screening programs** to identify potential breakthrough drugs,
- **Recruitment** of outstanding senior and junior faculty members who have gone on to earn numerous national awards,
- **Professional development** programs for graduate students and postdoctoral fellows,
- **Mentoring assistance** for researchers interested in commercializing discoveries.

CBC-supported projects have moved science forward on many fronts, generating:

- Numerous discoveries that have been **patented** or are in the patent process,
- **Several hundred jobs**, and training programs for highly-skilled technical workers,
- Over **1,200** scientific publications,
- Over **\$430 million** in follow-on funding for CBC-initiated research,
- An estimated total economic input of more than **\$1.5 billion** for the Chicago economy.



CBC MISSION:

Promote the development of the biomedical industry in Chicago

Securing Tools for Discovery



In 2014, each CBC university received a special **Infrastructure Award** to acquire novel, state-of-the-art instrumentation that would be new to the Chicago area and available for use through the Open Access Initiative. NU and UChicago collaborated to establish a multi-institutional core facility in cryo-electron microscopy, including a revolutionary new detector that allows an unprecedented level of resolution – the first instrument of its kind in the Midwest. UIC obtained a suite of instruments that created the city’s first Single Cell Analysis Core Facility.

The CBC has built unprecedented and unique links between university core facilities, fostering collaborative decision-making and avoiding redundant expenses.

Identifying New Targets for Anti-Microbial Treatments

The bacteria that cause strep throat and pneumonia secrete protein pheromones that regulate their ability to cause disease. Michael Federle (UIC) (*right*) recently determined the molecular structure of a pheromone-binding receptor, a key component of the bacterial signaling network. Federle used a 2014 CBC **High-Throughput Screening (HTS) Supplemental Grant** in the robotic screening core facility at UIC to identify chemical compounds that bind to the receptor and thus inhibit virulence¹.



Michael Federle has patented these newly-discovered inhibitory molecules and is working to develop them into a novel type of antibiotics.

Partnering with Pharma to Design New Drugs



Monoclonal antibodies can be effective anti-cancer agents, but there are significant drawbacks to the current methods of production. A 2009 CBC **Spark Award** to Anthony Kossiakoff (UChicago) and Vladimir Gelfand (NU) allowed the development of a high-throughput technology platform to efficiently produce customized, engineered, “synthetic antibodies.” Advances made with Spark funding allowed Kossiakoff and colleagues to win a \$12 million center grant from the NIH, which was matched with a **\$2.3 million Lever Award** from the

CBC in 2012. The technology developed by the center proved so promising that in July 2015 the pharma company **Celgene** committed to a 3 year, **\$25 million partnership** to use the technology to develop next-generation cancer drugs based on synthetic antibodies.

CBC funding helped move the promising synthetic antibody technology into the pipeline towards commercialization.

¹Parashar V, Aggarwal C, Federle MJ, Neiditch MB. Rgg protein structure-function and inhibition by cyclic peptide compounds. Proc Natl Acad Sci U S A. 2015 Apr 21;112(16):5177-82.

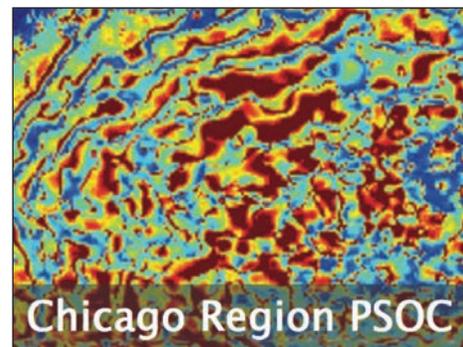
Photos (*from top*): Dr. Amy Kenter using the Fluidigm system at UIC; Dr. Michael Federle at his lab; Automated antibody phage display selection and screening system at UChicago. Credits: Brian Kay, CBC; Megan Strand; Marcin Paduch & Daniel King, respectively.

CBC MISSION:

Execute a plan capable of improving the health of citizens of Chicago and beyond

Expanding Personalized Medicine Beyond the Genome

Professors Vadim Backman (NU), Lucy Godley (UChicago), and Jack Kaplan (UIC) recently received the CBC's **sixth Lever Award**, which provides **\$1.5 million** to match a \$10 million grant from the National Cancer Institute for the **Chicago Region Physical Sciences-Oncology Center (CR-PSOC)**. Backman, Godley, and Kaplan are part of a larger team that combines the tools and perspectives of chemistry, genetics, and physics with the goal of identifying targets for cancer treatment. The CBC Lever supports core facilities and innovative instrumentation that is not available anywhere else in the country.



The CR-PSOC is a hub in a national network of Physical Sciences-Oncology Centers formed to develop new cancer drugs.

Fighting Cancer Resistance



Melanoma treatment is being revolutionized by effective immunological (T-cell) therapies, but only a subset of patients responds to these treatments. Stefani Spranger at UChicago (*left*), a 2014 CBC **Postdoctoral Research Grant** recipient, recently found that immune T-cells must infiltrate into tumors in order to be effective¹. Resistant tumors were found to have a specific signaling pathway that prevents this infiltration. Disrupting the signaling pathway (WNT/ β -catenin) should allow immune cells to enter tumors and kill them.

Drugs that target components of the WNT/ β -catenin signaling pathway could be a new way to overcome resistance to immunologic therapies.

Investigating a New Approach to Alzheimer's Disease

Assistant Professor Daniel Dombeck (*right*) joined NU in 2011 with support from a CBC **Junior Investigator Recruitment Award**. He studies the role of dendrites (parts of nerve cells) in memory formation, and examines how the brain interprets the world around it². He recently received a highly-selective **McKnight Scholar Award**, a prestigious grant that supports young scientists doing basic research on problems that have an immediate and significant impact on clinically relevant issues.



Dendrites may become a new target for therapeutics to combat memory deficits and debilitating neurologic diseases.

¹Spranger S, Bao R, Gajewski TF. Melanoma-intrinsic β -catenin signaling prevents anti-tumour immunity. *Nature*. 2015 Jul 9;523(7559):231-5.

²Sheffield ME, Dombeck DA. Calcium transient prevalence across the dendritic arbour predicts place field properties. *Nature*. 2015 Jan 8;517(7533):200-4.
Photos (*from top*): From the Chicago Region PSOC Press Release; Dr. Stefani Spranger at 2015 American Society of Clinical Oncology (ASCO) Annual Meeting; Dr. Daniel Dombeck in his lab. Credits: www.psoc.northwestern.edu; www.targetedonc.com; Roger Anderson, respectively.

PROGRAMS

Lever Award

Up to \$ 2,500,000

Lever Awards provide matching funds for collaborative large-scale federal grants for National Centers. To date, **six National Centers** have been established in Chicago with the help of CBC Lever Awards.

(See p. 4; bottom, and p. 5; top, for a description of two CBC Lever Awards.)

Recruitment Award

Up to \$ 1,000,000

Two senior and six junior faculty have been hired to date.

(See p. 5; bottom, for a discussion of one of the Junior Investigator Recruitment Awards.)

Infrastructure Award

Up to \$ 1,000,000

Three grants have established the city's first multi-institutional core facilities for single cell analysis and for single molecule imaging using cryo-electron microscopy. The instruments are broadly available via the Open Access Initiative.

(The acquired equipment is described on p. 4; top.)

Catalyst Award

Up to \$ 200,000

Sixty-three Catalysts have been awarded to date. High-risk/high-reward projects have addressed diverse topics, ranging from the design of unique instruments and reagents for research to explorations of the basic mechanisms of human biology in health and disease.

Educational Opportunities

In addition, the CBC supports the Chicago Innovation Mentors (CIM); organizes many educational opportunities each year (including seminars, workshops, and the Annual CBC Symposium); and curates a website that is a central information source for Chicago-based biomedical researchers.



High-Throughput Screening (HTS) Supplemental Grant

Up to \$ 20,000

Twenty-three awards have been made to date. Projects have included screens for new cancer therapeutics and small molecule inhibitors of infectious agents such as *Plasmodium falciparum* (malaria) and *Clostridium difficile* (colitis).

(An example of a HTS Grant can be found on p. 4; middle.)

Postdoctoral Research Grant

Up to \$ 15,000

To date, **seventy-two grants** have been approved. Grants covered a wide range of basic science topics (gene interaction networks, development, cell motility) as well as biomedically-relevant topics (memory function, mechanisms of cancer metastasis, the design of nanocarriers for targeted drug delivery.)

(See p. 5; middle, for an example of a recent PDR Grant.)

Exploratory Workshops

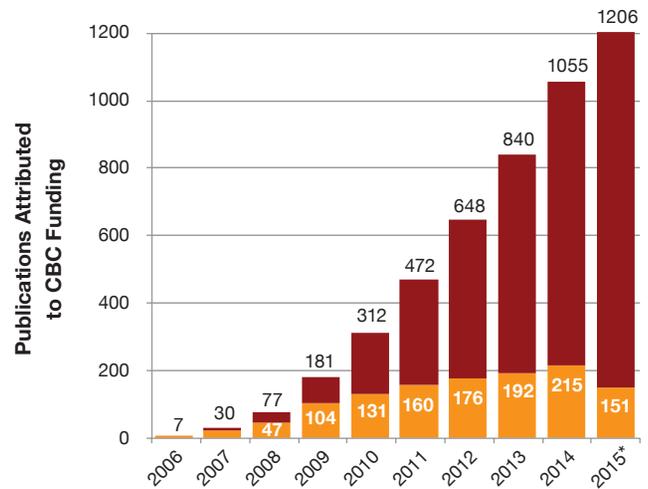
Up to \$ 2,000

As of July 31, 2015, **five workshops** have been organized (vascular biology, lipoproteins, cellular heterogeneity, control of cellular differentiation and gene expression.)

MEASURES OF IMPACT

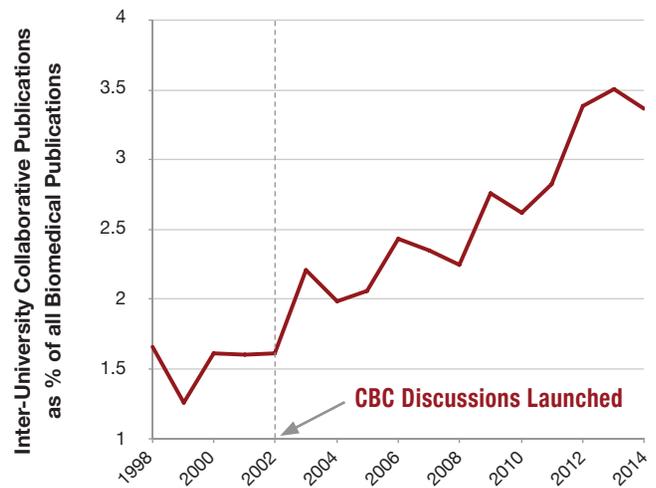
Impact on Scientific Discoveries

Research funded by CBC award programs has yielded a total of **1206 publications** (as of July 31, 2015*). These papers, most in high-impact journals, report advances in many biomedical subject areas, moving science forward on many fronts. The graph on the right shows yearly publications (in orange) and cumulative publications (in red).



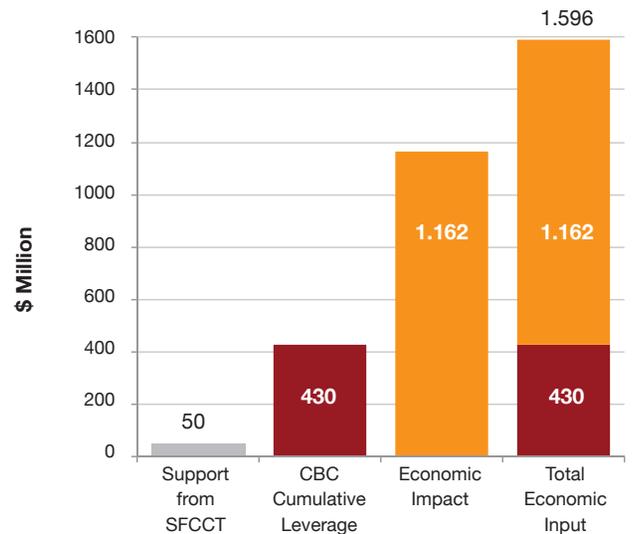
Impact on Collaboration in Chicago

The percentage of biomedically-relevant publications from inter-institutional teams in Chicago¹ (right, red line) has significantly accelerated since CBC discussions began to bring faculty members together in 2002 (dashed line). From 2002 to 2014, the percentage of collaborative publications per year **more than doubled** in Chicago (from 1.64% to 3.38%), with a growth rate substantially higher than in other metro areas. The observed trend illustrates the importance of sustained stimulation of collaborative science.



Economic Impact on Chicago

From 2006 to 2015, the Searle Funds at The Chicago Community Trust (SFCCT) awarded \$50 million to the CBC (right, grey bar). The CBC used SFCCT funding to support cutting-edge basic biomedical research projects that have gone on to win additional funding from external sources, primarily the NIH. To date, this additional funding totals over **\$430 million** (red bar). Economists have calculated that, in Illinois, each biomedical research dollar increases business activity by \$2.43^{2,3}. Using this multiplier, the Economic Impact of the combined SFCCT and NIH research funding is **\$1.162 billion** (orange bar). Thus, CBC activities (Cumulative leverage + Economic Impact) have provided a total economic input of almost **\$1.6 billion** to the Chicago economy since 2006 (red/orange bar).



*Data collected through July 31, 2015. ¹Biomedically-relevant inter-university publications were counted for the CBC universities. Data came from the *Web of Science* database, courtesy of Luis Amaral, et al., NU. ²Ehrlich E. 2011. "An Economic Engine: NIH Research, Employment, and the Future of the Medical Innovation Sector." P. 11. United for Medical Research. ³Clinch R. 2012. "Presentation on Measuring the Economic Impact of R&D Investments." International Symposium on Assessing the Economic Impact of Nanotechnology.

Celebrating 10 Years of the CBC

- Stimulating creative, risk-taking, groundbreaking research
- Cultivating a unique culture of inter-institutional collaboration
- Building the biomedical research talent base
- Strengthening the city's infrastructure for science
- Feeding discoveries into the pipeline of Chicago's innovation economy

All made possible through the generosity of the Searle Funds at The Chicago Community Trust and The University of Chicago, Northwestern University, and the University of Illinois at Chicago.