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Born in 1950 in Cologne
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PROJECT

Redefining Multi- and Interdisciplinary Approaches in Basic Science: Integrative Multidisciplinarity

Some of the most interesting problems in science, and many of the most important facing society, need research at the interfaces of traditional disciplines for their solution. Examples include: understanding life as networks of chemical reactions; interpreting the molecular basis of disease; global stewardship; the production, storage, and conservation of energy and water; and the management of carbon dioxide. Therefore, more and more research will need to be conducted at the interfaces of the once "traditional" disciplines. Such interfaces exist between biology and chemistry, biology and physics, mathematics and biology, pharmacology and chemistry, engineering and biology, material science and biology, and many more. I will research how and to what extent novel concepts and breakthrough discoveries are carried out by teams that comprise scientists who come from different fields, using Structural Biology, which is in practice deeply inter- and multi-disciplinary, as the primary example. I intend to work on making explicit the "bridging concepts" that are required in traversing the traditional disciplinary boundaries that have characterized basic science. If the future of science is one that depends on escaping the restraints of narrowly disciplinary language and frameworks, as I believe it is, then we will need new language to negotiate those boundaries. In Pittsburgh I direct the interdisciplinary Pittsburgh Center for HIV Protein Interactions, dedicated to determining the high-resolution structures of HIV proteins and their host protein interacting partners. The biological theme of our research program seeks to define events, pathways, and host cell factors that are involved in HIV cellular infection after viral-cell membrane fusion and prior to integration of the viral genome into that of the infected cell. The PCHPI engages virologists, cell biologists, and structural biologists in a collaborative effort to push the field of HIV biology forward with the hope that the knowledge gained can be effectively leveraged for developing novel therapeutic strategies. My experiences in this Center will aid in elucidating how disciplinary boundaries can be traversed.

Recommended Reading

Byeon, I. L., X. Meng, J. Jung, G. Zhao, R. Yang, J. Ahn, J. Shi, J. Concel, C. Aiken, P. Zhang, and A. M. Gronenborn (2009). "Structural convergence between CryoEM and NMR reveals novel intersubunit interactions critical for HIV-1 capsid function." Cell 139: 780-790.
Omichinski, J. G., G. M. Clore, O. Schaad, G. Felsenfeld, C. Trainor, E. Appella, S. J. Stahl, and A. M. Gronenborn (1993). "NMR structure of a specific DNA complex of Zn-containing DNA binding domain of GATA-1." Science 261: 438-446.
Clore, G. M. and A. M. Gronenborn (1991). "Structures of larger proteins in solution: three- and four-dimensional heteronuclear NMR spectroscopy." Science 252: 1390-1399.

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TUESDAY COLLOQUIUM, 07.05.2013

Integrative Multidisciplinarity: The need for a multiscience perspective in the natural sciences

Those of us engaged in careers that are dedicated to experimental laboratory research rarely have the opportunity to step back from the lab bench or the computer to reflect on how scientific practice has changed or to consider the kinds of interactions among disciplines that have proved most effective in kindling great discovery. In the field of structural biology, research at the interfaces of traditional disciplines, such as biology, chemistry, and physics is essential for addressing the most important problems, and because of this, scientific practice in structural biology is deeply inter-disciplinary and multi-disciplinary. Structural biology, which emerged as a discipline in the mid-1980s, aims to provide the atomic and molecular underpinnings of cellular and organismal function, employing technologies that are still developing.

If future progress in the natural sciences depends on escaping from the restraints of narrowly defined disciplinary language and frameworks, as I believe it is, then we will need new approaches and language to negotiate these boundaries and teach the "art of border crossing" to young scientists. In my project at WiKo, I am investigating how and to what extent teams of scientists that hail from different fields achieve novel concepts and carry out breakthrough discoveries. My talk will use research in structural biology to demonstrate the imperative of integrating knowledge and practices from traditional disciplines and present a progress report on my approach to this inquiry.

PUBLICATIONS FROM THE FELLOWS' LIBRARY

Gronenborn, Angela M. (Chicago, Ill.,2017)

After fifty years, why are protein X-ray crystallographers still in business?

https://kxp.k10plus.de/DB=9.663/PPNSET?PPN=1048672999

Gronenborn, Angela M. (2012)

Domain swapping

https://kxp.k10plus.de/DB=9.663/PPNSET?PPN=818980710

Gronenborn, Angela M. (2009)

Protein acrobatics in pairs - dimerization via domain swapping

https://kxp.k10plus.de/DB=9.663/PPNSET?PPN=818981288