

Notes of a Protein Crystallographer - Homage to Prof. M.G. Replacement: A Celebration of Structural Biology at Purdue University.

Macromolecular crystallography has developed into an extremely powerful technique to determine the three-dimensional structure of the molecular components of living systems. Its place among modern scientific disciplines is now well established. However, this was not so forty years ago when the pioneering heroes of protein crystallography were beginning to conquer, one by one, the structures of the icons of our field: myoglobin, hemoglobin, lysozyme and the others that followed. In fact, the future of the field was not clear in the mid 60's as the MIR method pioneered by Perutz for the structure of hemoglobin failed to yield rapid successes when applied to other proteins.

At that time in the history of the field, 1964 to be exact, Prof. M.G. Replacement moved from the MRC in Cambridge to Purdue University in West Lafayette, Indiana, in the heart of the American midwest. To commemorate the 40th anniversary of that event and to celebrate also the achievements of structural biology during those forty years, a symposium was organized at Purdue University on April 9, 2005. Naturally, the purpose of the meeting was also to honor the man behind it, **Michael G. Rossmann**.

"A Celebration of Structural Biology at Purdue University: a Symposium in Honor of Michael G. Rossmann"

April 9, 2005
9 a.m. to 5 p.m., Room G140
Forney Hall of Chemical Engineering

SPEAKERS

Roger M. Burnett	Anders Liljas
Terje Dokland	Ming Luo
Ignacio Fita	Dino Moras
Alexander E. Gorbalenya	Ivan Raymont
Jack Johnson	Tomitake Tsukihara
Andrew G. W. Leslie	Dale B. Wigley

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The date also corresponded approximately to MGR's 75th birthday so it was a memorable occasion for several reasons. An earlier meeting ten years ago also honored Michael (New directions in Protein-Structure Relationships. Symposium in Honor of Professor M.G. Rossmann's 65th Birthday. Purdue University. Oct. 21, 1995). On this occasion the symposium was more encompassing of the science and had a much more global character. The scientific topics and the featured speakers addressed advances in vast areas of structural biology. They came from the four corners of the world to share their work with the new generation of structural biologists currently being trained at Purdue.

A detailed report of the meeting has been published recently in *Structure* (Abad-Zapatero, C. (2005) *Structure*, **13**, 1-4). An abridged version is presented here to convey the excellence of the science discussed, the ambiance of the meeting and the camaraderie among all participants. Readers are encouraged to consult the published meeting review for a complete technical summary.

The symposium opened with brief comments by **Jeff Vitter** (Dean) and **Richard Kuhn** (Department Chair). The morning session, chaired by **Jeff Bolin**, (Associate Dean of Research) focused on Proteins and Complex Assemblies.

Dale Wigley (London Research Institute, London, UK) formerly a visiting scientist in MGR's lab discussed helicase structures in detail, focusing on the quaternary complex of RecBCD bound to a DNA hairpin duplex. **Andrew Leslie** (MRC, Cambridge, UK) a former postdoc at Purdue and member of the virus group in the late 1970's, reviewed the main structural and functional features of the multimeric structure of the ATPase as unveiled in the last ten years combining the structural data with the results of the dynamic fluorescence studies of Yoshida and coworkers in Japan.

After the coffee break, **Anders Liljas** (University of Lund, Sweden) one of Michael's postdocs during the heroic years of LDH, addressed some of the still unanswered questions about protein synthesis. He suggested a more integrated, five-pronged approach where x-ray, NMR, cryoEM, theoretical (computational) chemistry and physical chemistry would be needed to understand the most complex problems in molecular biology. **Tomitake Tsukihara** (Osaka University, Japan), a member of the group that solved Southern Bean Mosaic Virus (SBMV) in the late 1970s, presented the results that the group in Japan has been obtaining during the last decade on the structure and reaction mechanism of cytochrome c oxidase. Given the sheer size of the oxidase (13 subunits) and the complexity of the reaction catalyzed by this enzyme, one is constantly reminded of the subtlety of the conformational changes required to transfer protons or electrons by such a large multimeric enzyme across the mitochondrial membrane.

In perfect consonance with the spirit and intensity of the honoree, the organizers allowed the attendees only a brief break for a lunch that was packed with anecdotes and recollections from a few persons whose lives intersected with Michael's at critical times in their careers. Over a background of images of the French Alps and MGR in full hiking gear provided by **Janet Smith** (University of Michigan, Ann Arbor), **Don Bilderback**

(CHESS, NY) reviewed the impact that the crystallographic work on rhino virus played in the development of synchrotron radiation for virus crystallography. as *Alwyn Jones* (Institute of Cell and Molecular Biology, Uppsala, Sweden) in his own inimitable style, captured the audience with his recollections of the impact of the early days of computer graphics on macromolecular crystallography.

It was a very special moment when *Sharon Wilder*, MGR's personal assistant and factotum, told the story of how she found her way to Michael's office for her job interview. The rest is history. Outsiders will probably never realize what a unique role Sharon has played. She was anonymous and unassuming yet always extremely competent and knowledgeable in a myriad of tasks. She always orchestrated the routine of the laboratory with a gentle but effective harmony. The audience recognized her unique contribution with a standing ovation at the end of her brief presentation. By taking care of so many odd-jobs she allowed MGR to concentrate on the important tasks needed to revolutionize the field. This is indeed a major contribution.

John E. ('Jack') Johnson (Scripps Research Institute, California), a close associate of Michael for many years, concluded the lunch period with some candid anecdotes. He described his time at Purdue from the late days of the dehydrogenases (GPDH and LDH) project to his impact on the critical work on the Southern Bean Mosaic Virus (SBMV). The methods developed during those years are now mainstream in the area of virus crystallography.

The afternoon session was chaired by *Carol Post* (Purdue) and was devoted almost exclusively to virus work. Ming Luo (University of Alabama), former graduate student, presented structural genomics results of the South Eastern Collaborative for Structure Genomics. *Roger Burnett* (Wistar Institute, Philadelphia), MGR's first (surviving) graduate student, discussed the evolutionary implications of the finding that the structure of the major coat protein (P3) of bacteriophage PRD1 resembles that of the component of the human adenovirus hexon. *Alexander Gorbalenya* (Leiden University Medical Center, The Netherlands), a former visiting scientist, discussed his explorations into the classification and life cycles of various virus genera within the universe of RNA-containing virus.

Ignacio Fita (Institut de Biologia Molecular de Barcelona, Spain), former postdoc on the catalase project, presented the structure of a representative of the minor group of human rhinovirus (HRV2-V23) bound to the ligand binding repeats of its cellular receptor (VLDLR). *Terje Dokland* (University of Alabama, Birmingham), former postdoc associated with the lab, presented his results on the structures of the nucleocapsid and core proteins of two enveloped ssRNA⁺ virus of two different families. *Jack Johnson* (Scripps Institute, California) discussed the results of several structural techniques (i.e. crystallography, SAXS and intrinsic capsid fluorescence) to illuminate the nature of the particle maturation in the bacteriophage HK97.

It was most fitting to hear MGR himself at the of end the day, reviewing the myriad of scientific projects and achievements that have taken place in his laboratory since 1964 when he moved to Purdue until now and what might still be in store for the future. In closing, he emphasized once again what he wrote in the Foreword to *Crystals and Life*: 'It has been my privilege to host

and work with many pre- and post-doctoral students with vastly different cultural backgrounds during almost forty years at Purdue University in Indiana. We have together enjoyed the pleasures of discovery and agonized over disappointments'. I think that I can speak for the majority of the attendees to the symposium when I say: Michael, it has been our privilege to work with you and to experience the pleasures of discovery and the anguish of the temporary failures along the way. You have enriched our personal and professional lives immensely.



After the official reception at the end of the meeting, it was time to honor another anonymous contributor to the field: MGR's wife *Audrey*. From her early cartoons drawn to convey the meandering of the polypeptide chain in LDH, she has followed the breakthroughs of the laboratory. She hosted dinners and other social events for generation upon generation of students, post-docs, associates and collaborators. She also produced pottery masterpieces to mark each scientific milestone of the laboratory or the departure of friends or co-workers. The attendees flocked to University Place to present their tribute, friendship and homage to her. There were hugs and emotional exchanges with this remarkable woman who has played such an important role in the life of not only Michael, but also of every single person who has had the good fortune of interacting with her.

A beautiful sunset completed this momentous day of spectacular structural biology, excellent science, warm friendships, camaraderie and unforgettable memories. Based on what we observed during our visit, they are nowhere near finished yet.

Cele Abad-Zapatero

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