



2009 Hansen Family Award goes to Professor Patrick Cramer

Molecular copiers

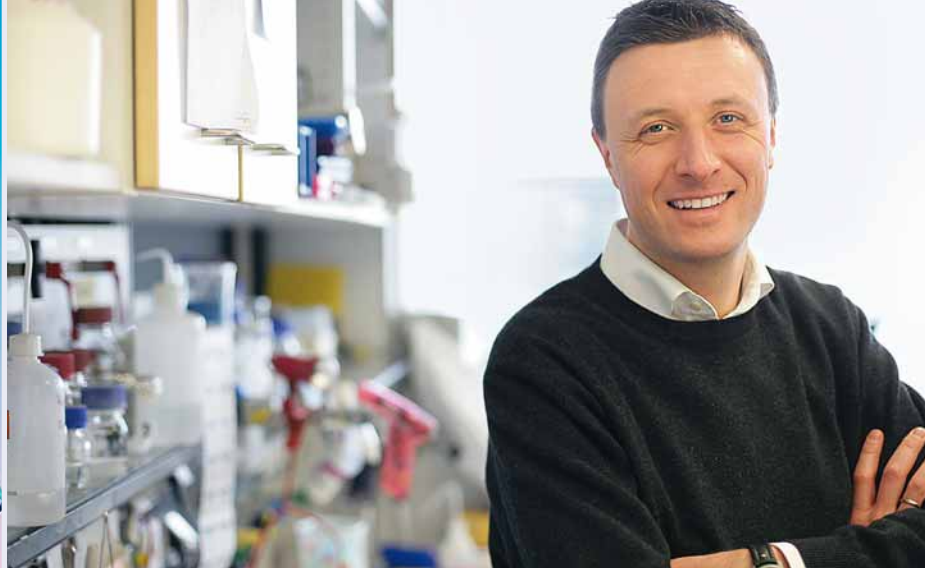
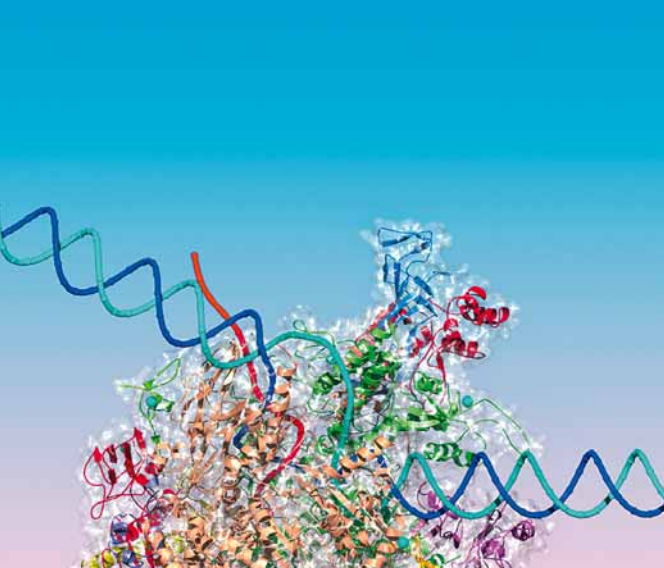
Without enzymes, life would come to a standstill. They breathe the very life into genetic information by duplicating it in whole or in part. Professor Patrick Cramer and his team at the Gene Center of Ludwig Maximilian University in Munich have traced how these biochemical mechanisms operate – step by step and minutely down to atomic scale. For this achievement, the biochemist has been honored with the 2009 Hansen Family Award.

Everyone is different and each individual has a unique genetic make-up. Like a book, it is a source of information that is vital to our existence, comprising around 25,000 genes in total. They are unable to do much, however, unaided. "Genes themselves are mute," explains Professor Patrick Cramer, Head of the Gene Center at Ludwig Maximilian University in Munich. "The content of the

genetic information is processed only when the genes are read," continues Cramer. The first step in this reading process is the creation of copies of individual gene segments, a task that falls to RNA polymerase. This enzyme copies the segments of the DNA strand and these copies can then be used to produce cell components such as proteins or even messenger substances. This pro-

cess is identical in all living things and is, so to speak, the cells' language.

Cramer and his team have been working on this key biochemical process – with great success. His outstanding achievements in the field of RNA research have earned him the 2009 Hansen Family Award. Achieving this distinction, however, has necessitated meticulous research. "RNA polymerase



Stefan Jennebach, Laurent Larivière, Professor Patrick Cramer and Jasmin Sydow (photo left, left to right) from the Ludwig Maximilian University in Munich discuss a model of polymerase (above) which is necessary for the duplication of genetic information. Professor Cramer (right) received the 2009 Hansen Family Award in recognition of this achievement.

firstly had to be obtained in sufficient quantities from yeast cells, then crystallized and bombarded with X-ray light," explains Cramer. Even though every living cell contains around 10,000 of these polymerases, a kilogram of yeast cells is needed to isolate five milligrams of these tiny copiers. The yeast cells are crushed in a ball mill, the enzymes are freed from the cell clusters and the desired polymerases are crystallized. Cramer's research team then used X-ray light to obtain individual snapshots of

this enzyme. This enabled them to work out in minute detail the polymerase's mode of operation, down to an atomic scale. The individual images of this biochemical mechanism were pieced together by the researchers, just like a flicker book.

The result was a film sequence providing a detailed understanding of how the polymerase operates. "The strand of DNA, the double helix, passes through the enzyme in a corkscrew motion," explains the 40-year-

old biochemist. "The molecular copier uses one of the two twin strands as a template and adds the matching counterpart, segment by segment. Signals at the starting and end points clearly indicate to the enzyme where to stop reading." Cramer's research team is now so used to working together that the many time-consuming steps from yeast culture through to the photos of the polymerase crystals can be accomplished in two months. "Fortunately, I have a brilliant team from a very wide range of disciplines: biologists, chemists, bioinformation scientists and process engineers," says Cramer. "Exchange across disciplines is very important for our research."

This key step will continue to pre-occupy the scientists working with the Munich biochemist in the future too. For precise knowledge of these fundamental molecular principles is important not just in the development of diseases such as cancer. The mechanisms also play a major role in the development and improvement of medicines such as antibiotics.

Promoting pioneering research



The Hansen Family Award is bestowed by the Bayer Science & Education Foundation. The foundation's primary objectives are to honor outstanding research achievements, promote scientific talent and provide financial support

for significant school science projects. The Hansen Family Award recognizes scientists who have made pioneering advances in research in innovative fields of biology and medicine. Professor Patrick Cramer (second from left) receives the award, endowed with €50,000, from Dr. Wolfgang Plischke, Bayer Management Board member with responsibility for research. Looking on are Bayer CEO Werner Wenning and Professor Ernst-Ludwig Winnacker, Secretary General of the European Research Council.



www.lmb.uni-muenchen.de/cramer

Extensive information on Professor Cramer's field of research.