Peltier-cooled incubator IPP, ideal for protein crystallography

Hardly any vibrations, almost no noise, highly precise and accurate. The PhosphoSites research group at the University Hospital in Frankfurt, doing basic research on protein kinases, cultivates its protein crystals in a Memmert incubator IPP, a crystal growth chamber par excellence. Low-vibrations and highly precise.

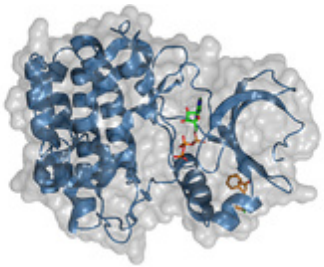


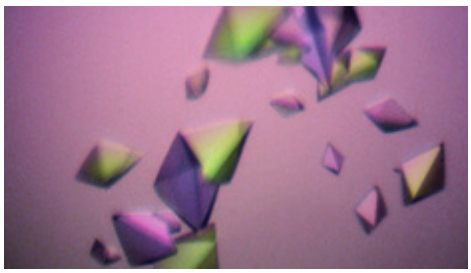
Illustration: the crystal structure of the **protein kinase** PDK1 in complex with ATP and an allosteric activator. For a clearer presentation, only the basic framework of the protein with secondary structures is shown. The surface of the protein is transparent and ATP (green) and the allosteric activator (orange) are represented as ball-and-stick models.

Every child learns that **proteins** are vital, and dutifully eats an egg for breakfast. But not many people know about the significance of this central component of life, of which there are several hundred thousand in the human body. Haemoglobin transports oxygen to the blood, collagen supports the skin and bones, antibodies repel pathogens, enzymes work as catalysts for biochemical reactions, other **proteins** support the movements of the muscle apparatus or the transmission of pulses between nerve cells. **Proteins** essentially consist of 20 different amino acids.

The complexity of **protein** research is down to the seemingly infinite sequences of amino acids, as well as specific spatial structures. The largest known protein, titin, which is essential for muscle function, consists of more than 27,000 amino acids, for example.

Hope for diabetics, cancer sufferers and Alzheimer patients

A market worth millions has now formed around research into **proteins**, and there is hardly a university that does not have its own **research group** for **protein** biochemistry,

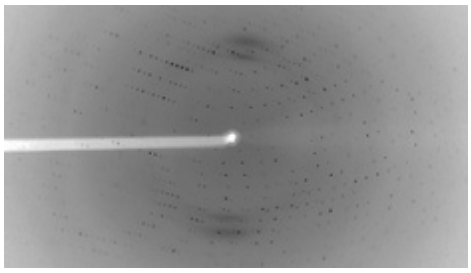


A perfect single **protein crystal**

proteomics, or specifically for structural biology/**protein crystallography**. While the pharmaceutical industry is developing commercially exploitable drugs with the help of **protein crystallography**, academic workgroups such as the PhosphoSites **research group** at the University Hospital in Frankfurt, led by Dr. **Ricardo M. Biondi**, are doing basic research in which **protein crystallography** is one of several methods used to find answers in their research field. In the case of the Frankfurt team, this involves the phosphorylation of **proteins** by enzymes, so-called **protein kinases**, which in case of malfunction can trigger cancer, diabetes and neurological diseases. Dr. Jörg Schulze, a member of Dr. **Biondi's** team, estimates that 30 percent of the drugs that are currently being developed are involved with **protein kinases**, and that the trend is increasing.

A perfect single **protein crystal** forms the basis for valid research results in **protein crystallography**

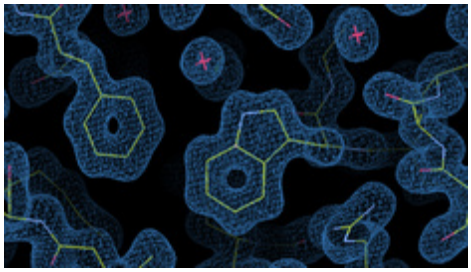
The atomic structure of the protein crystal is being explored



Typical diffraction pattern of a **protein crystal**.

Protein crystallography researches the atomic structure of **protein molecules** and thus enables conclusions to be drawn regarding mechanisms in the human body. In this research, X-rays are diffracted on the lattice structure of a **protein crystal**, a detector registers the reflexes of the diffraction patterns and, using complex mathematical correlations, calculates the 3-dimensional electron density, representing the spatial arrangement of the amino acids. Simple as this sounds, **protein crystallography** in reality is extremely complex. One big challenge is to cultivate perfect single **protein crystals**.

Protein crystals must grow in a low-vibration environment



The electron density is represented as blue lattice grids. Yellow: amino acids of the **protein**. Red: ordered water molecules.

The sensitive **protein crystals** grow in the **cooled incubator**, as slowly and with as little vibration as possible, at constant temperatures between 4 °C and 20 °C, often for weeks or months. Above all because of its low-vibration properties, the PhosphoSites **research group** decided on the Memmert **incubator** IPP 400 as a **crystal growth chamber** ideal to store these **crystallization** preparations,

since it controls temperature with high accuracy due to its **Peltier technology** without a compressor.

The ventilator in the **cooled incubator** was scaled down in power specifically for the requirements of **protein crystallography**, in order to minimise two crucial features: **low noise** and **low vibration**.

Control precision in the cooled incubator with Peltier technology

In addition to low noise and **low vibration**, the exact controllability of the incubator plays a crucial role in **crystallization**, since temperature fluctuations can influence the reproducibility of the crystals, particularly during the nucleation phase. 10 years ago, Memmert first managed to adapt **Peltier technology** for more powerful laboratory equipment – so that this could be heated and cooled with just a single system. A **Peltier element** in a **Peltier-cooled incubator** is switched up to 16,000 times a second, thus enabling an extremely sensitive temperature control.

An overview of focus topics

- **Protein Crystallography**
- **Protein kinases**
- **Protein molecules**
- **Crystallization**
- **Crystal growth chamber**
- **Peltier-cooled Incubator**
- **Peltier technology**
- **Peltier element**
- Control precision
- **Low vibration**
- Low noise

Picture credit: PhosphoSites research group

Autor: Memmert GmbH + Co. KG

molecules.

Bee cultivation in the Peltier-cooled incubator

Low-vibration environment: The Würzburg BEEgroup is carrying out **basic research** into the health of bees in the **cooled incubator** with **Peltier elements**.

more information

Laboratory appliances with Peltier technology

Peltier-cooled incubator IPP

constant climate chamber HPP

temperature control storage chamber IPS