12TH HERMANN STAUDINGER LECTURE

NOBEL PRIZE LAUREATE

JOHN E. WALKER

MRC CAMBRIDGE, UK

ENERGY AND LIFE

The extraction of energy from food and its conversion to a form that the body can use to provide fuel for all its activities, is essential for life. The key steps take place in the mitochondria, tiny organelles found in most cells. The mitochondria are surrounded by two hydrophobic membranes, and they use energy released by the controlled burning (oxidation) of sugars and fats to build up an excess of protons (hydrogen ions) between the two membranes. Almost all of the oxygen that we breathe in is consumed in this burning process. The mitochondria build up the proton excess with molecular pumps embedded in the inner membranes to displace protons from their internal spaces. Just as water stored in a dam provides energy to drive turbines in hydro-electric power stations, the mitochondria use the excess of protons to drive molecular turbines in their inner membranes. These turbines are connected to and supply power to molecular factories that turn out the energy currency of biology in the form of the molecule adenosine triphosphate, which is carried out of the mitochondrion and made available to the cell. Energy is released for biological processes by controlled reaction of adenosine triphosphate with water. The products of this reaction, adenosine diphosphate and phosphate, are returned to the mitochondria and recombined in the molecular factories to regenerate the adenosine triphosphate. We understand the precise construction and workings of the molecular factories. Our research is directed at understanding how the molecular turbines function and how the factory and turbines are linked together. We are also interested in understanding where these machines came from and how they have evolved. When these aims have been reached, we shall have revealed a fundamental process upon which life depends.

September 14th, 2012
2:15 pm
FRIAS Lecture Hall
Albertstraße 19, 79104 Freiburg

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