accademia nazionale dei lincei

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«Conferenze Lincee»



10 gennaio 2019 - ore 17:00

The fuel of life

Conferenza “Max F. Perutz”

Sir John E. Walker

Linceo, Nobel Prize Laureate

Medical Research Council – Mitochondrial Biology Unit

University of Cambridge - UK

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ummary. – The lecture will be devoted to the topic of how the biological world supplies itself with energy, and what medical consequences ensue when the energy supply chain in our bodies is damaged or defective. We derive our energy from sunlight, which, via photosynthesis in green plants, provides high energy components in the foods that we ingest. We harvest that energy, effectively by “burning” (oxidising) the high energy components, releasing cellular energy in a controlled way to generate the fuel of life, in the form of the molecule known as adenosine triphosphate (or ATP for short). The key steps in this process take place in the mitochondria inside the cells that make up our tissues. They serve as biological “power stations” that contain millions of tiny molecular turbines, the ATP synthase, that rotate rather like man-made turbines churning out the cellular fuel in massive quantities, which is then delivered to all parts of our bodies to provide the energy to make them function. Each of us makes and expends about 60 kg of this fuel every day of our lives.

The ATP synthases consist of two rotary motors linked by a stator and a flexible rotor. Rotation of the membrane bound rotor is driven by the proton motive force, itself generated by oxidative metabolism (or by photosynthesis in green plants). A unique direction of rotation ensures that ATP is made from ADP and phosphate in the globular catalytic domain.

(*continued on reverse*)



Sir John E. Walker

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However, for reasons yet to be uncovered some eubacterial ATP synthases, which in many respects resemble the ATP synthases in metazoans, are unable to carry out this hydrolytic reaction. Why this is so, is of great interest today, especially since the ATP synthase in Mycobacterium tuberculosis is a validated drug target for the treatment of tuberculosis, and differences between human ATP synthases and those in bacterial pathogens can be exploited in the fight against bacterial resistance to antibiotics.

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| *Sir John E. Walker*  Medical Research Council  Mitochondrial Biology Unit  University of Cambridge - UK | The origins and propagation of life on earth depended upon developing an ability to generate ATP, and so the question arises about how such a complex machine was put together early in evolution. Clues are to be found in the process of how the modern ATP synthase is assembled.  A central part of my efforts has been devoted to determining structures of ATP synthases at atomic level using methods pioneered by the late Max Perutz.  This lecture is dedicated to his memory. |

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