S2.11 Structure of photosystem I and its natural electron acceptor ferredoxin in co-crystals at 3.8 Å resolution

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Photosystem I is a large membrane protein complex that catalyzes the first step of light reactions in photosynthesis. The molecular structure of this complex is solved to atomic resolution (2.5 A). Ferredoxin (Fd) acts as the natural electron acceptor of Photosystem I and mediates the electron transfer from Photosystem I to the FNR, where finally $NADP^+$ is reduced to NADPH. The aim of our studies is to unravel the interaction between Photosystem I and ferredoxin at atomic detail by co-crystallization of Photosystem I with ferredoxin. The trimer of Photosystem I has a MW of 1 056 kDa compared with 10 kDa for ferredoxin. The phase was solved by a combination of molecular replacement and heavy atom anomalous diffraction. The position of ferredoxin was predicted by modeling the docking of ferredoxin to PS I and confirmed by omit mapping. The space group has been determined to be P21 with a=214.5, b=235.6, c=261.2 A and alpha=90.0, beta=100.47, gamma=90.0. The R-factor of the current model is 21.8% and the Rfree is 34.2%. In the asymmetric unit are six PS I and six Fd. Docking and binding of Fd to PS I and electron transfer are now discussed in detail with respect to the co-crystal structure with the distances to the subunits PsaA and PsaB and the three extrinsic subunits Psa C, D and E to the Fe_4S_4 and Fe_2S_2 clusters.

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S2.12 Growth and photosynthetic performance of the ricefield cyanobacterium *Anabaena cylindrica* to the herbicide bentazon

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Bentazon is a selective herbicide recommended for integrated rice weed management and acts by binding to the exchangeable quinone at the photosystem II (PS II) reaction centre. However, its precise molecular mechanism of inhibition has not been yet well characterized and its phytotoxic effects remain unexplained. In this study, the effects of bentazon on dry weight yield, chlorophyll *a* content, photosynthesis (complementary analysis of O_2 evolution and of quantum efficiency of PS II) and respiration were studied in *Anabaena cylindrica*, a cyanobacterium isolated from Portuguese rice fields, in a time- and dose-dependent exposure throughout 72 h. Higher bentazon concentrations induced a significant decline on biomass yield with time. Whereas concentrations ranging from 0.75 to 2 mM did not significantly modified chlorophyll *a* content with time, photosynthesis (O_2 evolution) and respiration (O_2 consumption) were severely inhibited in a time and dose response manner, particularly with higher concentrations. Bentazon also significantly reduced the fluorescence parameters F_v/F_m, Φ_{PSII} and qP, as indicators of photosynthetic performance. Since *A. cylindrica* is a primary source of aquatic food web and an important biofertilizer for rice cultivation, its protection from potential residual effects of bentazon is essential for enriched local soil fertility.

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(S3) Membrane transporters symposium lecture abstracts

S3/1 An ancient look at UCP1

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Brown adipose tissue serves as a thermogenic organ in placental mammals to defend body temperature in the cold by nonshivering thermogenesis. The thermogenic function of brown adipose tissue is enabled by several specialised features on the organ as well as on the cellular level, including dense sympathetic innervation and vascularisation, high lipolytic capacity and mitochondrial density and the unique expression of uncoupling protein 1 (UCP1). This mitochondrial carrier protein is inserted into the inner mitochondrial membrane and stimulates maximum mitochondrial respiration by dissipating protonmotive force as heat. Studies in knockout mice have clearly demonstrated that UCP1 is essential for nonshivering thermogenesis in brown adipose tissue. For a long time it had been presumed that brown adipose tissue and UCP1 emerged in placental mammals providing them with a unique advantage to survive in the cold. Our subsequent discoveries of UCP1 orthologues in ectotherm vertebrates and marsupials clearly refute this presumption. We can now initiate comparative studies on the structure–function relationships in UCP1 orthologues from different vertebrates to elucidate when during vertebrate evolution UCP1 gained the biochemical properties required for nonshivering thermogenesis.

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S3/2 Structural studies on bacterial and mammalian transporters

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Membrane transporters that transduce free energy stored in electrochemical ion gradients into a concentration gradient are a major class of membrane proteins. We have been studying the structure and mechanism of membrane transporters using lactose permease (LacY) from *E. coli* as a model system. We have been using