valinomycin or Complex I inhibitor, rotenone. Under such conditions mitochondrial reticulum formed short bulky spheres, nucleoids clustered inside however maintained their autonomy.

This work was supported by the Czech Scientific Foundation GACR grant no. P304/10/P204 (to A.D.), P302/10/0346 (to P.J.), and the Czech Ministry of Education ME09029 (to P.J.).

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doi:10.1016/j.bbabio.2012.06.405

21P2

Bacterial oxygen production in the dark

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Nitric oxide (NO) and nitrous oxide (N_2O) are among nature's most powerful electron acceptors. In recent years it became clear that microorganisms can take advantage of the oxidizing power of these compounds to convert recalcitrant aliphatic and aromatic hydrocarbons. For two unrelated bacterial species, the 'NC10' phylum bacterium '*Candidatus Methylomirabilis oxyfera*' and the γ-proteobacterial strain HdN,1 it has been suggested that under anoxic conditions with nitrate and/or nitrite, monooxygenases are used for methane and hexadecane oxidation, respectively. No degradation was observed with nitrous oxide only. Similarly, "aerobic" pathways for hydrocarbon degradation are employed by (per)chlorate-reducing bacteria, which are known to produce oxygen from chlorite (ClO_2^-). In the anaerobic methanotroph *M. oxyfera*, which lacks identifiable enzymes for dinitrogen formation, degradation of methane in the presence of nitrite was directly associated with both oxygen and dinitrogen formation. These findings strongly argue for the role of NO, or an oxygen species derived from it, in the activation reaction of methane. Although oxygen generation elegantly explains the utilization of 'aerobic' pathways under anoxic conditions, the underlying mechanism is still elusive. We will discuss the current knowledge on intra-aerobic pathways, their potential presence in other organisms and present candidate enzymes related to quinol-dependent NO reductases (qNORs) that might be involved in the formation of oxygen.

doi:10.1016/j.bbabio.2012.06.406

21P3

The energy sulfur metabolism of the hyperthermophilic bacterium *Aquifex aeolicus*

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Aquifex aeolicus, a highly thermophilic bacterium, grows at 85 °C with molecular hydrogen as electron donor and molecular oxygen as electron acceptor. A source of sulfur (elemental sulfur, thiosulfate or hydrogen sulfide) is absolutely required for growth. Stimulated by its exceptional physiological properties, we have set out to study its energy metabolism and the proteins involved in the bioenergetic pathways. We have combined tools of proteomics, biochemistry, and physical-chemistry to characterize two high molecular weight membrane-bound protein edifices representing two complete "respirasomes" involved in two distinct respiratory pathways. One superstructure, formed by the stable association of a [NiFe] hydrogenase and a molybdenum sulfur reductase, is responsible for sulfur reduction by H_2 [1]. The second one is a new supercomplex involved in oxygen respiration and contains all proteins and complexes required for the electron transfer from H_2S to O_2. It contains the monotopic flavoenzyme sulfide quinone reductase (Sqr), the *bc* complex and the three-subunit ba_3 cytochrome *c* oxidase [2, 3]. Thus two different energy pathways (sulfur reduction and sulfur oxidation) are organized in this bacterium as supramolecular structures in the membrane. Moreover, additional cytoplasmic enzymes involved in sulfur compound utilization were characterized from *A. aeolicus*: sulfur oxygenase reductase (SOR), which catalyzes the simultaneous oxidation and reduction of elemental sulfur, in the presence of oxygen [4] and a sulfur transferase SbdP [5] which might function as a sulfur supplier, distributing elemental sulfur to some enzymes of energy sulfur metabolism, and thus optimizing respiration on elemental sulfur [6]. Taking advantage of the complete genome sequence of *A. aeolicus*, in addition to the experimental data, we propose a model for the energetic optimization of sulfur compounds, integrating known and hypothesized pathways [7].

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doi:10.1016/j.bbabio.2012.06.407

21P4

Ferredoxin:$NADP^+$ oxidoreductase junction with CdSe/ZnS quantum dots — An example of enzymatically active nanohybrids to be used in photosynthesis research

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Ferredoxin:$NADP^+$ oxidoreductase (FNR) is a key photosynthetic enzyme. Isoforms of FNR may also play a role in other metabolic pathways [1]. Here, we present the hybrid of FNR and quantum dots/semiconductor surfaces. Quantum dots (QD) are colloidal nanoparticles, few to several nanometers in diameter. QDs are mainly built from semiconductor materials (e.g. CdSe, CdTe, ZnS), homogenous or composed of core and shell (e.g. CdSe/ZnS). Due to their nano-size and type of semiconductor material, they have unusual fluorescence properties, giving them advantage over typical fluorophores: (i) narrow emission band of maximum tuned by crystal size, (ii) broad absorption spectrum and large Stokes shift, and (iii) significant resistance for photo-bleaching [2].

Functionalization (conjunction of other molecules to a surface) of QDs and other semiconductor-based structures increases their usefulness. We are showing conjugates created by covalent bonding