Metabolism of tall bugs & small bugs – From Observation to Application

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The exact knowledge of metabolic rates of living organisms and their energy demands is of crucial importance in various research fields. In ecology for example lots of questions focus on adaptations of organisms to their environment, with increasing relevance these days of climate change. In Biology a lot of questions deal with species specific traits which enhance survival, a higher competitiveness of invasive species or define the divergence between species. But there are also adaptations of clinical relevance, organisms like parasitic protozoans, microorganisms and vector organisms, raising questions in toxicology, diagnosis and therapy. Since Lavoisier and Laplace (1780) heat flow calorimeters have been used to directly measure the energetic turnover of living organisms. Today we have access to much smaller heats due to the technical development within the last decades. Present calorimeters are able to measure the metabolic heat dissipated by a few cells only, by tissues, bacteria, fungi or protozoans. Even the heat of the very slow growing mycobacteria (e.g. tuberculosis) or borrelia can be detected nowadays. This precision in detecting tiny heat flows, keeping temperature constant and instrument drift small opens a broad field of clinical applications to calorimetry, amongst them diagnosis, therapeutic approaches and drug testing. A field whose potential is by far not utilized yet.

This talk presents some examples on how to access more applied themes by adjusting approaches or the setup of instruments. Metabolic rates at different temperatures for example could give evidence on which animals may be better adapted to withstand present and coming climatic changes. To understand the metabolism and energetic requirements of vector organisms like mosquitoes or bugs will help to consider which actions will be undertaken and how to fight those problem species. Toxicological investigations will help to reveal more specific pesticides, drugs and antibiotics. Especially with respect to present problems with multiresistent organisms in hospitals (mycobacteria, streptococci) toxicological experiments within the calorimeter will be of increasing relevance, a direct and easy approach of drug testing. There are some diagnostic approaches for calorimetry as well, e.g. in detecting bacteria in septic blood samples. Simultaneously different antibiotics can be tested saving precious time and preventing allergic incidents.