

Search of mitochondrial activation factors using *Tetrahymena* and study on their physiological effects

Takashi FUJIHARA, Tetsuo OZAWA, Osamu NUMATA (Graduate School of Life and Environmental Sciences, University of Tsukuba)

Using *Tetrahymena* and rhodamine 123, we developed a simple method of measuring mitochondrial membrane potential. We then examined whether several catechins, oolong tea and black tea could increase mitochondrial membrane potential. We found that the high-molecular-weight polyphenols in both teas, and several catechins, could increase mitochondrial membrane potential and activate the mitochondria. The high-molecular-weight polyphenol was referred as MAF (mitochondrial activation factor). The MAFs were purified from oolong tea and black tea by a combination of solvent extraction and Toyopearl HW-40F column chromatography. The MAFs have gallic acid residues, procyanidin structures and bonding between B ring and B ring of catechin group. The MAF isolated from oolong tea increased the mitochondrial membrane potential and ATP content in *Tetrahymena* and mouse sperm, and elevated their swimming velocity. These results suggest that the MAF increases ATP synthesis through activation of oxygen respiration in the mitochondria and that the MAF is a first respiratory activator. Since swimming velocity depends on ciliary and flagellar motility, the MAF directly or indirectly activates ciliary and flagellar movement. When MAF was administered to diabetic model mice on a daily basis, their blood sugar level decreased to 80% of the previous level and the occurrence of fatty liver was reduced.