Relationship between physical properties and lipid metabolism in temperature acclimation of cells

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Living organisms of the earth live in various environments by adapting themselves to physical and chemical changes of their environments. Cellular mechanism of adaptation to the environment has been developed and stored in genetic information of DNA through the long history of the earth. And the mechanism is realized in cell membranes as modification of lipid composition. The author investigated relationship between physical properties of biomembranes (i.e. phase transition, phase separation and fluidity) and lipid metabolism in protozoa, *Tetrahymena* cell. There was close relationship between growth temperature of the cells and phase transition temperature of the cell membranes measured by differential scanning calorimeter. When growth temperature of *Tetrahymena* cell was lowered from 39.5 C to 15 C, phase separation was observed by freeze-fractured electron microscope in microsomal membrane and ratio of unsaturated phospholipid to saturated phospholipid was raised in cell membranes. There was also relationship between membrane fluidity and desaturation of membrane phospholipid, and then relationship between membrane fluidity and swimming velocity of *Tetrahymena* cells. Using thylakoid membrane from algae in which desaurase gene was knockouted, it was suggested that lowering growth temperature of cells induced expression of desaurase genes.