**Direct effects of dopamine on mitochondrial thermogenesis in brown adipocytes**

Rose Kohlie, Nina Perwitz, Hendrik Lehnert, Johannes Klein, Alexander Iwen
Department of Internal Medicine I, University of Lübeck, Germany

**Background:** Brown adipose tissue (BAT) is specialized in thermogenesis, i.e., the production of heat. Uncoupling protein 1 (UCP1) mediates this effect in mitochondria of brown adipocytes [1]. Catecholamines are known to be critically involved in the regulation of BAT thermogenesis [2]. However, little is known about dopamine (DA)-mediated effects on thermogenesis. Here, we investigated direct cellular effects of DA on mitochondrial thermogenesis and mass in brown adipocytes.

**Methods:** Cell culture: SV-40T immortalized murine brown adipocytes were used for all experiments. Western blot: Protein lysates were prepared and immunoblotting was performed using specific antibodies. Mature brown adipocytes were treated with dopamine (DA; 1 or 10nM) for 24h in serum free medium. cAMP determination: Brown adipocytes were treated as stated in the figure. Cells were lysed and supernatants were analyzed using an ELISA kit (Caymen Chemical, Hamburg, Germany). Oxygen consumption: Respiration was measured using Oxoplates (FluoSTAR OPTIMA; BMG-Labtech, Ortenberg, Germany). JC-10 assay: Mitochondrial membrane potential (Δψm) was analyzed with the JC-10 dye (Biolum, Hamburg, Germany). Fluorescence intensities of JC-10 monomers and aggregates were quantified using a microplate reader.

**Statistical analysis:** Paired Student's t-test was performed using Sigma Plot **p<0.01,** **p<0.05.

**Summary:** D1-like and D2-like dopamine receptors were detectable in brown adipocytes. Treatment of brown adipocytes with dopamine:
- increased cAMP concentrations
- increased oxygen consumption, Δψm, and UCP-1 levels
- increased expression of mitochondrial mass markers

These direct effects of dopamine on mitochondrial thermogenesis were mediated by D1-like receptors and p-38 MAP kinase.

**Conclusion:** Dopamine directly increased thermogenesis in brown adipocytes. Targeting D1-like receptors on brown adipocytes may help to induce thermogenesis, pointing towards novel therapeutic approaches to treat obesity.

**References:**