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The role of carbohydrates at the origin of homochirality in biosystems

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Pasteur has demonstrated that the chiral components in a racemic mixture can separate in homochiral crystals. But with a strong chiral discrimination the chiral components in a concentrated mixture can also phase separate into homochiral fluid domains, and the isomerization kinetics can then perform a symmetry breaking into one stable homochiral system. Glyceraldehyde has a sufficient chiral discrimination to perform such a symmetry breaking. The requirement of a high concentration of the chiral reactant(s) in an aqueous solution in order to perform and maintain homochirality; the appearance of phosphorylation of almost all carbohydrates in the central machinery of life; the basic ideas that the biochemistry and the glycolysis and gluconeogenesis contain the trace of the biochemical evolution, all point in the direction of that homochirality was obtained just after or at a phosphorylation of the very first products of the formose reaction, at high concentrations of the reactants in phosphate rich compartments in submarine hydrothermal vents. A racemic solution of D,L-glyceraldehyde-3-phosphate could be the template for obtaining homochiral D-glyceraldehyde-3-phosphate (aq) as well as L-amino acids.

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Obesity related hypertension: Altered downstream regulation of leptin on haemodynamic and renal sympathetic nerve activity in high fat fed rabbits

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Objective: High fat diet (HFD) induced hypertension in rabbits is neurogenic and due to the central action of leptin. This action is dependent on secondary neuronal activation in alpha-melanocortin stimulating hormone (alpha-MSH) and neuropeptide Y (NPY) positive cells. Neurons in the ventromedial hypothalamus (VMH) and Dorsomedial hypothalamus (DMH) are innervated by both neuronal populations and transduce leptin signalling from the Arcuate to other hypothalamic and hind brain nuclei. The VMH and DMH are also capable of responding to leptin signals directly independent of NPY or alpha-MSH neurons. In the present study we assessed the contribution of leptin, alpha-MSH and NPY neurons in the VMH and DMH on development of diet-induced neurogenic hypertension.

Design & Method: Male New Zealand White rabbits were instrumented with a VMH or DMH cannula and a renal sympathetic nerve electrode. Blood pressure was measured by means of an intra-arterial catheter. Following 3 weeks of a HFD (13.5% fat, n=10) conscious rabbits had higher renal sympathetic nerve activity (RSNA), blood pressure and heart rate compared with control diet-fed animals (3.5% fat, n=10).

Results: Rabbits exhibited higher blood pressure, heart rate and renal sympathetic nerve activity when fed a high fat diet compared to controls (n=6-10). Alpha-melanocyte-stimulating hormone injection into the ventromedial hypothalamus increased blood pressure and renal sympathetic nerve activity ($P<0.05$) in high fat diet rabbits. By contrast, no changes were observed in blood pressure or renal sympathetic nerve activity following alpha-melanocyte-stimulating hormone injections into the dorsomedial hypothalamus. Leptin antagonist injection into ventromedial and dorsomedial hypothalamus decreased blood pressure ($P<0.05$) when given to high fat diet rabbits. Neuropeptide Y injection had no effect on blood pressure or renal sympathetic nerve activity in either nucleus.

Conclusions: We conclude that the VMH is the likely origin of leptin-mediated sympathoexcitation, alpha-MSH hypersensitivity and altered central responsiveness to NPY.

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