TU02 Energetics and brain activation

TU02-01

ASCORBIC ACID PARTICIPATES IN A GENERAL MECHANISM FOR CONCERTED GLUCOSE TRANSPORT INHIBITION AND LACTATE TRANSPORT STIMULATION

Castro, M. A.[1], Angulo, C.[1], Nualart, F.[2] and Concha, I. I.[1]

[1]*Biochemistry Institute, Universidad Austral de Chile, Valdivia, Chile*

[2]*Department of Cellular Biology, Universidad de Concepción, Concepción, Chile*

Here, we present a novel function for ascorbic acid. Ascorbic acid is an important water-soluble anti-oxidant and cofactor in various enzyme systems. We have previously demonstrated that an increase in neuronal intracellular ascorbic acid is able to inhibit glucose transport in cortical and hippocampal neurons. Because of the presence of sodium-dependent vitamin C transporters, ascorbic acid is highly concentrated in brain, testis, lung and adrenal glands. We explored how ascorbic acid affects glucose and lactate uptake in neuronal and non-neuronal cells. First, the expression of glucose and ascorbic acid transporters in non-neuronal cells was studied. Like neurons, HEK293 cells expressed GLUT1, GLUT3 and SVCT2. We observed that only intracellular ascorbic acid, but not extracellular, inhibits 2-deoxyglucose transport in HEK293 cells. As monocarboxylates such as pyruvate and lactate, are important metabolic sources, we analyzed the ascorbic acid effect on lactate transport in cultured neurons and HEK293 cells. Intracellular ascorbic acid was able to stimulate lactate transport in both cell types. Our data show that ascorbic acid inhibits glucose transport and stimulates lactate transport in neuronal and non-neuronal cells. Thus, according to astrocyte neuron lactate shuttle hypothesis and our results, ascorbic acid could work as a metabolic switch, modulating neuronal metabolism between rest and activation periods. FONDECYT1060135, 11070065.

TU02-02

GENETIC REGULATION OF THE MICE MALE ULTRASONIC VOCALIZATION

Choi, H.[1], Kim, D. H.[1], Jeon, J.[2], Kim, Y.[2] and Kim, D.[1]

[1]*Department of Biological Sciences, KAIST, Daejeon, Korea*

[2]*Department of Mechanical Engineering, KAIST, Daejeon, Korea*

Human languages are communication methods by vocalization and characterized by highly patterened and structured. There was only few animal models for language such as birds song, and the absent had been the obstacle to research the language function and origin. Recently, it was shown that the male mice ultrasonic vocalizations (USV) are not mere calls but songs with highly patterned. As the mice model are advantageous to the bird models in genetics and behavioral knowledges, it is important to find the regulation factors of USV. To test the genetic influences on the USV, We analyzed the sexual behaviour and USV patterns in mice strains genetically close. The USV patterns showed difference between the near origin strains and their F1 hybrid offsprings showed similarity to one parent strain only. The result suggests that the patterns of mice songs are determined by genetic regulation.

TU02-03

STEADY-STATE BRAIN GLUCOSE TRANSPORT KINETICS EVALUATED WITH A FOUR-SITE CONFORMATIONAL MODEL

Duarte, J. M., Morgenthaler, F. D., Lei, H. and Gruetter, R.

Center for Biomedical Imaging, EPFL, Lausanne, Suisse

Glucose (Glc) supply from blood to brain occurs through facilitative transporter proteins. As brain Glc (G_{brain}) concentration can be higher than the carrier K_m, reversible Michaelis–Menten kinetics has been introduced to describe the transport at steady-state. This implies a near linear relation between brain and plasma Glc, as it has been experimentally determined. A conformational four-site exchange model accounting for trans-acceleration and asymmetry of the carrier was included in a recently developed multi-compartmental model of Glc transport. Based on this model, we demonstrated that G_{brain} as function of plasma Glc can be described by a single, analytical equation describing three kinetic compartments: blood, endothelial cells and brain. Transport was described by four parameters: apparent half saturation constant K_t, apparent maximum rate constant T_{max}, the iso-inhibition constant K_{ii}, and Glc consumption rate CMR_{glc}. Previous published data, where G_{brain} was quantified as a function of plasma Glc by biochemical or NMR spectroscopy, were used to determine the aforementioned kinetic parameters. Glc transport was characterized by K_t ranging from 1.5 to 3.5 mM, T_{max}/CMR_{glc} from 4.6 to 5.6, and K_{ii} from 51 to 149 mM. It was noteworthy that K_t was on the order of a few mM, as previously determined from the reversible model. This model of Glc uptake into the brain includes both efflux and transport inhibition by G_{brain}, predicting that G_{brain} eventually approaches a maximum when it is higher than K_{ii}. However, as K_{ii} largely exceeds G_{brain}, iso-inhibition is unlikely to be of substantial importance when plasma Glc is below 25 mM. As a consequence, the reversible model can account for most experimental observations under physiological conditions.

TU02-04

DEVELOPMENT OF WIRELESS, IMPLANTABLE NEURAL RECORDING SYSTEM FOR BMI SUPER COMPANION DOGS

Komissarova, J. G.[1], Lang, Y.[1], Lee, H. J.[1], Ham, H. G.[1], Xue, M. J.[1], Ahn, J. M.[2] and Shin, H. C.[1]

[1]*Department of Physiology, Hallym University, Chuncheon, Korea*

[2]*Department Electronic Engineering, Hallym University, Chuncheon, Korea*

We have developed a TiWiNets combined with advanced digital signal processing capable of realizing a totally implantable system for BMI. It consists of a preamplifier with 2 opamps for each channel, bluetooth module (BM), a Labview-based monitor program, and 16bit-RISC microcontroller. Digital finite impulse response (FIR) windowed sinc filter was implemented with hanning window (cosine), having a 3dB passband from 400 to 1500 Hz and a 48-dB stopband for other frequencies using the microcontroller. Less than ±2% error was obtained between simulated and measured FIR results. Due to the design of FIR filter the TiWiNets size could be reduced dramatically to module dimension of $22^{1}26^{1}8$ mm. An *in vivo* performance was evaluated by transmitting neural spikes from software-selectable 2 channels of the TiWiNets implanted in an intra-cranial brain areas. In the monitor program, a neural spike detection algorithm with auto-reference, time-frequency analysis,