CELL BIOLOGY

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Abstracts

Light-Induced Changes in Photoreceptor Metabolism, A New Clue to Visual Function. EDWARD A. KIMBLE, PURDUE UNIVERSITY.——Light induced changes in the respiration of bullfrog retinae have been recorded under conditions where synaptic transmission is known to be blocked, *i.e.* after treatment with 10mM sodium aspartate. Under these conditions, illumination causes a decrease in respiration that is apparently related to known changes in the active transport of sodium ions and which amounts to a decrease in respiration of -6800 O_2 molecules per photon captured. Elimination of sodium transport by treatment with 10^{-4}M ouabain or by removal of sodium gives rise to a second type of response. Illumination now stimulates respiration (+2160 O_2 molecules/photon captured). This response is abolished by removal of calcium but readdition of calcium restores the response. These responses appear to reflect changes in metabolic energy usage. Furthermore, bypassing anaerobic sites of energy production does not change the general pattern of response. This technique allows detection of chemical events in the retina which are not currently detectable by electrophysiological measurements.

The Distribution and Mobility of Anionic Sites on Intestinal Absorptive Cell Brush Borders. RALPH A. JERSILD, JR. and R. W. CRAWFORD, Department of Anatomy, Indiana University Medical Center, Indianapolis, Indiana 46202.——The distribution and behavior of anionic sites on the microvillous surface of rat jejunal absorptive cells were studied using polycationic ferritin (PCF) as a visual probe. Segments were incubated in PCF either before or after glutaraldehyde fixation. The results indicated that the anionic sites can be divided into three groups based on their interaction with PCF. 1) Sites along the length of the microvilli which are accessible to binding PCF in living, unfixed cells. These sites are capable of translational mobility at the membrane surface and can be induced to cluster into discrete patches by PCF. Their redistribution is prevented by prefixation. 2) Sites randomly distributed along the length of the microvilli which are inaccessible to PCF without prior fixation. 3) Sites restricted to the microvillous tips which are accessible to PCF without fixation, but are apparently immobile. Independent variation was observed in the number of sites in each of the three groups among neighboring cells irrespective of villous position, suggestive of variations in the turnover of these sites.

The Structure of Small Molecule Permeation Channels in Human Red Blood Cell Membranes. WILLIAM K. STEPHENSON and R. SCOTT VANDER WALL, Department of Biology, Earlham College, Richman, Indiana 47374.——The

permeability of human red blood cell (rbc) membranes to water and various alcohols was determined by comparing hemolysis times. The maximum diameter of the permeation channels or pores for small molecules was determined to be 10 Å since the rbc is relatively impermeable to glucose. Alcohols with van der Walls radii diameters of up to 6.3 Å are able to enter the rbc. An increased number of hydroxyl groups retards permeability. We conclude that the channels by which small molecules permeate the rbc membrane are lined with ionic and/or polar groups which interact with the permeating molecules.

Morphological and Functional Interaction of Dissociated Rat Superior Cervical Ganglion Neurons and Heart Ventricular Cells in Co-culture. KATHLEEN L. KING*, DANIEL C. WILLIAMS, GEORGE B. BODER and RICHARD J. HARLEY. The Lilly Research Laboratories, Eli Lilly and Company, Indianapolis, Indiana 46206.——In the absence of exogenously supplied nerve growth factor, dissociated newborn rat superior cervical ganglion neurons will survive and extend processes on a monolayer of dissociated rat heart ventricular cells in culture. Interaction between these two types of cells in co-culture was stimulated by the addition of tyramine which is believed to increase heart rate *in vivo* by effecting release of catecholamines from sympathetic nerve endings. In 83% of the co-cultures examined in the presence of $5x10^{-6}$M tyramine, an increase in the beat rate of the ventricular cells contacted by neuronal processes was observed and measured by means of a photooptical system. Heart cells cultured without neurons did not show a positive chronotropic response to this concentration of tyramine. Examination of the co-cultures with electron microscopy has revealed muscle cell surfaces in close apposition to neuronal varicosities containing granular and agranular vesicles. The dimensions of the junctional spaces, the vesicle size, and the spatial relationships were similar to those in the mouse ventricle *in vivo*. These observations suggest that the association of sympathetic neurons and heart ventricular cells in co-culture is at least in some ways similar to their morphological and functional interaction *in vivo*.

Effect of Retinol Palmitate on Glycolipid and Glycoprotein Galactosyl Transferase Activities of Rat Liver Plasma Membrane. KIM E. CREEK, D. JAMES MORRÉ and C. L. RICHARDSON, Departments of Biological Sciences and Medicinal Chemistry, Purdue University, West Lafayette, Indiana 47907.——Vitamin A has been implicated in glycosyltransferase reactions and retinol phosphate has been identified as a lipid carrier for certain hexoses destined for incorporation glycoproteins. Both vitamin A-deficient and -supplemented diets have similar effects in depressing levels of liver glycolipids and in the first glycosyltransferase unique to the ganglioside biosynthetic pathway (Richardson *et al.*, Biochim. Biophys. Acta 488, 88, 1977). In the present study, effects of retinol palmitate on catalysis of transfer of galactose from UDP-galactose to endogenous glycoprotein and glycolipid acceptors by purified plasma membrane preparations from rat liver were examined. Results show a log dose dependency with an optium at about 1/1000 unit per assay. Above or below this optium concentration, the vitamin inhibited the enzymatic activity as in previous studies *in vivo*. The significance of these findings to use of

retinol derivatives in cancer chemotherapy will be discussed. Work supported in part by a grant from the Phi Beta Psi National Sorority to C.L.R.

Fast Axoplasmic Transport of Calcium is Associated with the Transport of a Protein in the Mammalian Nerve. ZAFAR IQBAL, Department of Physiology and the Medical Biophysics Program, Indiana University School of Medicine, Indianapolis, Indiana 46202, U.S.A.——The role of calcium in axoplasmic transport has come under attention in our laboratory as a result of studies showing that Ca^{2+} is required in the medium to maintain axoplasmic transport and that it is transported at a fast rate of 410 mm/day in cat sciatic nerve (Iqbal & Ochs, Neurosci. Abst. *1*: 802, 1975; Ochs, Iqbal, Worth & Chan, Int. Soc. Neurochem. Symp., 1977). This communication describes that the transport of Ca^{2+} in the nerve is associated with the transport of a calcium binding protein in the nerve. These studies were made by injecting $^{45}Ca^{2+}$ into L7 dorsal root ganglion of cat and the labeled transported protein in the nerve characterized by gel filtration using Sephadex G 100 and Biogel A 5m columns. Fast transported $^{45}Ca^{2+}$ was found associated with a protein peak eluting in the range of 15,000 dalton. Using [^{3}H]-leucine as a precursor, this 15,000 dalton protein was found to be transported at the same rate as $^{45}Ca^{2+}$ labeled protein in the sciatic nerve. When [^{3}H]-leucine labeled protein was incubated with $^{45}Ca^{2+}$ and processed for gel filtration, both $^{45}Ca^{2+}$ and [^{3}H]-activities eluted at the same elution volume from the column. These results suggest that Ca^{2+} is transported in the nerve in association with the protein. Some possible roles played by the calcium binding protein will also be discussed. Supported by the NIH grant PHS R01 NS 8706-08.

The Effects of Isoproterenol on Mitosis and Cell Ultrastructure. MEG DURKIN and CHARLES W. GOFF, Department of Life Sciences, Indiana State University, Terre Haute, Indiana 47809.——Isoproterenol and other factors which enhance the activity of adenyl cyclase and thus lead to increased intracellular levels of CAMP in a number of animal systems has been shown to lead to a decrease in cell division within 24 hours. In an attempt to determine whether isoproterenol has the same effect on plant systems, onion roots (*Allium cepa*) were grown in a solution of 0.5 mM isoproterenol over a 24-hour period. Roots were sampled at 0, 1, 3, 6, 9, 12 and 24-hour intervals, fixed and squash preparations of the roots were examined under light microscopy. The mitotic index was calculated and compared against control roots grown in distilled water. The experimental cells showed a significant decrease in the percentage of mitotic cells 1 hour after treatment (from 11.5% to 5.9%) and remained approximately one-half of the percentage of mitotic cells for the control cells thorughout the 24 hour period. Studies are in progress to determine whether any ultrastructural changes, particularly involving the mitotic process, are associated with the presumed change in intracellular CAMP level.

Increased amounts of ATP related to cellular activation of onion leaf base tissue. DR. W. S. COURTIS, Assistant Professor of Biology, IUPUI, 1201 E. 38th Street, Indianapolis, Indiana 46205.——Previously protected (quiescent) onion leaf base tissue exposed to the ambient atmosphere contained significantly more ATP per gram fresh weight than control tissue. Although 48 hour exposed tissue contained more ATP than 24 hour exposed tissue, the difference (6 nm ATP per

gram fresh weight) was not significantly different. These data suggest that leaf base mesophyll cells are activated by exposure in a manner similar to that reported for outer epidermal cells using other techniques.