11.1

ADAPTATION OF INTEGUMENTAL TRANSPORT IN *MYTILUS* TO REDUCTIONS IN EXTERNAL SALINITY. A.L. Silva* and S.H. Wright. Department of Physiology, University of Arizona College of Medicine, Tucson, AZ 85724.

Taurine, the principal osmolyte in molluscan integument, is actively transported by *Mytilus* gill. This process, which can occur against gradients in excess of 10^7 to 1, is dependent on external Na^+. We previously showed that taurine transport is sensitive to changes in external salinity, and presumed this reflected, at least in part, the requirement for Na^+. In this study we examined short-term adaptation of transport in *Mytilus* gill to reduction in external salinity. Acute exposure of isolated gills from *M. californianus* to 60% artificial seawater (ASW), which corresponds to a reduction in external Na^+ from 425 mM to 255 mM, resulted in >90% inhibition of taurine uptake. The tissue initially increased in wet weight following exposure to 60% ASW, but within 30 minutes returned to near control weight. Similarly, taurine transport in the gill, following step-wise acclimation (20 minutes per 10% step reduction) of tissue to 60% ASW, approached that of control gills held in normal ASW. Acute exposure of isolated gills to 60% ASW made isosmotic to normal ASW with mannitol resulted in <20% inhibition of taurine transport. Replacement of Na^+ with Li^+ to 60% of normal ASW reduced transport by >50%. These results suggest that *Mytilus* gill responds to reduced external salinity by adaptive changes in integumental transport that run contrary to the predicted effect of the concomitant reduction in external Na^+. This adaptation may involve both a volume regulatory response and a synergistic action of Na^+ and other ions on active taurine accumulation. Supported by NSF Award DCB88-19367.

11.2

BOTH NA^+ AND CL^- GRADIENTS ARE DRIVING FORCES FOR NACL-L-GLUTAMATE COTRANSPORT IN LOBSTER HEPATOPANCREATIC BRUSH BORDER MEMBRANE VESICLES. L.M. Balon* and G.A. Ahearn. Univ. of Hawaii, Honolulu, HI 96822.

Our previous work indicated that 3H-L-glutamate transport by lobster (Homarus americanus) brush border membrane vesicles (BBMV) was stimulated by the presence of both Na and Cl ions in the external medium, but the catalytic or energetic nature of this action was undefined (J. Exp. Biol. 130: 175-191). In the present study, a zero-trans time course experiment using inwardly-directed transmembrane Na or Cl gradients led to similar transient accumulations of 3H-L-glutamate above equilibrium values in the presence of equilibrated concentrations of the respective counterions. The uptake overshoots observed in the presence of single ion gradients were doubled when gradients of both Na and Cl were used simultaneously. In equilibrium shift experiments where vesicles were pre-equilibrated with 3H-L-glutamate and either of the monovalent ions, an inwardly-directed gradient of each counterion led to the transient accumulation of additional labelled amino acid above its equilibrium concentration, indicating that either ion gradient was capable of energizing the net flow of L-glutamate. A cotransport stoichiometry of 1 Na/1 Cl/1 glutamate was confirmed using the Static Head analysis where a balance of ion and amino acid driving forces were attained with a 10:1 Na or Cl gradient against a 10:1 L-glutamate gradient. Supported by NSF grants DCB88-09930 and DCB89-03615.

11.3

DIFFERENTIAL SCALING OF MASS-SPECIFIC METABOLISM AND NUTRIENT TRANSPORT DURING LARVAL DEVELOPMENT OF AN ANTARCTIC AND A TEMPERATE ECHINODERM. Fraser M. Shilling and Donal T. Manahan Dept. of Biol. Sciences, Univ. So. Calif. Los Angeles CA 90089

We examined the oxygen consumption rates and maximum rates (J_{max}) of alanine transport across the integument in similar-sized (mass) bipinnaria-stages of the antarctic asteroid Odontaster validus and the temperate asteroid Asterina miniata. The purpose of this study was to determine the relative scaling (to mass) of energy needs and nutrient inputs for similar larvae developing in environments with different temperatures (Antarctica: -1.0°C; California: 15.0°C). The mass-specific metabolic rate of bipinnaria of A. miniata was 25-times greater than that of O. validus; in contrast, the mass-specific J_{max} for alanine was only 3-times greater. When metabolic demand was expressed as alanine-equivalents (3 mol O_2 = 1 mol alanine), it was found that for the temperate form, the J_{max} for alanine (31.7 pmol alanine/larva-h) could account for metabolic demand. However, for the polar form, the J_{max} for alanine could supply 8-times the metabolic demand. These results suggest that invertebrate larval forms living in environments with low nutrients and temperatures have lower mass-specific metabolic rates while maintaining relatively higher mass-specific rates of nutrient transport. This suggestion is supported by our observations that during the early development of O. validus there was a doubling in dry organic weight from the egg (625 ± 18 ng) to the gastrula-stage (1355 ± 71 ng). Thus, growth occurred for those stages lacking a digestive system.

11.4

EFFECTS OF DIETARY COMPOSITION ON INTESTINAL NUTRIENT TRANSPORT IN A EURYHALINE TELEOST. E. Titus*, W.H. Karasov and G.A. Ahearn. University of Hawaii, Honolulu, HI 96822.

Dietary modulation of intestinal nutrient uptake as a function of varying carbohydrate and protein composition was investigated in the tilapia Oreochromis mossambicus. D-glucose, L-proline and acetate transport were measured utilizing isotopic uptake into brush border membrane vesicles. Adult fish were raised for approximately four weeks on either a high protein/low carbohydrate (HP) diet (65% protein) or a low protein/high carbohydrate (LP) diet (4% protein). The rate of D-glucose transport was enhanced in fish raised on the LP ration over those raised on the HP ration (Vmax: 84.2 ± 18.2 pmol/mg protein/sec vs. 37.4 ± 10.9 pmol/mg protein/sec., respectively, $p < 0.05$). This change in transport rate was specific in that there was no significant effect on Vmax for either L-proline or acetate as a result of dietary ration. There was no significant effect of dietary ration on the apparent Km for D-glucose (LP: 0.34 ± 0.17 mM vs. HP: 0.12 ± 0.03 mM, $p > 0.2$). Additionally, there was no significant dietary effect on apparent Km for either L-proline or acetate. These results indicate that D-glucose transport across the intestinal brush border membrane adapts to the dietary levels of carbohydrate. This adaptation is apparently an effect of increased transport rate or number of glucose carriers rather than enhanced carrier affinity, as indicated by the relative difference in Vmax and relative similarity in Km for the two diet groups. Supported by NSF grant DCB87-15278.

11.5

DIURNAL AND POSITIONAL DIFFERENCES IN ACETATE UPTAKE IN THE HINDGUT OF PRAIRIE VOLES. I. D. Hume and W. H. Karasov (SPON: H.V. Carey). Dept. Wildlife Ecology, Univ. of Wisconsin, Madison, WI 53706

As part of a research program on acetate uptake in hindgut fermenters of different size and dietary habit, we studied acetate uptake in the cecum, proximal colon and distal colon of 16 prairie voles (Microtus ochrogaster, body mass 32-68g) fed a mixture of high-alfalfa rabbit pellets and laboratory chow. Lengths (cm) and nominal surface areas (cm^2) of the hindgut of these herbivores were, respectively, 7.6 and 9.6 (cecum); 9.3 and 6.8 (proximal colon); and 11.1 and 7.0 (distal colon). We measured uni-directional uptake of ^{14}C-acetate (not transmural flux) by intact tissue in vitro over a concentration range 0.05 - 100mM. We found evidence of mediated uptake (apparent $K_m \leq 1mM$), but uptake was primarily passive over the concentration range 10-50mM, the likely concentration of acetate in the lumen. At 50mM, uptake (nmol/min·cm^2) was higher ($P<0.001$) in the distal colon (193 ± 12) than in the proximal colon (89 ± 11) and cecum (83 ± 4) ($\bar{x}$ ± SE, n = 8). This pattern of higher uptake in the distal than in the proximal colon is notably different from that seen in other species. A further consistent finding was a 30% higher uptake at night than during the day; at other concentrations this diurnal difference was as great as 90%. Supported by NSF BSR8452089.

11.6

INTESTINAL NUTRIENT TRANSPORT (INT) IN MAN M.E. Gumpper* (Spon: R.F.Tislow) Univ. of PA. Med. Sch. and Marriott Lifecare Community, Haverford, PA 19041

INT is essential in man who are unable to swallow food. Jejunostomy is used if gastric input is not possible. Prolonged nasal feeding can lead to complications. It is important that the nutrient preparation should be neither constipating (threat of impaction) nor producing diarrhea. The intestinal food response of stroke-aphasic patients should be obtained from families or referring physicians. Otherwise a trial and error method will be needed as described in the following case: 85 y. FEM. with L.CVA, aphasic and dysphagic developed after six months on Jevity (R, Ross) a life threatening fecal impaction in the sigmoid, found by competent nursing care. Skillful intervention by the intestinal surgeon with removal of the impacted masses, restored intestinal motility. By resuming jejunal feeding with decreasing amount of Jevity (R.) and increasing amounts of Osmolite (R., Ross) and 25% springwater no further problems were encountered. In todays society with increasing demand for health care, it is imperative to have a good nutritional state to maintain body weight and healing power. This procedure lends itself to further research in man and animals.