Herzfrequenz oder die Erhaltung der Atmungsaktivität haben keine Beziehung zur Toleranzzeit des Herzens[8,13,16].

Die von uns bei Tieren mit etwa 25%igem D_2O-Gehalt des Körperwassers gefundenen Veränderungen im Blutdruck- und Atmungsverhalten in Asphyxie bedeuten somit 1. eine gegenüber den beiden Kontrollgruppen im Mittel 40–46%ige signifikante Verlängerung der Toleranzzeit des Herzens, 2. trotz nur geringfügiger zeitlicher Verschiebung des letzten spontanen Atemzugs bis zuletzt bessere Voraussetzungen für eine spontane Wiederbelebung durch signifikante Verstärkung der Atmungsaktivität.

Diese Effekte beruhen mit Sicherheit nicht auf einer erniedrigten Körpertemperatur (sie wurde konstant gehalten) oder Senkung der Herzarbeit. Es müssen andere durch das D_2O ausgelöste Effekte eine Rolle spielen. Ob es sich bei der Verbesserung der myokardialen Toleranz um eine Verbesserung der anaeroben Energiebereitstellung des Herzens handelt oder um eine Verringerung des Energiebedarfs infolge einer Verringerung des Energieverbrauchs, lässt sich zur Zeit noch nicht beurteilen. Neben der D_2O-bedingten Veränderung der Wasserstoffionen-Aktivität und veränderten Enzymaktivitäten dürfte auch die Stabilisierung zellulärer Strukturen von Bedeutung sein, wie sie bei Herzen in normothermer Ischämie beschrieben wurde[5]. Ein Schutz cerebraler Strukturen vor anoxischen Schädigungen durch D_2O lässt sich zwar für das Atemzentrum an Hand der Erhaltung einer stärkeren Atmungsaktivität in der 2. Phase vermuten, für andere cerebrale Strukturen ist jedoch hierüber noch keine Aussage möglich.

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Amino acid absorption in jejunum and ileum in vivo – a kinetic comparison of function on surface area and regional bases

M.A. Mitchell[1] and R.J. Levin

Department of Physiology, University of Sheffield, Sheffield S10 2TN (England), 22 July 1980

Summary. Maximum absorptive capacities (V_{max}) for the jejunum and ileum corrected for the presence of an unstirred layer of water have been calculated for glycine, valine and methionine *in vivo* in fowls per unit surface area and per region. V_{max} per cm^2 showed that ileal enterocytes had a greater absorbing capacity than jejunal for glycine and valine but not for methionine. V_{max} for glycine and valine, calculated for the whole jejunum and ileum, however, were not different but for methionine the jejunal value was 1.9 times greater than the ileal.

Materials and methods. Female chickens (450–550 g) were anaesthetized with halothane. A 20-cm segment of either jejunum or ileum was exteriorized and perfused with a solution containing ^{14}C-labelled glycine, valine or methionine over a range of concentrations. The absorption of the amino acids was measured as luminal loss per 15 min and was corrected for a linear non-saturating component and calculated per 10-cm length of intestine and per cm^2 of surface area. The latter was assessed from measurements of the dimensions of villi obtained from upper and lower small intestine. The absorption data were then subjected to kinetic analysis to estimate the 'apparent' maximum absorptive capacities (V_{max}).

The total surface area available for absorption in either the whole jejunum or the whole ileum was assessed by measuring the length of the 2 intestinal regions using recognized anatomical markers and multiplying by values previously obtained for the area of 10-cm segments of the 2 regions. The absorption expressed on the different bases was corrected further for the presence of the effective unstirred layer at the surface of the absorbing epithelium by a computer programme. This programme gives the best estimates of the kinetic parameter 'real V_{max}' [2]. These values calculated from absorptions assessed on the different bases, were compared in upper and lower small intestine.

Results. The V_{max}'s for the 3 amino acids indicate that there are regional differences in absorptive functions but that the nature of the difference is dependent upon the structural basis used for calculation. The V_{max} for glycine, measured per cm^2 surface area, is significantly higher in the ileum than in the jejunum by 51% ($p < 0.05$) (table). Similarly, the V_{max} for valine is significantly higher in the ileum by 119% ($p < 0.01$). On this basis the V_{max}'s for methionine are the same in both upper and lower small intestine. The maximum absorption per sec. for the whole of the jejunum or ileum is also shown in the table. The values in the 2 regions for glycine and valine do not differ significantly whereas the value for methionine in the jejunum is almost double that in the ileum ($p < 0.001$).

Discussion. The difficulties in quantifying intestinal transport *in vivo* have been discussed extensively[3]. It is clear from the present study that interpretation of such absorp-

'Real V_{max}' for glycine, valine and methionine transport in vivo in jejunum and ileum in domestic fowls

	Gly		Val		Meth	
	Jejunum	Ileum	Jejunum	Ileum	Jejunum	Ileum
Per unit area (pmoles cm^{-2} sec^{-1})	36.6± 5.3 (6)	55.2± 6.1* (6)	37.5± 7.0 (6)	82.3± 12.7** (6)	147.2± 14.4 (7)	148.0± 5.4 (6)
Per region (nmoles sec^{-1})	26.5± 3.9 (6)	20.5± 2.5 (6)	27.2± 5.1 (6)	31.0± 4.5 (6)	105.9± 10.3 (7)	55.2± 2.0*** (6)

The values are given as the mean± 1 SE of the mean. The results are calculated a) per unit surface area and b) per region. The figures in parenthesis indicate the number of estimates. Jejunal-ileal comparisons * $p<0.05$; ** $p<0.01$; *** $p<0.001$.

tion data depends on the structural basis used for calculation. When V_{max} is calculated per unit surface area of intestine it represents an index of enterocyte function whereas when V_{max} is calculated for a whole region of intestine it represents the functional capacity of the region. Using this interpretation our results indicate clearly functional differences between jejunal and ileal enterocytes with respect to the absorption of the amino acids. The V_{max}'s calculated per cm^2 suggest that the ileal enterocytes have a greater absorbing capacity than jejunal enterocytes for glycine and valine but not for methionine which has the same high V_{max} in both regions. Because the whole jejunum has a greater number of enterocytes than the whole ileum the functional maximum absorptive capacities of the 2 regions exhibit another pattern. On this basis, there are no differences for glycine and valine absorption but the maximal rate of methionine absorption is 1.9 times greater in the jejunum than in the ileum.

Previous studies have produced conflicting results. A higher rate of neutral amino acid absorption was found in jejunum than in the ileum per unit length in rat[4] and in man[5]. In chickens lysine absorption was higher in the jejunum per unit weight[6]. Under in vitro conditions, however, the transport of lysine by chicken intestine[7] was greatest in the ileum regardless of the basis used. None of these studies employed a range of concentrations or kinetic analysis to characterize the transfer mechanisms. The only in vitro kinetic study using chick intestine[8] reported a constant transport rate of methionine throughout the small bowel but only 1 week-old birds were used and, like all the previous in vivo studies, no correction for unstirred layers was applied.

Our results reveal functional differences in the capacities for absorption of the amino acids when comparing the jejunal and ileal enterocytes. Nutritionally, however, the functional maximum absorptive capacity of the whole jejunum or ileum is probably more important. From this point of view the maximum absorptive capacities for glycine and valine are the same in the 2 regions but that for methionine is much higher in the jejunum.

Further analysis of the importance of the concept of the functional maximum absorptive capacity to the nutrition of animals must await measurements of residence/contact times of nutrients in the respective regions.

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Lipid transport in the migrating Monarch butterfly, *Danaus p. plexippus*[1]

S. Turunen[2] and G.M. Chippendale[3]

Department of Entomology, University of Missouri, Columbia (Missouri 65211, USA), 5 May 1980

Summary. The transport of lipid in the haemolymph of the Monarch butterfly during its fall migration was examined. Diglyceride was the major lipid class of 2 electrophoretically distinct lipoprotein fractions in both males and females. Triglycerides, hydrocarbons, free fatty acids, phosphatidyl cholines and phosphatidyl ethanolamines were minor components of these lipoproteins. Differences in lipid transport attributable to sex were not detected.

Although the ecology of the long distance migration of the Monarch butterfly, *Danaus plexippus plexippus,* has received considerable study[4,5], little is known about the butterfly's regulation of its available energy sources[6-9]. During the autumn Monarch butterflies migrate from their breeding grounds in the Great Lakes Region and Northern Plains of North America to overwintering locations in the Gulf Coast, southern California, and Mexico. Some individuals undergo a return migration in the spring to recolonize northern breeding grounds. During their fall migration adults utilize their nutrient reserves, mainly triglycerides, supplemented by consumed nectar, whereas during their spring migration they draw primarily upon their nutrient reserves of lipid[10,11].

Although diglycerides are known to predominate in the haemolymph of several insects, including the Monarch butterfly[9], where they are conjugated to proteins and are the primary lipid transport molecule[12-14], the details of lipid transport in the Monarch butterfly are lacking. For example, the mechanism by which this insect regulates its energy supplies to carry out its annual cycles of migration and reproduction is just beginning to receive study. Juvenile hormone and an adipokinetic neurohormone appear to be control factors[9,11]. A low titre of juvenile hormone may promote migratory flight, whereas a high titre of the hormone may be required to initiate ovary development. The titre of juvenile hormone may, therefore, be involved in regulating whether migration or reproduction is initiat-