Because of the extraction procedures used and the small quantity of lipid removed, we are unable to determine accurately the surface density of the lipid in the respective cuticle. Hydrocarbons, whose nonpolar properties make them well suited for barrier function\textsuperscript{6}, are a major constituent of the surface lipids of both cuticle types. Differences in the molecular composition of the hydrocarbon fractions are probably not sufficient to significantly affect permeability, although the greater percentage of long chain hydrocarbon molecules in sclerotized cuticle should theoretically enhance its diffusion resistance\textsuperscript{3}. Any advantage conferred by this compositional difference may very well be countered by the increased thickness of the lipid-rich inner epicuticle in arthrodial membrane. A thicker inner epicuticle in arthrodial membrane may also help compensate for the absent exocuticle; however, the latter's role in contributing to barrier function in sclerotized cuticle remains speculative.

The response of the different cuticle types to chemical treatments and mechanical abrasion (shams) sheds additional light on their barrier properties. The lipid barrier on the surface of arthrodial membrane appears to be quite labile judging by the marked increase in permeability following hexane application or simply mild rubbing. In contrast, the barrier function provided by surface lipids associated with sclerotized cuticle was unaffected by the same treatments. A strong base in combination with chloroform:methanol was required to disrupt this barrier and even then the increase in permeability was less than observed for arthrodial membrane treated with solvent alone. These data suggest that in sclerotized cuticle the epicuticular lipids are more tightly bound to proteins and/or are covered by a substance or layer that is essentially lipid-insoluble. There is histochemical evidence for an appropriately located layer consisting of acid and neutral mucopolysaccharides in the cuticle of the scorpion \textit{Heterometrus llurus}\textsuperscript{3}. Such a coating would dissolve when the cuticle is treated with KOH, leading to the increased permeability observed. Functionally, the layer would also protect that portion of the scorpion integument that is most likely to experience damage due to soil abrasion.

Despite the much greater permeability of cockroach cuticle, epicuticular lipids still represent a major barrier component, as their removal produces much higher transcuticular water loss rates. The reduced barrier effectiveness of cockroach lipids can be explained in part by their unique composition. Cockroach surface waxes are composed mainly of hydrocarbons (85-95\%), with the unsaturated molecule \textit{cis}, \textit{cis}-6,9-heptacosadiene accounting for 71\% of the total fraction\textsuperscript{15}. Together, these hydrocarbons produce a mobile, grease-like coating rather than the hard wax coating found in scorpion cuticle and in most other xeric-adapted arthropods. Not only is this grease less effective in retarding water loss, but its thermal stability is also lower. In fact, phase changes that probably lead to the restructuring of these superficially-deposited hydrocarbons and, hence, to increased permeability begin at temperatures as low as 30° C. Furthermore, the coating over the surface lipids that protects and contributes to the waterproofing barrier in sclerotized scorpion cuticle is either absent or poorly developed in the cockroach. Without an effective barrier to water efflux, transpiration across scorpion arthrodial membrane would lead to rapid dehydration, especially in gravid females during hot, dry summer conditions. Nonetheless, these findings cannot be applied indiscriminately to all arthropods or, for that matter, even to other scorpion species. During our study we also measured the permeability of the pleural membrane of the scorpion \textit{Pandinus imperator}, a large, tropical species that occurs in lowland rainforests. The mean value for pleural membrane in two gravid females was 11.95 µg cm\(^{-2}\)h\(^{-1}\)mm Hg\(^{-1}\). This value, which is comparable to rates observed for the cockroach pronotum, is also about 2.5 times greater than the permeability of the sternite in the same two scorpions. Obviously, species differences and habitat conditions will have a major bearing on the respective cuticular permeabilities and the mechanisms that have evolved to minimize water loss.

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Effect of glucose administration on bilirubin excretion in the rabbit

M.E. Muñoz, J. González and A. Esteller

Department of Animal Physiology, Faculty of Pharmacy, University of Salamanca, E-37007 Salamanca (Spain), 12 March 1986

Summary. The effect of i.v. infusion of glucose on the hepatic handling of bilirubin was examined in rabbits. A significant increase in the excretion of conjugated bilirubin into the bile was observed, accompanied by a decrease in bilirubinemia. Hepatic bilirubin concentrations were lowered and the UDP-glucuronosyl and UDP-glucosyl transferase activities increased.

Key words. Bilirubin; glucose; glucuronosyl transferase; rabbit; bilirubinemia; conjugates, bilirubin.

The hepatic handling of bilirubin depends on a series of different processes: plasma transport and translocation across the sinusoidal membrane of the liver cell, storage in the hepatocyte, conjugation and transfer into the bile. Previous studies in different species have demonstrated that glucose administration can lead to increased bilirubin excretion in fasted animals, with or without decreases in bilirubinemia\textsuperscript{1-3}. The possibilities of increased bilirubin conjugation or of alterations in bilirubin bind-
collection, a 300-gl blood sample was obtained. Bile and plasma was kept for analysis; the rest was reinfused (after rewarming) 24 h. At the end of the experiments, animals were killed by through the duodenal cannula. At the midpoint of each bile collected in darkness under melting ice and one part ( < 10%) of animals, the normal saline infusion was replaced during the period (min 80–120 of experiments) b) last 40 min of the postinfusion period (min 140–180 of experiments).

Table 1. Biliary bilirubin excretion in the control rabbits and after glucose administration

<table>
<thead>
<tr>
<th></th>
<th>Total</th>
<th>Unconjugated</th>
<th>Conjugated</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>a</td>
<td>b</td>
<td>a</td>
</tr>
<tr>
<td>Control</td>
<td>4.57 ± 0.46</td>
<td>4.49 ± 0.48</td>
<td>0.57 ± 0.15</td>
</tr>
<tr>
<td>Glucose</td>
<td>6.77 ± 0.64*</td>
<td>6.84 ± 0.36*</td>
<td>0.79 ± 0.09</td>
</tr>
</tbody>
</table>

Each value represents the mean ± SEM from 8–10 rabbits; *p < 0.05 significantly different from the control. a) last 40 min of the glucose infusion period (min 80–120 of experiments) b) last 40 min of the postinfusion period (min 140–180 of experiments).

Table 2. Determinations on liver in the control rabbits and after glucose administration

<table>
<thead>
<tr>
<th></th>
<th>Control</th>
<th>Glucose</th>
</tr>
</thead>
<tbody>
<tr>
<td>UDP-glucose</td>
<td>0.245 ± 0.048</td>
<td>0.888 ± 0.115*</td>
</tr>
<tr>
<td>UDP-glucuronosyl transferase</td>
<td>0.504 ± 0.034</td>
<td>0.858 ± 0.100*</td>
</tr>
<tr>
<td>UDP-glucosyl transferase</td>
<td>1.110 ± 0.029</td>
<td>1.349 ± 0.018*</td>
</tr>
<tr>
<td>Unconjugated bilirubin</td>
<td>0.143 ± 0.021</td>
<td>0.085 ± 0.017*</td>
</tr>
</tbody>
</table>

Each value represents the mean ± SEM from 4–6 rabbits; *p < 0.05 significantly different from the control.

Discussion. The results of this study clearly show that i.v. glucose administration lowers plasma bilirubin concentration and increases biliary bilirubin excretion in fasted rabbits, in a similar way to that reported earlier in other species such as the pony2 or the monkey3. The phenomenon does not seem to be related to the effects on bile flow or bile acids, because both canalicular bile flow and bile acid secretion are decreased after glucose administration7. Although the underlying process is difficult to explain and the existence of additional mechanisms cannot be ruled out, it seems apparent that exogenous glucose modifies the process of hepatic conjugation of the pigment. The increase in bilirubin excretion is a progressive phenomenon with maintained stimulation during the postinfusion hour and is accompanied by exsanguination. The portal vein was perfused with ice-cold 0.154 M NaCl and the livers rapidly removed and stored at −20°C.

Results. The mean plasma glucose concentration in the controls was 6.88 ± 0.07 mmol/l. Glucose administration gave a peak glucose concentration of 21.3 ± 0.13 mmol/l. A significant decrease in plasma bilirubin concentration was observed in glucose-treated rabbits as compared to the control values (fig.). Total bilirubin excretion into bile increased significantly after glucose infusion with respect to the controls, with maximal differences appearing during the third hour of the experiments (table 1); the conjugated form of the pigment showed values significantly higher than those found in the control rabbits (table 1). By the end of the assays, the hepatic concentration of UDP-glucose together with bilirubin UDP-glucuronosyl and UDP-glucosyl transferase activities were determined in digiplex-activated livers with bilirubin as acceptor substance at the standard concentration (164 μM)3. Unconjugated bilirubin in liver was assayed by the method of Piper and Hargreaves4. The hepatic concentration of UDP-glucose was estimated by the method of Kepler and Decker5. Glucose in plasma was assayed by the glucose-oxidase method6. Results were expressed as means ± SEM. The significance of the differences was calculated by Student’s t-test. P-values of 0.05 or less were considered as statistically significant.