

ous and water immiscible substances which imitate the tissue so far as the production of currents is concerned can be analyzed in all details much more easily than the tissue itself. The work along this line is not yet entirely finished, the results obtained so far show that biological potential differences are located at the junction of water immiscible fatty membranes and aqueous solution and that their magnitude is determined by peculiar phenomena of distribution. These phenomena of distribution can be fully accounted for by well-established physiochemical laws, but they are of rather complicated nature.¹

The biological potential differences are not determined by ionic mobility as has been frequently assumed.

The methods used in this work are essentially physiochemical. The results obtained so far may appear insignificant to the physiologist as most of the more important electrophysiological observations especially those connected with irritation (action currents) remain unexplained. However the explanations for all these phenomena which the alteration theory can put forward are very hypothetical. It therefore seems justified at the present time to try a thorough explanation on the basis of well known physical laws of the very simplest electric phenomena observed in tissues.

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The synthesis and rate of elimination of hippuric acid after benzoate ingestion in man.

By **HOWARD B. LEWIS.** (By invitation.)

[From the Department of Physiological Chemistry, University of Pennsylvania, Philadelphia, Pa.]

Ten grams of sodium benzoate were administered to a healthy man on a diet of milk, butter, and cane sugar, *i. e.*, glycooll-free. The urine was collected at two hour intervals, and the relation between the elimination of hippuric acid and urea studied. As compared with the corresponding control periods on the same

¹ The details of this work are published in the *Journal of the American Chemical Society*, XXXV, 344 (1913), *Transactions of the American Electrochemical Society*, XXIII, 401 (1913), *Zeitschrift f. Electrochemie*, XIX, 319 (1913).

diet, there was observed a diminution of the urea-nitrogen eliminated during the first six hours after the benzoate ingestion, a diminution corresponding to the nitrogen eliminated as hippuric acid-nitrogen.

Periods.	Total Nitrogen.	Urea + NH ₃ Nitrogen.	Undetermined Nitrogen.	Hippuric Acid Nitrogen.
I-III, control.	3.521	3.074 (87.3%)	0.447	—
VIII-X, benzoate.	3.760	2.436 (64.8%)	1.324 (0.481)	0.843

If the hippuric acid-nitrogen be subtracted from the undetermined N (shown in parentheses), the undetermined N is comparable with that of the control periods. This indicates that in man as in rabbits and pigs, the glycocholl available for synthesis into hippuric acid may be derived at the expense of substances whose N normally appears in the urine as urea-nitrogen. At the end of six hours the greater part of the hippuric acid had been eliminated and the urea elimination had become normal again.

No free benzoic acid nor glycuronates could be detected in the urine, indicating a complete conversion to hippuric acid and a very rapid elimination. In order to ascertain whether the rapidity of elimination was influenced by the liquid diet of the preceding experiment, the work was repeated on the same subject on a mixed diet, and on a purine-free diet. In both experiments, the greater part (85-95 per cent) of the hippuric acid was eliminated within six hours. Another subject received six grams of sodium benzoate and eliminated the greater part of the hippuric acid within six hours. An amount of sodium hippurate equivalent to the benzoate fed was administered, and the elimination of the hippuric acid studied. The rate of elimination was practically identical with that of the benzoate experiments. This indicates the great rapidity with which the human organism can detoxicate and eliminate a toxic substance such as sodium benzoate.