spectrometric, since the strong cytochrome c bands seem to prevent observation of other cytochromes.

Of special significance is succinoxidase activity. The oxidation of succinate by molecular oxygen requires a system of enzymes and cytochromes that seems to demand an unbroken organization(10). The opinion is held by many(11) that a disturbance of such a close association as is present in the cell results in destruction of succinoxidase activity. If this be true, then any preparation retaining succinoxidase activity must have been removed from the cell as an intact unit. The succinoxidase system from most sources, by virtue of its demand for organization, is extremely sensitive to inactivation(11). We have found the system in the red fraction granule to be sensitive to drying and aging and treatment with acetone, although not especially vulnerable to heat.

Taking all of the evidence together, from phase microscopy, from staining technics, and from enzyme activity, we now feel safe in making the statement that the red fraction is a specific granule isolated from the bacterial cell. To the best of our knowledge this is the first such instance reported for bacteria.

Conclusions. The red fraction, previously isolated from a stenothermophilic bacterium, represents a specific piece of bacterial protoplasm. The evidence presented consists of photographs taken with the phase contrast microscope, photomicrographs of stained preparations of bacteria and of red fraction, and of enzymatic data. The enzymatic data rest chiefly on the presence of succinoxidase activity.

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Effect of Desoxycorticosterone on the Colon: Its Relation to the Action of Cation Exchange Resins in Man.* (18573)

EUGENE Y. BERGER, GERTRUDE P. QUINN, AND MARY A. HOMER.

From the New York University Research Service, Goldwater Memorial Hospital, Welfare Island, N. Y.

One of the actions of the adrenal gland affects the transfer of sodium from the lumen of the kidney tubule to the surrounding blood stream. Desoxycorticosterone acetate (DOCA) acts in a similar fashion. This system of sodium transfer found in the kidney is analogous to that found in the intestinal tract where sodium is again transferred from the lumen to the surrounding circulation. Previous investigation of the influence of the adrenal gland on the transfer of sodium in the latter system has indicated that the adrenalectomized animal transfers sodium across the wall of the intestine at a somewhat slower rate than normal(1-3). The present study concerns the influence of DOCA on the mucosa of the colon as indicated by the eventual excretion of sodium in the stool of rat and man.

The rat was selected because normally sufficient amounts of sodium appear in the stool to measure changes with certainty(4,5). In man, the fecal excretion of sodium is normally so small(6) that changes are often difficult to interpret. For the purpose of this study, a cation exchange resin was fed to

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man to insure sufficient amounts of sodium in the stool so that changes could be quantified(7). After suitable periods of observation DOCA was administered to both rat and man, and the changes in the fecal excretion of electrolytes were measured.

Procedures. Three Rockland County white rats weighing 400 to 500 g were studied in separate metabolism cages. They were allowed food and distilled water *ad libitum.* The diet consisted of Purina checkers, containing 150 mEq of sodium and 250 mEq of potassium per gram. Each day, the rats were weighed and their daily intake of food and water recorded. Stools obtained over 3-day periods were pooled for analysis. Electrolyte excretion in the stool of these rats was measured over a 36-day period: 12 control days, 12 days during which each rat received 1 mg of DOCA in sesame oil daily, and 12 recovery days. In the studies conducted in the human, the subjects selected were ambulatory hospital patients without evidence of disturbance in their fluid balance. They were fed the regular ward diet, containing 80 mEq of potassium and allowed salt *ad libitum.* In addition, they received 100 mEq of sodium chloride daily in the form of nonenteric coated tablets. Ammonium carboxylic resin† was administered in dosage of 15 g 3 times daily for a period of 27 days. For a 9-day period, from the 10th to the 18th day of the 27 days on resin, the subject received daily intramuscular injections of DOCA in sesame oil. Urine was collected in 24-hour specimens, and the stool in 72-hour specimens throughout the period of observation. The stools of both rat and man were dried under infra red light. Triplicate aliquots of the dried feces were treated with concentrated sulfuric acid and ashed overnight at 700°C. The ash was dissolved in hydrochloric acid

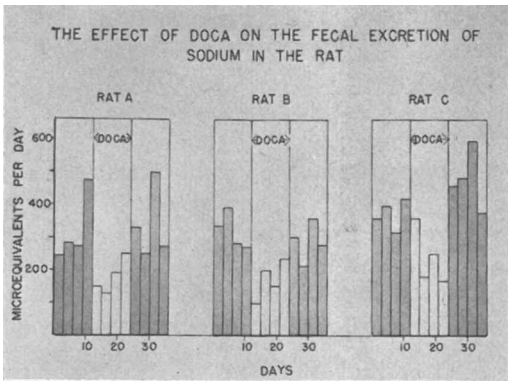

FIG. 1.

and analyzed for sodium and potassium. The urine collected in the human studies was analyzed for sodium and potassium. Sodium and potassium were determined with an internal standard flame photometer(8).

Observations. Observations in the animal. The rats consumed about 16 g of food daily and did not alter their salt or water intake appreciably throughout the experimental period. Rats receiving 1 mg of DOCA daily evidenced an appreciable decrease in their fecal excretion of sodium. Comparing the mean fecal sodium excretion during 12 days control with the 12 days on DOCA, Rat A showed a 44% decrease, Rat B showed a 46% decrease, and Rat C showed a 35% decrease while on DOCA (Fig. 1). During the 12-day DOCA period, there was a tendency for the fecal sodium to return towards normal values. This is quite probably due to a depression of the rats' endogenous DOCA-like activity. Fecal potassium was also measured in these rats. Comparing the mean fecal potassium excreted during the 12-day control period with that excreted during the 12 days of DOCA administration, Rat A decreased 15%, Rat B decreased 13%, and Rat C increased 9%. These changes are within the daily variation of fecal potassium excretion and are not considered significant.

Observations in man. To investigate the influence of DOCA on the absorption of sodium from the intestine in man, a cation

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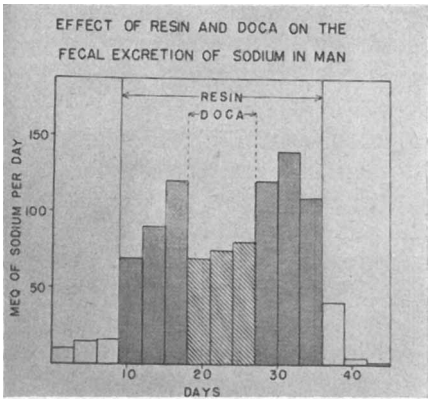

FIG. 2.

exchange resin was fed. The subject was a 55-year-old male suffering from central nervous system lues. When he was fed 45 g of ammonium carboxylic resin daily, his fecal excretion of sodium increased to a mean of 68 mEq a day for the first 3-day collection period (Fig. 2.). In the second 3-day period, the fecal sodium reached 90 mEq daily, and in the third increased to 120 mEq per day. At this point DOCA was administered intramuscularly for 9 days in doses of 15 mg daily for the first 3 days, 20 mg daily for the next 3 days, and 25 mg daily for the last 3 days. The fecal excretion of sodium decreased from 120 mEq per day to 68, 73 and 80 mEq in the 3 successive 3-day collection periods while the subject was receiving DOCA. When the DOCA was discontinued, the fecal excretion of sodium again increased to a mean of 120, 140 and 116 mEq per day in 3 successive collection periods. The resin was now discontinued, and in the ensuing 9 days, fecal sodium fell to normal values.

The urinary sodium averaged 280 mEq a day during the 9-day period prior to the administration of resin, and when resin was introduced, fell to a mean of 150 mEq a day during the first 9 days on resin. There was a further fall in urinary sodium to a mean of 87 mEq a day for the 9 days when DOCA was administered in conjunction with the resin. When DOCA was discontinued, urinary sodium increased to a mean of 141 mEq daily, and when resin was discontinued increased to a mean of 272 mEq daily, values comparable to those obtained during the similar periods prior to the administration of DOCA.

The fecal excretion of potassium increased from 50 to 70 mEq per day when DOCA was administered in addition to the resin and returned to 50 mEq in the post-DOCA period (means of 9-day periods). The increase in fecal potassium excretion is small and is not considered to be a direct effect of DOCA on exchanging sodium for potassium but rather, attributed to an increase in available space on the resin as a consequence of the decrease in sodium. This view is substantiated by the observations in the rat where resin was not used, since under these circumstances, DOCA did not augment fecal potassium excretion.

The urinary potassium progressively decreased while resin was administered and did not seem to be influenced by DOCA. This progressive decrease in urinary potassium excretion is presumably due to progressive losses of potassium in the stool(7).

Similar studies were conducted in 2 other patients with similar results. In one, the fecal excretion of sodium was 50, 62, and 66 mEq of sodium daily in 3 successive collection periods on resin. With the addition of DOCA the fecal excretion of sodium fell to 3, 23, and 13 mEq daily in 3 successive collection periods. In the second patient on resin, only 13 to 19 mEq of sodium appeared in the stool but with the addition of DOCA the fecal excretion of sodium again fell to 6 mEq daily.

Discussion. DOCA decreases sodium excretion in the stool of the rat and when man is fed exchange resin, DOCA decreases the effectiveness of the resin in removing sodium in the stool. The action of cation exchange resin in the intestine is better understood when consideration is given to the mechanism of transfer of sodium across the wall of the gut. The exchange of ions on the surface of the resin is almost immediate and the pattern of electrolytes on its surface is dependent on the number and nature of electrolytes in the surrounding media(9,10). As the concentra-

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tion of sodium varies along the intestinal tract, the amount of sodium fixed to the resin changes, the exchange occurring as soon as the surrounding electrolytes change. When the content of the ileum reaches the colon, the resin is suspended in a solution containing about 140 mEq of sodium per liter(11). In the colon, sodium moves more rapidly from the lumen to the blood than from the blood to the lumen which results in a net reabsorption of sodium from the colon(12). As the sodium ion leaves the lumen of the colon a new equilibrium is established between that sodium on the resin and that in the colon contents. It is the balance of these two attractions, the resin and the colon mucosa, which eventually determines the effectiveness of cation exchange resins in removing sodium in the stool.

Summary. The present data indicate that the action of DOCA is not limited to a control of the transfer of sodium from the lumen of the kidney tubule to the surrounding blood stream but also influences the transfer of sodium from the lumen of the intestine to the surrounding blood stream. DOCA, in addition, influences the transfer of sodium through the sweat and salivary glands by decreasing the sodium concentrations in their secretions(13,14). The evidence indicates that DOCA affects the transfer of sodium through various organs, among them the colon, in each instance limiting the escape of sodium from the body.

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Bilateral Cortical Necrosis of Kidneys in Cortisone-Treated Rabbits Following Injection of Bacterial Toxins.* (18574)

LEWIS THOMAS AND ROBERT A. GOOD.†

From the Departments of Pediatrics and Medicine and the Research Laboratories of the Variety Club Heart Hospital, University of Minnesota Medical School.

Thomas and Mogabgab(1) reported that treatment with cortisone or ACTH produced a striking modification of the local skin reaction of rabbits to the intradermal injection of Shwartzman's meningococcal toxin. The treated animals did not develop the usual reaction of edema and erythema caused by toxin; instead, numerous petechial hemorrhages appeared throughout the skin site approximately 24 hours after the intradermal injection of toxin. The observations suggested that cortisone and ACTH, while inhibiting the local inflammatory response to toxin, might have brought about an increase in the vulnerability of the tissue to direct damage by bacterial toxin. Similar experiments, briefly described elsewhere(2), were undertaken to determine the effect of cortisone on the course of skin infection by living microorganisms, employing various strains of Group A hemolytic streptococci which were known to produce local inflammatory reactions, sometimes followed by abscess formation, in normal rabbits. When cortisone was administered for 2 or 3 days before and after an injection of

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