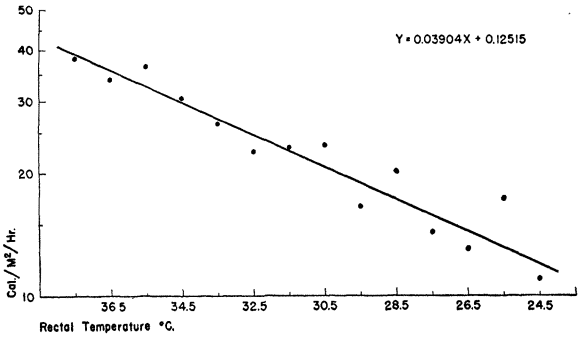

FIG. 1. Relationship between rectal temperature and heat production observed in 18 experiments on 11 animals.

through the observed data was fitted by the method of least squares. Application of van't Hoff's law to the warm-blooded organism within this temperature range would appear to be valid. Whether this observation can be extended to energy exchanges in separate organ systems cannot be answered at the moment, but studies are now in progress to elucidate this point.

Further and more comprehensive reports of the studies being conducted on animals maintained at this reduced and stable body temperature will appear shortly.

References

1. BIGELOW, W. G., LINDSAY, W. K., and GREENWOOD, W. F. *Ann. Surg.*, **132**, 849 (1950).
2. DILL, D. B., and FORBES, W. H. *Am. J. Physiol.*, **132**, 685 (1941).
3. WOODRUFF, L. M. *Anesthesiology*, **2**, 410 (1941) .

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Chemical Transformation of Steroids by Adrenal Perfusion VI. Allopregnane-21-ol-3,20-dione[1, 2]

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A multicycle perfusion of allopregnane-21-ol-3,17-dione (I) through isolated cow adrenals was performed a year and a half ago. In the course of working up the perfusate, difficulties in purifying the transformation products were encountered. Therefore a repetition of this perfusion was planned applying the newly developed processing techniques (*1*). Since, however, some time will elapse until this work can be started, and in view of a recent communication in which one of the transformation products of the above perfusion (allopregnanediolone) was described as a rat liver metabolite of desoxycorticosterone (*2*), it was felt that a preliminary report was advisable.

[1] This investigation was supported by a grant from G. D. Searle and Company, Chicago, Illinois.

[2] The acetoxyallopregnandione was donated by A. White, Chemical Specialties Company, Inc. Thanks are due to L. Ruzicka and H. Heusser for their generous cooperation. Infrared analyses and interpretations were kindly made by H. Rosenkrantz.

Purified I (m.p. 158–165°, $[\alpha]_D^{22} + 104.8 \pm 1.5°$ in chloroform) was readily converted by the surviving adrenals. Relatively little starting material was recovered. At least six transformation products at levels exceeding 1% were distinguished by their elutability in the silica gel chromatography. Of these, the following two have been identified.

The 11β-hydroxylated product, *allopregnane-11β, 21-diol-3,20-dione* (II), was found in relatively low concentration compared to the quantities of corticosterone formed in corresponding Δ^4-unsaturated desoxycorticosterone perfusions (*3*). Other 11-hydroxylated compounds might possibly be present, since several fractions were not identified. Hayano and Dorfman subsequently found with their beef adrenal residue preparation that I was converted to the 11β-hydroxylated derivative only approximately one half as readily as was desoxycorticosterone (*4*). The identification of compound II was completed as follows. An authentic sample of allopregnane-11β,21-diol-3,20-dione (*4*) was converted into the 21-monoacetate and found to be identical with the acetate of II (m.p. 189–192°) by mixed m.p. and infrared spectrometry. Absorption bands of a solution in carbon disulfide were found near 3460 (hydroxyl), 1751, and 1231 (acetate), 1730 (carbonyl at C.20), 1715 (carbonyl at C.3), 1087, 1054, and 1040 cm^{-1} (some fingerprint bands).

Another transformation product, obtained at a 15% level, was established as the reduced derivative *allopregnane-3α,21-diol-20-one* (III) as follows. After several crystallizations from ether, the m.p. 156–162° was attained. Admixed with compound I, a m.p. depression of 40° was observed; III showed the reducing properties of a steroid with a 20,21-ketol side chain toward silver ammonio reagent and was not precipitable with digitonin. Since the crystals appeared to be not entirely pure, the substance was converted to the acetate and yielded analytically pure leaflets with m.p. 165–166.5°, $[\alpha]_D^{27} + 98 \pm 2°$ (*c*, 0.710 in chloroform).

Analysis	$C_{25}H_{38}O_5$	Calcd.	C	71.75	H	9.15
		Found	C	71.66	H	9.21

These data suggested that this product was identical with allopregnane-3α,21-diol-20-one-diacetate (m.p. 165°, $[\alpha]_D + 92°$ in chloroform) (*5*). Ruzicka and Heusser kindly made a comparison of the acetate of compound III with their authentic material; the admixture did not produce an m.p. depression. Upon receipt of a sample of the authentic material, the identity of the substances could be substantiated by infrared spectrometry. Absorption bands of both samples in the solid state were found near 1739 and 1237 (ester groups), 1073, 1052, 1038, and 1019 cm^{-1} (some fingerprint bands). The keto group at C. 20 was only weakly resolved, visible by an inflection at 1710 cm^{-1}.

The formation of the corresponding 3β-hydroxyl derivative can for the moment not be excluded since several substances were not identified. In any case, its

presence would not exceed one-fifth the quantity of III on the basis of the weights of the two fractions with the presumable chromatographic polarity.

The formation of III, the 3α-hydroxyallo derivative, as a major transformation product of an adrenal perfusion is of particular interest, since reduced corticosteroids isolated from beef adrenal extracts have been found to have almost exclusively the 3β,allotetrahydro configuration. In fact, only the 3α,allotetrahydro derivative of 17α-hydroxycorticosterone has thus far been identified from this source (*6, 7*). Moreover, after adrenal perfusions of Δ^4-3-ketosteroids such as cortisone (*1*) only the 3β,allotetrahydro derivatives have so far been isolated. In these instances, the 3-ketoallodihydro derivatives were also found. The appearance respectively of the α- or β-epimeric saturated 3-hydroxy derivatives after adrenal perfusions of saturated and unsaturated 3-ketosteroids may suggest that these two structures undergo a sterically different course of biohydrogenation.

References

1. MEYER, A. S. *J. Biol. Chem.* (in press).
2. SCHNEIDER, J. J. *Ibid.*, **199**, 215 (1952).
3. LEVY, H., *et al. Ibid.* (in press).
4. HAYANO, M., and DORFMAN, R. I. *Ibid.*, **201**, 175 (1953).
5. PLATTNER, P. A., RUZICKA, L., and FURST, A. *Helv. Chim. Acta*, **26**, 2274 (1943).
6. REICHSTEIN, T., and SHOPPEE, C. W. *Vitamins and Hormones*, **1**, 345 (1943).
7. ZAFFARONI, A., and BURTON, R. B. *J. Biol. Chem.*, **193**, 749 (1952).

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A Remotely Controlled Pipetting Apparatus for Radioisotopes

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With increasing interest in the utilization of radioactive isotopes in biological experimentation and medical therapy, means for processing isotopes by remote control are essential to prevent exposure of operating personnel.

The two foremost health hazards that are involved in working with radioisotopes are danger from excessive radiation and the possibility of radiation from within the body as a result of ingesting radioisotopes. Under these conditions a remote control pipetting apparatus for handling "hot" solutions becomes a necessary item of equipment for most radioisotope laboratories. Although descriptions of some remote control pipetting devices have appeared in the literature and several are available commercially (*1–4*), the apparatus described here permits pipetting at a considerable distance from the operator without entailing a similarly long air column in series with the pipet, thereby minimizing the tendency for the meniscus to overshoot. Furthermore, this apparatus may be utilized not only with simple "distance shielding" but will also allow the operation to take place within a totally shielded enclosure for work at higher levels.

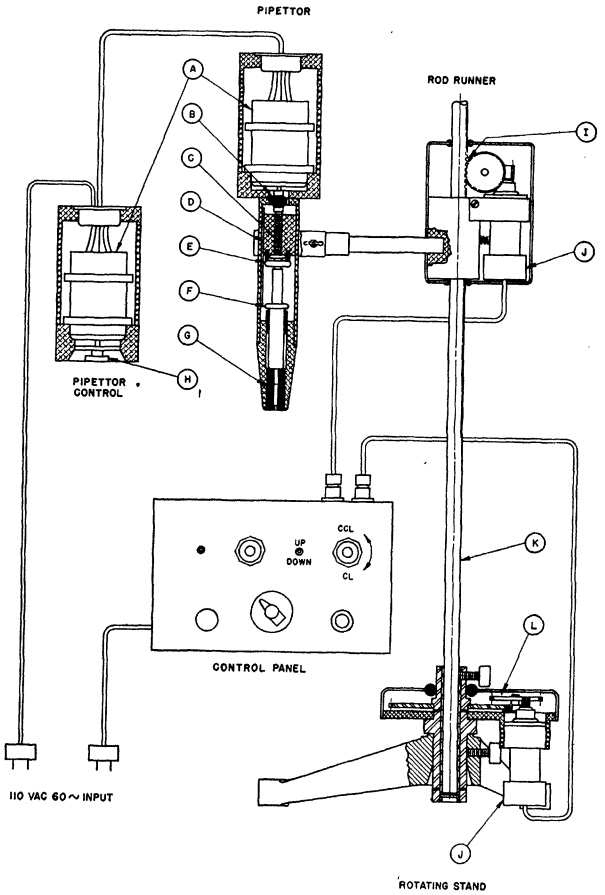

FIG. 1. A, synchro motors; B, flexible coupling; C, ¼—40 lead screw; D, keyed nut; E, self-aligning spring connection; F, hypodermic syringe; G, rubber grommet; H, control knob; I, rack drive; J, gear motors; K, framing rod; and L, gear reduction.

The pipetting device shown schematically in Fig. 1 makes use of three "building-block" appliances: a rotating ringstand, a rod runner, and the pipettor itself. These items are not available commercially but can be duplicated and combined to permit a variety of motions.

The rotating ringstand is a tube mounted in bearings on a tripod base, driven in rotation by a small dc gearmotor at speeds of from 0 to 3 rpm. The inside diameter of the tube was made ½ in. to permit the use of the common size laboratory rod. The control box contains a variable transformer and rectifiers to provide variable voltage dc power.

The rod runner (*5*), which is controlled from the same panel, contains a similar dc motor. A worm on the motor shaft engages a worm gear which is spring-loaded into a tapered groove in the rod to develop the necessary frictional driving force.

The pipettor is designed to accommodate glass hy-