liquid, which sets up vibrations in the surface, and as a result the ring detaches at a pull less than the maximum.

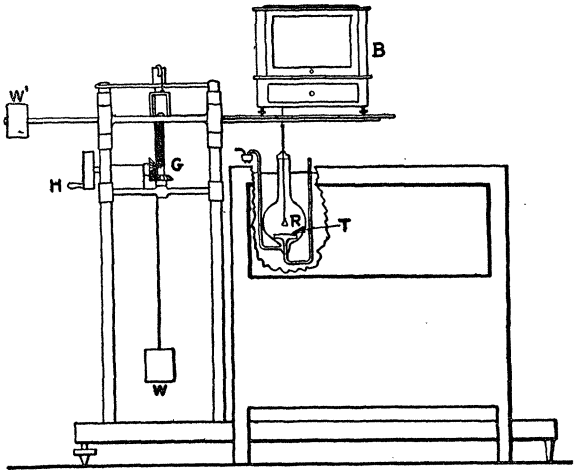

FIG. 4. Apparatus for Determining Surface Tension by the Ring Method.

For accurate work it is important that the ring be kept level. Fig. 5 illustrates the error due to tipping

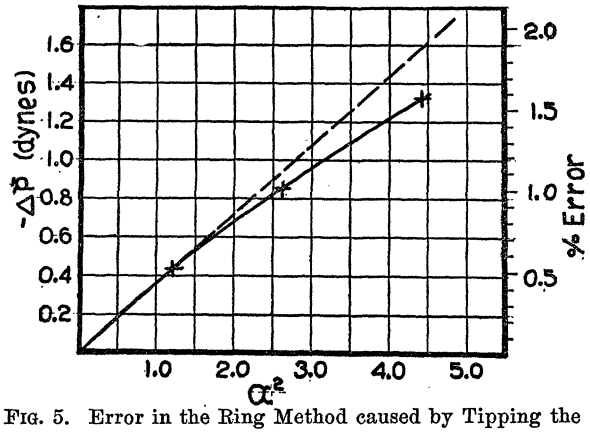

FIG. 5. Error in the Ring Method caused by Tipping the Ring. α^2 is the square of the angle of deviation from the horizontal.

the ring. Here α^2 is the square of the angle of deviation from the horizontal. With an angle of 1 degree the error is approximately half a per cent. This is in marked contrast with the drop weight method for which an angle of 1 degree has no measurable effect, and even an angle of 5 degrees produces an error of only 0.04 per cent.

It should be kept in mind that while the drop weight method is independent of the angle of contact between the liquid and the solid of the tip, provided proper tips are used, the ring method is highly dependent on the angle, and should be used only when it is zero.

The four most widely used methods for the determination of surface tension are: (1) capillary height, (2) drop weight, (3) ring and (4) bubble pressure. Of these the capillary height and drop weight methods are the most accurate, and the bubble pressure method is the least accurate. With pure liquids the methods are accurate under the best condition to the following extent: capillary height, $\pm$ 0.05 per cent.; drop weight, $\pm$0.1 per cent.; ring, $\pm$ 0.25 per cent., and bubble pressure, $\pm$ 1.5 per cent. However, with certain solutions, especially biological liquids, the drop weight method is much more accurate than the determination of the capillary height.

The large error of the bubble pressure method is due to the fact that those who use it most do not determine the maximum pressure, which the theory demands, but only a mean pressure, which is related in an unknown way to the surface tension. Dr. T. F. Young is now engaged in a critical study of the method, and it seems probable that its accuracy will be greatly increased.

Of the four methods only that of the capillary height has been an absolute method. However, Drs. B. B. and H. Z. Freud have recently published a communication[8] in which they present a satisfactory theory, which gives the same results as our experiments. Thus the ring procedure becomes an absolute method for the determination of surface tension. The determination of the bubble pressure would give a third absolute method if the procedure were carried out in a way demanded by the theory, but, unfortunately, most of those who use it do not meet the conditions of the theory.

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THE REVIVAL OF COMATOSE ADRENALECTOMIZED CATS WITH AN EXTRACT OF THE SUPRARENAL CORTEX

IN previous brief reports published in this journal[1] the writers described the preparation of an active extract of the suprarenal cortex of beef and its effect upon the life-span of bilaterally adrenalectomized cats. It was demonstrated that extract-treated animals survive in normal health indefinitely and when the extract treatment is discontinued death from adrenal insufficiency results within a short time. To date we have not had an adrenalectomized animal present any symptoms of adrenal insufficiency while receiving treatment. At the end of one hundred days of treatment (an arbitrarily selected period, after which the extract is discontinued) the animals can not be distinguished from normal cats. Mention was also made in the earlier publications of the fact that non-treated adrenalectomized cats showing early

[8] SCIENCE, 71: 345, 1930.
[1] SCIENCE, 71: 321, and 71: 489, 1930.

symptoms of adrenal insufficiency could be returned to normal by administering extract.

Recently we have completed a series of experiments in which the extract was tested on comatose animals prostrate and on the verge of death from adrenal insufficiency. The extract employed is a modification of the one previously described and is very low in adrenalin and solid content.

The cats were bilaterally adrenalectomized and allowed to develop very severe adrenal insufficiency symptoms. At the time of first injection of extract they were prostrate and unable to stand on their feet or move about, and so weak that if placed on their feet they promptly collapsed. The skin was cold and clammy and the rectal temperature down to 95°. The rectal temperature of normal or unilateral operated cats ranges from 101.4 to 102°. Adrenalectomized cats presenting the symptoms just described live but a few hours and death may occur at any moment.

By repeated injections of our purest preparations we have been able to revive such animals and return them to normal condition and to keep them in perfect health by daily injections. The body temperature, blood picture, appetite and strength return to normal.

It is a striking experience to one working with the animals to take a comatose cat with death imminent from adrenal insufficiency and by a few injections to revive it so that within seventy hours it has completely recovered and is running and playing about the laboratory apparently none the worse for its hazardous experience.

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THE HORMONE OF THE ADRENAL CORTEX

IN 1927[1] we first published a method for producing an extract of the adrenal cortex which would prolong the lives of totally adrenalectomized cats. Saturation of an acid extract with NaCl forms a precipitate which when dissolved and injected produces this effect. Heating the extract to 80° C. for five minutes destroys the active substance. The addition of ethyl alcohol to make 80 per cent. precipitates the proteins coagulable by heat and nitric acid but does not destroy the hormone.

We have long realized that the method of separating the hormone by salting out is unsatisfactory as a means of concentrating the active substance because with each precipitation so much is lost. We therefore have been working for some time with organic solvents.

The simplest method of preparing a concentrated extract of the hormone is to extract the cortex with ethyl ether. Removal of the ether by vacuum distillation is followed by extraction of the residue with 80 per cent. ethyl alcohol. The alcohol is removed *in vacuo* and the residue taken up with water to make the desired concentration.

Adrenalectomized cats treated with such an extract can be maintained in good condition for an indefinite period. Such cats allowed to go without extract until so weak that they can not sit up and appear near death have been revived by injections of this extract.

One cat had gone so far that she was lying prostrated, breathing rapidly and constantly twitching in various muscles of the body. She was expected to die before we could use remedial measures. Within an hour after injection of cortical extract the twitching ceased and the breathing became normal. Seventy minutes after injection she was sitting up. In ninety minutes she had recovered her strength and was eating.

In 1928[2] we named this hormone cortin. It is the substance essential to life found in the adrenal cortex.

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[1] F. A. Hartman, C. G. MacArthur and W. E. Hartman, *Proc. Soc. Exper. Biol. and Med.*, 25: 69, 1927.

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