equal to the original volume of defibrinated blood, was used for the inoculation of a rhesus monkey (No. 88). This animal received 3 c.c. of this suspension intravenously.

A second monkey (Rhesus 83) was given 3 c.c. of the blood-serum intracerebrally, but a considerable proportion (we estimate one-half) was lost during the inoculation.

At the same time a third monkey (No. 84) received by intracardiac injection 3 c.c. of the defibrinated blood mixed with an equal volume of defibrinated blood from a normal rhesus. This animal served as a control for another experiment that will be reported in a later paper.

All three animals gave well-marked reactions with the appearance of an exanthem.

The third bleeding (June 5), forty-five hours after the second, was at a time when the patient's temperature was 101 F. and the eruption fully out. The blood was defibrinated and two monkeys inoculated: Rhesus 89a received 3.5 c.c. and No. 89b received 4.5 c.c. intravenously.

The general level of the temperature in both these animals was unusually high from the beginning and so continued for about two weeks; in the case of No. 89a there was noted, in addition, a rise above this level suggestive of a reaction. We think, however, that the generally high level of the temperature in both animals and this additional rise in one of them is to be accounted for by a diarrhea from which both animals suffered. Improvement in the diarrhea and a lowering of the temperature seemed to go hand in hand.

The fourth bleeding (June 7), about forty-eight hours after the third, was at a time when the eruption had almost, but not quite, faded from all parts of the body and desquamation had begun. Two rhesus monkeys were inoculated with the blood after defibrination; one (No. 90a) received 4 c.c. intravenously and 0.5 c.c. subcutaneously, the other (No. 90b) received 4.5 c.c. intravenously and 2 c.c. subcutaneously. At this writing, twenty-one days after inoculation, neither animal has presented evidence of a reaction.

Summarizing the results obtained from inoculations from this patient (Case 6) we have, first, a definite febrile reaction in both of two monkeys (one a *Macacus rhesus*, the other a *Macacus cynomolgus*) inoculated with blood obtained a few hours before the first appearance of the exanthem; second, marked reactions in all of three rhesus monkeys inoculated with blood (one with defibrinated blood, one with serum, and one with washed corpuscles) obtained about eighteen to twenty hours from the very first appearance of the eruption; third, no evidence of a reaction in one and at most a very doubtful reaction in the second of two animals inoculated with blood obtained about sixty-five hours after the first appearance of the eruption; fourth, no indications of a reaction in either of two monkeys inoculated with blood obtained 113 hours after the first appearance of the eruption.

This would indicate that the blood in our Case 6 was infective for the monkey just before the appearance of the exanthem (late in the preeruptive stage), during the stage of efflorescence of the exanthem (eighteen to twenty hours after its first appearance), that it had almost, if not quite, completely lost its infectivity sixty-five hours after the first appearance of the eruption, and that it was no longer infective 113 hours after the first appearance of the eruption.

Considering now, as a whole, the results obtained from inoculations with human blood from our six cases, we believe that they consistently point to a period of infectivity of the blood beginning at least just before and continuing for about twenty-four hours after the first appearance of the exanthem. At the end of about twenty-four hours from the first appearance of the eruption the infectivity of the blood for the rhesus monkey already appears very greatly reduced, and becomes progressively less thereafter.

It will be recalled that Hektoen³ (1905) found the blood infective thirty hours after the first appearance of the rash; but it should be pointed out that he worked with a much more susceptible animal—man. So that it would not be at all surprising if the period of infectivity were somewhat longer for man than for the monkey.

The existence of a more or less definitely limited period of infectivity of the blood in measles, strongly indicated by our experiments, would explain both the negative and the positive results of monkey inoculations reported by Josias⁴ in 1898, would throw light on the reported failures of subsequent workers,⁵ and would, therefore, make understandable the opinion almost universally held heretofore that the monkey is not susceptible to measles.

A NEW SPHYGMOMANOMETER

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Feeling the need for a simple, compact, accurate, and at the same time reasonably inexpensive, blood-pressure apparatus, I devised the following:

In describing this form of blood-pressure apparatus I do not claim to have evolved any new principles, but wish to state that it is an apparatus embodying features from several forms of sphygmomanometers now in use, with certain other alterations and modifications, making a practical and simple instrument. The reservoir principle is similar to that of the Stanton, while the use of the glass in its manufacture was adapted from Dr. Kercher's instrument. The pneumatic cuff is essentially that of Dr. Janeway. The use of the sliding scale and the box lid to support the instrument were also derived from the same source.

This instrument consists, as can readily be seen from the illustration, of a long glass tube of small bore continuous through a short U-shaped bend, with a large cylindrical glass reservoir partly filled with mercury, and into the upper end of which projects a short piece of glass tubing fused into it. To the upper end of this tube there is a short heavy rubber tube, attached in turn to a metal piece from which project, first, a metal stop-cock, second, a plain corrugated tube, and third, a projection carrying a needle-valve. Parallel to the long glass tube is a movable 300 mm. scale. To the upper end of the long glass tube is a steel stop-cock securely fastened to the glass. The glass portion is held in place by clamps and is easily removed. The metal parts are firmly secured to the lid, which, when opened, is held in an upright position. To the metal stop-cock *D* is

3. Hektoen, Ludvig: Experimental Measles, Jour. Infect. Dis., 1905, II, 238.

4. Josias, Albert: Recherches expérimentales sur la transmissibilité de la rougeole aux animaux, Méd. moderne, 1898, IX, 153.

5. Grunbaum, A. S.: Some Experiments on Enterica, Scarlet Fever and Measles in the Chimpanzee; a Preliminary Communication, Brit. Med. Jour., April 9, 1904, p. 817. Jordan, Edwin O.: A Text-Book of General Bacteriology, second edition, 1911. Measles, p. 564.

attached a rubber tube, along the course of which is a metal valve, and at the end is attached a metal pump. To the corrugated metal connection *C* is attached a long rubber tube which runs out to a pneumatic cuff. This cuff is 12 cm. wide and quite rigid, being made of stiff leather on the outside, and adjustable by means of straps. A narrower cuff will give too high readings in normal cases, and too low where the arm is large.

The operation of the instrument is very simple; all that is necessary is to turn the steel stop-cock on the end of the glass tube, push the pneumatic cuff on the patient's arm, and start to pump the air into the apparatus. The metal valve in the tube will sustain the pressure, but as a precaution, should it leak a little there is a metal stop-cock *D*, which can be shut off when the air-pressure is sufficient to obliterate the patient's pulse. Now the metal stop-cock *D* having been shut, the needle-valve *B* should be unscrewed slightly, and, the air-pressure being lowered, the mercury column in the long tube will be seen to fall slowly and evenly, the rate being regulated by the amount the needle-valve is unscrewed. The systolic pressure is then read on the mercury scale, when the patient's pulse first becomes palpable; or, if the auscultation method be employed, listening with ordinary binaural stethoscope over the ulnar or radial arteries just below the bend of the elbow, one will hear a loud, clear thump when the first cardiac beat comes through.

One reads the number of millimeters in the mercury column and gets the systolic pressure, which will be about 10 mm. higher than if palpated by the pulse at the wrist. In obtaining the diastolic pressure the mercury should be allowed to keep on falling, the physician observing the lowest greatest fluctuation, or, if the auscultation method is employed, continuing to listen over the artery until no sound are heard, and reading the mercury column at this point.

This explains in a few words the instrument and its operation, but there are some points about this apparatus in distinction to others which do not appear on the surface, and which are of great importance in the use and value of such an instrument.

Great care must be exercised in the selection of material with which the mercury comes in contact, as with most of the metals, as brass, in fact, all of the metals except platinum and steel, mercury will form a salt, thus in time creating a coating on the glass parts and greatly adding friction, eliminating the accuracy of the readings. So also in the case of soft rubber; mercury coming in contact with the sulphur used in its manufacture forms a black coating of sulphid of mercury.

Steel can be utilized, as indeed was done in the case of the Stanton instrument, but this means a heavy, cumbersome, and at the same time an expensive instrument, as steel is a difficult metal to work. Of course, platinum is too expensive for practical use. Now in the instrument I have described, this difficulty is obviated by having the mercury entirely contained in glass, so that it cannot touch any of the metal parts, save the steel stop-cock, which is non-corrosive, or the soft rubber connection, as the glass projection in the reservoir acts in preventing the back flow of mercury. Another thing of great value is the use of a metal pump and metal valve, thus doing away with all rubber bulbs, or, what is practically the same, ribbed expansive rubber tubing, for both are a constant source of repair and renewal, due to blowouts and accidents, particularly exasperating if they should happen in a patient's house

while taking a blood-pressure, as I have had occur when using bulb apparatus.

In addition, this apparatus has been made with a special view to compactness, being so proportioned that the instrument complete, inside of its wooden case, will fit in the ordinary 15-inch doctor's bag, and has the corners rounded to admit of its not injuring or catching the bag in which it is carried.

It is absolutely simple, being ready to use by raising the lid and turning one stop-cock.

There are no separate parts, screws or nuts to lose, no mercury to pour.

As the box is so arranged that it cannot be closed until the steel stop-cock on the end of the tube is shut, there can never be any loss of mercury. The entire glass portion is removable and capable of being cleaned. It is very accurate, using the full 300 mm. scale, whereas all U-tube instruments have to use a scale condensed one-half to allow for the depression of one column while

A new sphygmomanometer. *A*, steel stop-cock; *B*, needle-valve air-release; *C*, metal connection to cuff; *D*, stop-cock for tube to pump; *E*, rubber connection to mercury reservoir; *F*, glass reservoir; *G*, metal air pump; *H*, tube to pump; *I*, tube to cuff; *J*, pneumatic cuff; *K*, 300 mm. sliding scale.

the other is rising, and hence the graduations are only one-half as fine.

The dial instruments have even more condensed scales than the U-shaped instruments, and are open to the same objection.

Having an adjustable zero point one is always sure of accurate readings, whereas if a dial instrument (which, by the way, has to be standardized with a mercurial instrument) is not correct there is no way to determine its error, for one would have to test it with a mercurial instrument before finding it out. Their great advantage is compactness, but when one uses a wide rigid cuff, such as Von Recklinghausen proved to be the only accurate variety, the advantage of compactness is largely gone.

Then, too, having a large reservoir on one side and a small bore tube on the other the diastolic fluctuations in this form of apparatus, like the Stanton, are wide and easy to read, which result is not obtainable on any U-shaped tube.

Having a needle-valve release it has perfectly even and regular control of the air-pressure.

This instrument, being securely fixed in a wooden case, is not nearly so liable to injury as the delicate dial instruments; the glass portion not being cemented to the instrument is easily renewable should it become broken from undue violence.

Lastly, it is a simpler apparatus than most and can be manufactured at a more reasonable price.

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