my reflector can be readily acquired with a little practice, and I am confident that it will be found of much utility in many cases. It is very serviceable for class demonstration.

ON THE USE OF SALICYL-SULPHONIC ACID AS A TEST FOR ALBUMOSES AND PEPTONES (SALIPHONIC TEST).

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IN a former paper in the *BRITISH MEDICAL JOURNAL* of April 18th, 1891, I described the results which I had obtained by the use of salicyl-sulphonic acid as a test for proteids, dealing particularly with the extreme delicacy, reliability, and simplicity of the test as applied to albumin and globulin, and pointing out its value as affording a ready means of discriminating between (A) the proteids coagulable by heat (albumin, globulin, etc.) or precipitated by neutralisation (acid-albumin and alkali-albumin) on the one hand, and (B) albumoses and peptones on the other. I showed that with the former class of proteids (A) the precipitate formed by the addition of salicyl-sulphonic acid is not redissolved by heating, but, on the other hand, becomes coagulated; while with the second class of proteids (B) the precipitate readily redissolves on heating, to reappear when the fluid cools.

Roch had previously (unknown to me) suggested the application of salicyl-sulphonic acid as a test for albumin. He was unaware that it also precipitates globulins (for example, myosin, serum globulin, etc.), albumoses, etc., and is really a test for proteids, not simply for albumin. His method consisted in the addition of a little of the acid to a portion of the fluid to be examined; the occurrence of a precipitate was taken as indicating the presence of albumin. This was defective, inasmuch as my experiments have shown that the precipitate so formed may be any member of the proteid series, and the subsequent employment of heat is an essential proceeding.

Moreover, the delicacy of Roch's results with albumin itself was greatly lower than what my experiments yielded, and not so high indeed as that afforded by several of the well-known tests already in use. The different results as regards the delicacy of the test for albumin arrived at by Roch and myself probably depend—in part, at least—upon the difference in the methods which we followed. Roch used a comparatively dilute solution or crystals of the acid. I employed a saturated watery solution of the reagent and a smaller amount of the fluid to be tested, and found such a mode of procedure to be much more effective and precise.

My further investigation of the subject has been devoted largely to the uses of salicyl-sulphonic acid in regard to albumoses and peptones.

Albumose.—Primary albumoses are precipitated by the reagent, and heat causes a disappearance of the precipitate, to reappear when the fluid cools. This is a characteristic albumose reaction, and it forms a ready and effective test for the substance. The precipitate is not dissolved by dilution with water and is not soluble in excess of the reagent. This test I have found to be more delicate than the biuret reaction (pink colour with CuSO_4 and KHO), while at the same time the biuret test is not distinctive of albumose, but common to it and peptone. Salicyl-sulphonic acid also constitutes an excellent test for deuto-albumose (secondary albumose) if the fluid to be examined is first mixed with two or three times its bulk of a saturated solution of ammonium sulphate. It is only in presence of such a salt that deuto-albumose is precipitated by the reagent.

Peptone.—Peptone (both peptic and pancreatic) is readily precipitated, as I have already described, by salicyl-sulphonic acid in saturated ammonium sulphate solutions. The precipitate clears up on heating and reappears on cooling. (There can be no confusing this with an albumose precipitate, for, as is well known, albumoses cannot exist in a saturated ammonium sulphate solution, all the albumoses being insoluble in saturated solutions of that salt.) The peptone precipitate is immediately redissolved by the addition of a little water or nitric acid, for as soon as the solution is diluted and the

saturation with ammonium sulphate rendered incomplete, the precipitate dissolves. The presence of any considerable amount of glycerine prevents the appearance of this precipitate.

Again, the precipitate is readily redissolved by adding a further amount of salicyl-sulphonic acid, in marked distinction from the precipitates of the other proteids, which are not soluble in excess of the reagent. It is advisable, then, when testing for peptone in ammonium sulphate solutions to take a very small amount of salicyl-sulphonic acid, and gradually pour in a considerable quantity of the fluid to be examined. This constitutes an easy and accurate test for peptone in saturated ammonium sulphate solutions, a more delicate test than is afforded by the biuret reaction. It is to be noted that the peptone precipitate, like other proteid precipitates formed by salicyl-sulphonic acid, presents the appearance of a uniform opalescence or turbidity throughout the fluid, when the reagent is well mixed with it. Scattered crystalline flakes floating in a clear fluid may appear in strong solutions of ammonium sulphate and other salts, apart from the presence of proteids, but this cannot lead to any error, as it does not in the least resemble the general turbidity at once present with the occurrence of a proteid precipitate.

Further, in addition to showing the presence of peptone in the way described, salicyl-sulphonic acid may be used to separate peptone from the ammonium sulphate solution. The peptone is precipitated, filtered off, washed with a dilute solution of the reagent, and redissolved in a weak solution of an alkali; it is thus virtually freed from ammonium sulphate, and readily gives the biuret and other tests uncomplicated by the presence of saturated ammonium salt.

The fact that peptone is not precipitated by salicyl-sulphonic acid, except when the solution is saturated with ammonium sulphate, is a fact of much importance. For, while fluids saturated with ammonium sulphate (or sodio-magnesian sulphate) can only contain one proteid (peptone), fluids not so saturated may, in addition to other proteids, contain two (peptone and albumose), the reactions of which are for the most part identical, especially peptone and deuto-albumose, both giving the biuret action and many others in common. They are, indeed, at present distinguished from one another only by the fact that the one (albumose) is precipitated by ammonium sulphate, while the other (peptone) is not; this involves the comparatively slow process of saturation with ammonium sulphate. But by means of the saliphonic test it is easy to determine quickly which is present; for albumose gives a precipitate, at least when two-thirds saturated with ammonium sulphate, while peptone does not.

To conclude, salicyl-sulphonic acid serves as an extremely precise, reliable, and quick test for all proteids. And in addition to detecting the presence of proteid matter, the reagent enables one to assign the proteid present to one or other of three classes:

A. *Heat-coagulable proteids (albumin, globulin, myosin, etc.) and derived albumins (acid-albumin and alkali-albumin).* Precipitate does not dissolve on heating, but becomes coagulated.

B. *Albumoses.* Precipitate redissolves on heating, and reappears on cooling. To precipitate deuto-albumose effectively the fluid should first be mixed with twice its bulk of saturated ammonium sulphate solution.

C. *Peptones.* No precipitate, except in solutions already saturated with ammonium sulphate. If other tests (biuret, etc.) show presence of proteid, and no precipitate is given by salicyl-sulphonic acid, the proteid present must be peptone. A precipitate in ammonium sulphate solutions indicates the presence of peptone; it is readily redissolved on the addition of a little water or glycerine.

NOTES OF A CASE OF ACCIDENTAL COW-POX.¹

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As accidental, or, as Ceely calls it, casual cow-pox, is not common, and as with the spread of vaccination and revaccination, more and more perfectly performed—protective not

¹ Read at a meeting of the Midland Branch of the British Medical Association at Gainsborough, Lincolnshire.

only against small-pox but against cow-pox itself—this complaint will become rarer still, the following case may be of some interest.

My patient is the wife of a small farmer living in a village a few miles from Lincoln, and her history of the outbreak among the animals is as follows. They keep two cows, and some four weeks before my first visit one cow started with pimples on the teats and udder; these formed blisters, which burst while milking was proceeding. The teats became swollen and very tender; then scabs, dark red or almost black, appeared on the sores, and when these fell off scars were evident for some time. The second cow was attacked about a week after the first. I saw both the infected cows at my first visit, that is, about four weeks and a-half after the beginning of their illness. Then the teats of one cow had five or six oval scabs or crusts, in size between that of a sixpence and a shilling, very hard and reddish-brown in colour. The teats were then about their natural size but were still very tender. When one of these crusts was removed the sore beneath was rather deep and conical, and rapidly filled with sero-purulent fluid. The sores on the second cow's teats had much the same appearance, though in one or two places there was more of a vesicular aspect, with a firm, raised, and hard edge. The second plate of Ceely's, reproduced in Dr. Crookshank's first volume on *Vaccination*,² represents almost exactly the appearance I saw save for the blackened end of the teat. My patient told me that the cows, particularly in spring and fall, had this complaint, but I suspect it was only the blister-pock—a comparatively common and trivial matter—for I understand

that cow-pox usually recurs at some distance of time in the same herd, and is certainly far from being so common as she would seem to imply. Their milk, she added, was much lessened in quantity and very poor in quality, so that, especially as it was contaminated with pus lymph and blood from the sores in milking, it was all thrown away. As far as I could learn, there was no small-pox in or around the village, nor had there been any for several years. The history of the patient's illness is shortly as follows:—

She had been milking the cows for three or four days, as her husband was very busy, and on April 3rd, 1890, as she was bringing some firewood, she scratched or pricked rather deeply the second finger of her left hand. On Sunday, April 6th, she noticed at the place of the thorn-prick a small hard and painful pimple. Next day, April 7th, the finger began to swell and the pimple enlarged. On Tuesday, April 8th, she was rather feverish and had one or two slight rigors. The place became more and more painful. I first saw her on Wednesday, April 9th. The wound was then about the size of a silver penny-piece, raised and very firm, whitish in colour, with a vivid blush all round, and extending up the finger nearly to the hand, which was swollen. As she then thought there might be a portion of the thorn embedded in the place, and before I had heard any of the history of the cows, I incised the part; but no pus came away, only some blood and serum. It was exceedingly tough to cut into. On April 10th it was forming more into a large vesicle. The forearm was swollen, with reddened lines of lymphatics running up to the gland at the bend of the elbow, which was enlarged and tender. Her temperature was 103.6° F., her tongue was coated, and she had severe headache and nausea.

On April 11th her arm had commenced to swell; it was tender, very red, and full of tingling, and the axillary glands were large and painful. Her temperature was 104.2°, pulse 110. All this pain and swelling of her arm she was inclined to attribute to her having eaten some pork recently, as whenever she did so she almost invariably suffered from severe outbreaks of urticaria of an erysipelatoid character; and probably this tendency of hers did give more prominence to the cutaneous affection which originally was due to the vaccination. On April 12th she was decidedly better, her temperature being 102°, her pulse 96. The swelling of her arm had gone down, the glands much smaller, and the hand was not so swollen. The inoculation place had now exactly the appearance of a five-days' old vaccination mark.

On April 13th she was much better all round. On the 14th her arm was very nearly of its natural size; the forearm also had lost its pain and tenderness; the inoculation was about as large as a fourpenny-piece, still very firm, especially at the edges, which were raised, while there was a slight depression in the middle. Her temperature was 99.4°, her pulse 86. The appearance of the place is fairly accurately represented in the accompanying rough sketch. The constitutional symptoms soon disappeared, and by the end of the week the characteristic "tamarind-stone" crust had formed on the wound.

About three months afterwards the scar was very evident, looking in every respect like an ordinary vaccination mark. A week ago—that is nearly twenty months after the inoculation—the scar had faded considerably, and was very nearly the same colour as the surrounding skin. One particularly interesting point about my patient must not be forgotten: she had not been vaccinated since her infancy—she is now about 35—and I could discover no mark whatever of that vaccination.

It has been stated by Dr. Crookshank, following Dr. Creighton,³ that "cow-pox is strictly analogous to syphilis." The analogy ought to be indeed close and on all-fours to provoke a statement like this, which, as the author must know perfectly well, will prejudice people enormously against vaccination. The analogy may be accepted when it is proved that either in the cow or in man cow-pox is followed by anything akin to gummata, by anything like the nerve lesions, or like the tertiary symptoms of syphilis, or by an hereditary tendency to disease in any way resembling that due to hereditary syphilis. I do not deny that from a syphilitic child syphilis *plus* vaccine may be taken and inoculated on another, though probably the risk is minimised by being careful to take no blood from the syphilitic child; but to consider syphilis and cow-pox closely analogous on the likeness of the initial sores is as scientific as Fluellen's comparison of Macedonia and Monmouth, because there is a river in both.

Again, Dr. Crookshank says of Badcock's vaccination by lymph taken from cows inoculated with variolous matter, that it was not vaccination but "variolaion," and triumphantly refers to several experimenters who have produced attacks of small-pox by similar methods. These latter may, of course, have been caused by the variolous matter lying dormant, so to speak, where it was inoculated, and then becoming potent when it was transferred back to humanity, directly or indirectly. But Dr. Crookshank explains Badcock's successful experiments—which were very numerous and not attended by any small-pox epidemic—by the theory that "a strain of benign variolous lymph can be cultivated by judicious selection (where is the proof that Badcock did any 'judicious selection?') and completely deprived of any 'infectious properties.'"⁴ To which the answer seems fairly obvious. Small-pox is either small-pox or it is not small-pox; and small-pox, in Dr. Crookshank's own words, "is highly infectious." Then we may fairly ask this master of analogies where he will find any similar disease wherein the mild attacks are the least infectious? Take scarlet fever or diphtheria, and in both we know that the mildest possible attack may be powerfully infectious.

One word more. "Inoculation of cow-pox does not have the least effect in affording immunity from the analogous disease in man (syphilis), and neither do cow-pox, horse-pox, sheep-pox, cattle plague, or any other radically dissimilar disease exercise any specific protective against human small-pox."⁵ Notice has been taken above of the supposed analogy in the first part of the sentence, and one may add that few beyond Drs. Creighton and Crookshank would ever have fancied cow-pox could protect against syphilis. The whole sentence occurs near the end of Dr. Crookshank's first volume, and it will appear hardly credible that, in a work almost boasting that modern science is enshrined in its pages, in support of this dogma he does not vouchsafe a particle of evidence referring to modern times, nor does he give a single figure of modern statistics.

³ *Op. cit.*, vol. i, p. 460.

⁴ *Op. cit.*, vol. i, p. 306.

⁵ *Op. cit.*, vol. i, p. 464.

² *History and Pathology of Vaccination*, E. M. Crookshank, vol. i, plate ix, Figs. 1 and 2.