appeared, and the liver could not be felt below the ribs. At this stage a slight convergent strabismus was noticed for two days. Its ominous significance was not at once apparent; a day later, however, a hydrocephalic cry announced the presence of tuberculous meningitis. This was followed by convulsions, which lasted with intermissions till death took place thirty hours later, and six days after the abscess had been opened.

Though the ending to this case was disappointing, seeing that incising the abscess had afforded such marked relief, nevertheless, on account of the early age of the patient, I think it one worth recording.

NOTE ON A NEW METHOD OF PRODUCING HAEMOLYSINS.

BY

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By experiment we have found that if urine of a healthy man be injected two or three times subcutaneously into a rabbit, the serum of this rabbit acquires a marked haemolytic action on human red blood corpuscles.

When such serum is added to human red blood corpuscles, haemolysis occurs very rapidly. The following experiments illustrate our meaning.

First Tube contains ... { 15 drops of rabbit's serum. (This rabbit had received 3 injections of human urine.)
2 drops of washed human red corpuscles.
Result.—Haemolysis beginning after three minutes; complete in five minutes.

Second Tube contains... { 5 drops of the same serum.
10 drops of salt solution at 7 per cent.
2 drops of washed human red corpuscles.
Result.—Complete haemolysis in eight minutes.

Third Tube contains ... { 1 drop of same serum.
14 drops of salt solution at 7 per cent.
2 drops of washed human red corpuscles.
Result.—Complete haemolysis in twenty-six minutes.

Fourth Tube contains... { 5 drops of a 10 per cent. solution of same serum in normal salt solution (7 per cent.)
10 drops of 7 per cent. salt solution.
2 drops of washed human red blood corpuscles.
Result.—Complete haemolysis in forty-six minutes.

Fifth Tube contains..... { 2 drops of the same solution of serum as in the preceding experiment.
13 drops of 7 per cent. salt solution.
2 drops of washed human red blood corpuscles.
Result.—Complete haemolysis after fifteen hours.

Sixth Tube contains..... { 1 drop of the same solution of serum as in the preceding experiment.
14 drops of 7 per cent. salt solution.
2 drops of washed human red blood corpuscles.
Result.—Complete haemolysis after fifteen hours.

Seventh Tube contains { 1 drop of a 5 per cent. solution of serum prepared as before.
14 drops of 7 per cent. salt solution.
2 drops of washed human red blood corpuscles.
Result.—No haemolysis after fifteen hours.

A 0.66 per cent. solution of this serum, therefore, still possesses a fairly marked haemolytic action.

The serum heated to 56° C. during half an hour retains its haemolytic properties, though the appearance of this phenomenon is somewhat delayed.

The action of heat (56° C.) must be allowed to continue for five hours and a-half in order to completely destroy the haemolytic properties of some serums. If when the haemolytic properties have disappeared some serum of a normal animal be added, the serum regains haemolytic properties, though its action is still somewhat delayed.

First Tube contains ... { 15 drops of rabbit's serum (the same as in the preceding experiments) heated (56° C.) during two hours.
2 drops of washed (twice) human red blood corpuscles.
Result.—Haemolysis complete after forty minutes.

Second Tube contains ... { 15 drops of same rabbit's serum heated (56° C.) during three hours.
2 drops of washed human red blood corpuscles.
Result.—Haemolysis complete after fifteen hours.

Third Tube contains ... { 15 drops of same rabbit's serum heated (56° C.) during five and a-half hours.
2 drops of washed human red blood corpuscles.
Result.—Haemolysis absent after fifteen hours.

Fourth Tube contains... { 15 drops of same rabbit's serum as in the preceding experiment.
2 drops of washed human red blood corpuscles.
10 drops of serum of normal guinea-pig. (This serum alone having no effect on human red blood corpuscles.)
Result.—Haemolysis complete after eighteen minutes.

Fifth Tube contains ... { 15 drops of same rabbit's serum as in the preceding experiment.
2 drops of washed human red blood corpuscles.
5 drops of serum of normal guinea-pig.
Result.—Complete haemolysis after twenty-five minutes.

Sixth Tube contains ... { 15 drops of same rabbit's serum as in the preceding experiment.
2 drops of washed human red blood corpuscles.
2 drops of serum of normal guinea-pig.
Result.—Complete haemolysis after fifteen hours.

Seventh Tube contains { 15 drops of same rabbit's serum as in the preceding experiment.
2 drops of human red blood corpuscles.
1 drop of serum of normal guinea-pig.
Result.—Haemolysis absent after fifteen hours.

The serum of a normal animal, therefore, does not replace completely the substance lost by heating, which was contained in the serum of the animal previously injected with urine. In another experiment with the serum of another normal guinea-pig the haemolytic properties were regained to a more marked extent, but nevertheless the delay still existed. The same result was obtained with the serum of normal rabbits.

It must be noted, also, that the serum of certain rabbits injected with urine does not show all these properties to so marked a degree, even when scrupulous care had been taken that the conditions of the experiment were exactly the same. Thus, one kind of serum after being kept for twenty-two days in the ice-box retained its haemolytic properties almost completely, whereas another after twelve days' keeping was but slightly haemolytic without the addition of serum of a normal animal. The second serum lost its haemolytic power after being heated to 56° C. for 1½ hour, whereas the first lost the same property only after 5½ hours' heating.

The serum produced by the injection of human urine is not altogether specific for human red blood corpuscles. It has, for instance, some action on the red blood corpuscles of guinea-pigs also, although the intensity of this action again varies greatly, as the following experiments show:

SERUM OF RABBIT A (PREVIOUSLY INJECTED WITH HUMAN URINE). SERUM OF RABBIT B (PREVIOUSLY INJECTED WITH HUMAN URINE).

Experiment 1.
Tube contains 15 drops of serum, 3 drops of red blood corpuscles (washed twice) of normal guinea-pig.
Result.—Haemolysis complete in eight minutes.

Experiment 2.
Tube contains 1 drop of serum diluted in 14 drops of physiological salt solution and 3 drops of red blood corpuscles (washed twice) of normal guinea-pig.
Result.—Haemolysis complete in one hour.

Experiment 3.
Tube contains 5 drops of a 10 per cent. solution of serum in physiological salt solution, 10 drops of physiological salt solution, and 3 drops of red blood corpuscles of guinea-pig.
Result.—Haemolysis in fifteen hours.

Experiment 4.
Tube contains 2 drops of a 10 per cent. solution of serum in physiological salt solution, 13 drops of physiological salt solution, and 3 drops of red blood corpuscles of guinea-pig.
Result.—Slightly haemolysis in fifteen hours.

Experiment 5.
Tube contains 1 drop of a 10 per cent. solution of serum in physiological salt solution, 14 drops of physiological salt solution, and 3 drops of red blood corpuscles of guinea-pig.
Result.—No haemolysis in fifteen hours.

Whereas a 1.3 per cent. solution of serum No. 1 therefore has still some slight haemolytic action on the red blood corpuscles of a guinea-pig, a 3.3 per cent. solution of serum No. 2 has no haemolytic action.

The specificity of these serums is not absolute, and becomes more evident the more they are diluted and the longer they

are kept. Thus a 0.66 per cent. solution of serum No. 1 had a strong haemolytic action on human red blood corpuscles, whereas a 1.3 per cent. solution of the same serum had but a slight haemolytic action on the red blood corpuscles of guinea-pigs.

Serum No. 2 is still more specific, for whereas a 1 per cent. solution dissolved human blood corpuscles, a 3.3 per cent. solution had no such action on the red blood corpuscles of guinea pigs.

Similarly, the 3.3 per cent. solution of serum No. 1, kept for eighteen days, no longer dissolved the red corpuscles of guinea-pigs, though a 0.66 per cent. solution of the same serum still dissolved those of man. Serum No. 2, kept for twenty days, even when not diluted, and when fresh guinea-pig's serum had been added, no longer dissolved the red blood corpuscles of guinea-pigs, though a 1.3 per cent. solution still dissolved human red blood corpuscles, provided fresh serum from a normal animal were added.

The fact that such serum is not entirely specific is not astonishing, when one reflects that one is dealing with a liquid as complex as urine, for among the "haemolysogenous" substances contained in urine there must be several substances common to many kinds of animals.

Schattenfroth (*Centralblatt f. allgemeine Pathologie*, vol. xiii, No. 14, August, 1902) also injected animals with urine and found that the serum had strong agglutinating and haemolytic but no precipitating properties.

BOTTLE-FINISHERS' CATARACT.

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HARD cataract is very common in bottle-finishers. My experience as surgeon to the Sunderland and Durham County Eye Infirmary during the last seven and a-half years has impressed upon me this fact.

How much commoner it is in them than amongst the rest of the community is shown by the fact that 18 out of 75 (1 in 4) hard cataracts operated upon last year in our Eye Infirmary were in bottle-finishers, there being only 200 or 300 bottle finishers in a population of nearly a million and a quarter in this county.

Amongst bottle-makers the "bottle-finisher" is the man who is almost always the victim of the disease, but occasionally the "founder" suffers.

The Nature of a Bottle-finisher's Work.

The following particulars were learnt from visiting some bottle works in this neighbourhood, where 3-gill black wine bottles were being made. The mixed materials (sand, lime, clay, marl, etc.) are thrown by the "founder" into the large furnace ("tank"), which is kept at a white heat by the burning of currents of coal gas and air directed on to the surface of the metal. The "founder" has to push with a long iron rake the materials away from the mouth of the furnace into which he has thrown them, and consequently he has to look occasionally into the intense light and heat. He is provided with a piece of framed dark-blue glass, through which he can look into the furnace, but this he rarely uses, and consequently some founders get cataract. The "founder" may work six or seven shifts a week of twelve hours each. At the opposite end of the furnace are several openings, at which the different bottle-makers work in squads of five men each.

A lad generally begins as a bottle-maker as a "taker in," whose duty it is to carry the finished bottle from the bottle-finisher to the annealing chamber. He is afterwards promoted to be a "putter-up" or "wetter-off," whose work is to put up to be heated the iron pipe, 6 ft. in length, on which the bottles are blown, into the furnace, and knock off the remains of the bottle that has just been made.

He is next promoted while still an apprentice to be a "gatherer," whose duty it is to dip the iron pipe into the sea of molten metal and take up just sufficient liquid glass to make a bottle. During this part of the work he necessarily looks into the furnace; but he is young and his eyes do not suffer, though the skin of his face is often inflamed and blistered by the heat, especially the left cheek. With his back to the furnace he next rolls the glass on a stone and roughly forms the neck and shoulder of the bottle. He then hands the pipe to the bottle-blower, who shapes the body of the bottle on another stone, then places it in a mould and blows down the pipe into it to form a bottle. During this

process the cheeks of some (not all) of the bottle-blowers balloon out enormously. About two out of every three apprentices become expert enough to be promoted from being "gatherers" to be "bottle-blowers," and they are about the age of 21 at the time of promotion. A "gatherer" sometimes becomes a "founder." The glass-blower hands the blown bottle, still on the iron pipe, to the bottle-finisher, who takes hold of it with a "cage or sticker punty": the bottle is then cut from the pipe. The glass-blower does not look into the glass furnace and his eyes do not become cataractous.

The bottle-finisher, holding the bottle on the "punty" in his left hand, with an iron rod in his right looks directly with both eyes into the sea of molten glass, and takes just sufficient to form the rim on the neck of the bottle. Having done this he turns away from the furnace and sits under the shelter of a brick shade, in order to put the rim on the bottle. His left cheek is now towards the hot wall of the furnace, and it is therefore generally more inflamed than the right cheek by the heat. The extent to which the eyes of the bottle-finisher are exposed to the most brilliant light and intensest heat from the furnace may be estimated by the fact that he generally works five shifts each week, a shift lasting eleven hours, and at each shift he finishes 110 to 120 dozen bottles at the rate of $2\frac{1}{2}$ bottles per minute. The time in which he is obliged to look into the furnace whilst he gets the metal for the rim of each bottle is about three seconds, so that at each shift his eyes are exposed to the glare of the furnace for at least sixty-six minutes, or about five and a-half hours a week. This is the man, therefore, whose lenses become opaque. With the old furnaces, the left eye was more exposed to the furnace, but in the present furnace both eyes are equally exposed to the light and heat; if there is any difference the right is the more exposed.

Only about one in two bottle-blowers is promoted to be a bottle-finisher, and when he is so, he is generally between the ages of 25 to 40. The bottle-finisher is a much older man at his trade than either the "taker-in," the "gatherer," or the "putter-up," who are usually under the age of 21 and he has passed through all these grades of work as well as that of bottle-blower.

If the cataracts are due to the bright light and heat of the furnace, the question naturally arises: Do men similarly exposed to light and heat in other trades suffer from the same affection?

I have been informed that in other branches of the glass trade such as the making of tumblers, glass jars and plate glass it is only the "founder" who looks into the furnace (the "tank") and he only does so occasionally, and I have met with only one case in men from these works, in which the metal is gathered from "pots" and not from the huge "tank."

In large steel and iron works, such as are at Middlesbrough where the Siemens-Martin process is used, the intense light and heat of the furnace are so great (2,000° F. to 3,100° F.) that looking into it for a short time with the naked eye the observer becomes quite blind for a while—but there the furnace men use dark blue glasses and require only occasionally to look into the furnaces and so far as I know do not suffer from cataract.

In smaller steel and iron works no glasses are used, but as the men only at infrequent intervals look into the furnace and the glare is not so great they do not suffer. The light and heat to which puddlers are exposed are much less and they are not affected by cataract.

Both Eyes are Practically always Affected.

The disease begins about the same time in both lenses, so that they usually present the same appearances when the worker applies for treatment.

The Disease begins comparatively Early in Life.

It commences as often as not before the age of 50 years, and not uncommonly before the age of 40 even, whereas ordinary senile cataract is not often seen before the age of 50.

The Disease progresses Slowly.

The bottle-finisher is often able to work for some years after the opacities begin, especially if the pupil be kept dilated by atropine; the great improvement of the sight by the use of atropine is due to the fact that at first the periphery of the lens is clear.

Mode of Development.

The opacity first appears at the posterior pole of the lens, immediately under the posterior capsule, and is shaped like