height, which is fixed upon its vertical axis of rotation, and is enclosed in an outer chamber, containing water in such quantity that the lower extremity of the cup dips below its surface. The upper edge of the rotating cup is, in this application, surrounded by a stationary ring armed with vertical vanes, by which the overflowing liquid is arrested and directed downward, causing it to fall through a space or zone which is traversed by a number of radial and vertical blades projecting from the external surface of the rotating cup, which, in striking the falling liquid, project it with considerable force against the sides of the outer vessel, at the expense of a corresponding retarding effect on the cup, increasing its regulating-power.

The cup-spindle carries at its lower extremity a pinion, which gears into two planet-wheels at opposite points, which on their part gear into an inverted wheel surrounding the whole, which latter is fastened upon a vertical shaft in continuation of the cup-spindle, and is driven round by the engine in the opposite direction to the motion of the cup. The two intermediate or planet-wheels are attached to a rocking frame supported, but not fixed, upon the central axis, which wheels, in rotating upon their studs, are also free to follow the impulse of either the pinion or the inverted wheel to the extent of the differential motion arising between them. The rocking frame is connected to the regulating valve of the engine, and also to a weight suspended from a horizontal arm upon the valve-spindle, tending to open the valve and at the same time to accelerate the cup to the extent of the pressure produced between the teeth of the planet-wheels and the pinion, while the engine is constantly employed to raise the weight and to cut off the supply of steam. The result is that the engine has to conform absolutely to the regular motion imposed by the cup, which will be precisely the same when the engine is charged with its maximum or its minimum of resisting load.

The paper shows that the action upon the valve must take place at the moment when the balance between the power and load of the engine is disturbed, and that the readjustment will be effected notwithstanding a resistance of the valve exceeding 100 kilogrammes—a result tending towards the attainment of several important objects.

II. "On a Fluorescent Substance, resembling Quinine, in Animals; and on the Rate of Passage of Quinine into the Vascular and Non-vascular Textures of the Body." By H. Bence Jones, M.D., F.R.S., and A. Dupré, Ph.D., F.C.S. Received March 14, 1866.

Part I.

On a Fluorescent Substance, resembling Quinine, in Animals.

The term fluorescence in the last few years has found a place in physiological works because different substances that occur in the body have been said to possess the property of fluorescence. Of these the solution of bile-acids in concentrated sulphuric acid, the white of egg when kept for a

short time, and the urine sometimes, are the best-known fluorescing substances.

But as long since as 1845, Professor Brücke, in Müller's 'Archiv,' stated that he had found in many and very frequently repeated experiments, that the lens absorbed the blue rays of light to a very great extent, and that the cornea and the aqueous humour did so to a less extent, but that the lens together with these other media absorbed these rays to the greatest degree. He used the eyes of oxen and of rabbits, and the lens of a pike's eye, which last, when dried with care, preserved its transparency, and allowed the light to fall on a porcelain plate covered with tincture of guaiacum and bleach a portion of the green surface.

Professor Stokes, in his well-known paper "On the Change of the Refrangibility of Light," in the Philosophical Transactions for 1852, says (p. 512), "It is found that the property of change of refrangibility in the incident light is extremely common." "To make a list of sensitive substances would be useless work; for it is very rare to meet with a white or light-coloured organic substance which is not more or less sensitive." Among others he mentions horn, bone, ivory, white shells, leather, quills, white feathers, white bristles, the skin of the hand, and the nails. And in his conclusion (p. 557), he says, "The phenomenon of change of refrangibility proves to be extremely common, especially in the case of organic substances, such as those ordinarily met with, in which it is almost always manifested to a greater or less degree."

When speaking of the fluorescence of sulphate of quinine, he says (p. 541), "When quinine was dissolved in dilute hydrochloric acid, the blue colour was not exhibited, not even when the fluid was held in the sunlight and examined by superficial projection."

In 1855 Helmholtz published a paper in Poggendorff's 'Annalen,' vol. xciv. p. 205, in which he says that, as far as quinine paper showed that the spectrum extended, so far the eye could perceive light *.

He then proposes this question, Does the retina see the rays beyond the violet directly as it sees other colours of the spectrum, or does it fluoresce under the influence of these rays? and is the blue colour of the rays beyond the violet light of less refrangibility which shows itself in the retina only under the influence of the violet rays?

To determine this question, he says, I examined for fluorescence the retina of the eye of a man who had been dead for eighteen hours. The first experiment showed that it was very feebly fluorescent. The retina was less fluorescent than paper, linen, and ivory, but more than porcelain.

* In 1853 Prof. Donders, in a paper in Müller's 'Archiv,' p. 471, "On the Action of the Invisible Rays of high Refrangibility on the Media of the Eye," says that "most, if not all, the rays of higher refrangibility than the violet reach the retina, and are not absorbed by the different media through which the light passes;" and Dr. Kessler, in 'Archiv für Ophthalmologie,' 1854, vol. I. p. 449, says that "the crystalline lens is not the cause of the invisibility of the rays of high refrangibility; for when the lens is removed by operation these rays are not more visible.

The colour of the light dispersed through the retina is greenish white, very different from that which the direct perception of these rays usually gives.

In 1858, in the Comptes Rendus des Séances de la Société de Biologie pendant le mois de Novembre 1858, pp. 166 & 167, there is a short notice headed "Analyse et conclusions d'un travail sur la fluorescence des milieux de l'œil, par M. Jules Regnauld."

He used sunlight, and found in man and the mammifera that the cornea fluoresced in a very slight degree. In the sheep, dog, cat, and rabbit, the crystalline lens possessed in the highest degree fluorescent properties. In these animals, and also in many birds, the central part of the lens (endophaine of MM. Valenciennes and Fremy), preserved by desiccation at a low temperature, retained this property.

The central portion of the crystalline of many aquatic vertebrata and mollusca (phaconine of MM. Valenciennes and Fremy) is almost entirely without fluorescence.

The hyaloid body possesses only a very feeble fluorescence, due to the hyaline membranes; for the vitreous humour itself is not fluorescent.

The retina, as M. Helmholtz discovered, possesses a certain fluorescence which is not at all comparable in intensity to that of the crystalline lens of mammifera.

Finally, M. Regnauld concludes that, if we must attribute the accidents caused by feebly luminous radiations of the electric light to the phenomena of fluorescence, it is above all in the energetic action on the crystalline that it is natural to look for an explanation. The impression which the cornea undergoes must nevertheless not be neglected.

In 1859, in the 'Archiv für Ophthalmologie,' vol. v. part 11. p. 205, there is a paper by J. Setschenow of Moscow, "On the Fluorescence of the Transparent Media of the Eyes of Man and some other Animals." He undertook the examination at Professor Helmholtz's request, because it was possible that the phenomena of fluorescence observed by Helmholtz might have been modified by a post-mortem change in the eye.

He experimented on the eyes of oxen and rabbits. The fresh retina showed the same phenomena as the dead human retina. It diffused a greenish-white light, which, examined by a prism, gives a spectrum in which the red is wanting.

The vitreous humour in a thin glass vessel showed only traces of fluorescence. The lens, on the contrary, fluoresced very strongly: the colour of the dispersed light is white-blue, exactly like quinine; only the quinine was a little stronger. Examined by a prism, the dispersed light gave a spectrum in which the red was wanting, and in which the blue tone predominated. The fluorescence begins, as in quinine solutions, between G and H, and is strongest at the outer edge of the violet rays, and extends into the ultra-violet to the same distance in the case of the lens as in the case of the quinine solution.

When the cornea was cut out, it fluoresced much feebler than the lens; the aqueous humour did not fluoresce at all.

The appearances in the three last media, he says, can be shown with the greatest ease, even in the eye of a living man. When the eye is brought into the focus of the ultra-violet rays, immediately the cornea and the lens begin to glimmer with a white-blue light. The cornea in the living eye is much more strongly fluorescent than when dissected out, probably from the loss of transparency consequent on contraction of the texture and from evaporation.

The question how and why our eyes perceive the ultra-violet spectrum is still undetermined. The fluorescence of the lens would be rather a hindrance than a help; only the general sensibility to the light which the ultra-violet rays produce in our eyes can be explained by the fluorescence of the media lying before the retina.

In 1862, 'Zeitschrift für Rationelle Medicin,' 3rd series, vol. xiii. p. 270, Pfluger, by mixing fresh ox-gall with concentrated sulphuric acid, saw a clear dichrotic solution form. It had a deep red colour by transmitted light, and a beautiful green colour by reflected light. This was seen very beautifully when dried bile was put into sulphuric acid; and then the dichroism increased by standing. It is desirable to separate the cholesterin and the bile-fats.

The green fluorescence appeared when only blue or green light fell on the sulphuric-acid solution of the bile. On the contrary, it did not appear when the light was only yellow or red.

The sulphuric-acid solution of the bile absorbed all the rays of the spectrum except the yellow and the red.

In the 'Journal für Prakt. Chem.' vol. xcii. p. 167, Schönbein has the following remarks on the formation of a fluorescing substance in the putrefaction of human urine:—

If urine is left to stand in the air until it becomes covered on the surface with a thick layer of fungus, the alkaline fluid that filters from it shows a very strong fluorescence of a greenish colour. Small quantities of the stronger organic or inorganic acids take away this fluorescence, which, however, by alkalies can be again reproduced. This substance has a reaction like esculine, and, like this, is the opposite to quinine, the fluorescence of which is increased by those acids. The hydrobromic, hydriodic, and hydrochloric acids lessen the fluorescence of the solution of quinine almost to entire removal. Schönbein also remarked that fresh urine had a feeble fluorescence, and also that a weak solution of albumen, by standing long in the air, became fluorescent to a considerable degree.

This was the state of our knowledge of fluorescence in animals when, having traced the rate of passage of chloride of lithium and other mineral substances into and out of the textures by means of the spectrum analysis, we endeavoured to find some method of determining the rate at which organic substances passed into and out of the same structures.

Among all the delicate tests for different organic substances, the fluorescence of sulphate of quinine appeared likely to afford good results; for the following experiments on the delicacy of this test for sulphate of quinine show that this method of tracing sulphate of quinine into and out of the body, though inferior to the spectrum determinations of lithium, was superior in delicacy to the spectrum determinations of many other substances.

On the Delicacy of the Fluorescent Test of Sulphate of Quinine when a Ruhmkorf coil was used as the source of light.

One grain of sulphate of quinine was dissolved in five ounces of acidified water, and this was again and again diluted until one grain of quinine-salt was present in 1,800,000 parts of water. This, when examined in a quartz cell by the induction-spark, showed blue fluorescence distinctly in twenty grains of solution.

Another grain, dissolved in a litre and diluted until one grain of salt was present in 1,440,000 parts of water, when acidified, also showed the fluorescence distinctly in twenty grains of solution.

The same quantity, dissolved in one litre of water, was diluted to 512 litres. This was equal to one part in 7,200,000 parts of water; as the fluorescence could be seen in twenty grains of this solution, $\frac{1}{360,000}$ of a grain of sulphate of quinine gives the fluorescence.

In another experiment, $\frac{1}{25,000}$ of sulphate of quinine, in fifty minims of water acidified, showed the fluorescence strongly, and even $\frac{1}{100,000}$ of a grain of sulphate of quinine in fifty minims of water showed the fluorescence feebly. As the fluorescence could be seen in twenty grains of this solution, $\frac{1}{250,000}$ of a grain of sulphate of quinine gives the fluorescence.

In the last two sets of experiments the light of a bright induction-spark was concentrated by a small quartz lens.

One grain of disulphate of quinine, dissolved in 256 litres of water acidulated with one-eighth of sulphuric acid (1 to 8), shows fluorescence feebly in a quartz cell containing twelve grains of the solution. Hence $\frac{1}{330,000}$ grain gives the fluorescence feebly.

If one grain of disulphate of quinine is dissolved in a thousand litres, or one part of quinine to 15,440,000 of water, the fluorescence is still perceptible in one ounce of the solution.

On the Existence of an extractable Fluorescent Substance in Animals and Man.

Immediately on trying to apply this reaction to test the different textures of guineapigs, after and before they had taken quinine, we found that in health no part of any of the tissues of the guineapig was free from blue fluorescence. It became desirable, therefore, to separate the fluorescence produced by some fluorescing substance normally present in the tissues from that produced after quinine was given. After very many attempts to extract these substances separately from the tissues, and many more to separate them when they were conjointly extracted, all of which proved

unsuccessful, we resorted to the plan of determining the amount of natural fluorescence by comparing it with standard solutions of sulphate of quinine; and by the same means we measured the increase that occurred in the amount of fluorescence from the same organs after quinine had been taken.

The following plan was adopted for the extraction of the fluorescent substance from the textures, both before and after quinine was taken.

The part to be examined was treated on a water-bath with very dilute sulphuric acid, either directly or after previous drying in a water-oven. This extraction was repeated again and again. The acid extracts were mixed, filtered after cooling, neutralized with caustic soda, and repeatedly shaken up with their own bulk of ether. The residue left after evaporation of the ether was taken up by dilute sulphuric acid, filtered, and tested for the amount of fluorescence after having been made up to a certain bulk, generally twenty-five minims.

When a large quantity of material, as two or three pounds of liver, was employed, the acid extract was a second time neutralized and treated with ether; the residue from the second ethereal solution was then taken up with dilute sulphuric acid and tested.

In very dilute solutions the fluorescence of the animal substance cannot be distinguished from that produced by quinine; if the solution is more concentrated, the fluorescence of the animal substance is confined much more to the surface, the fluorescence in a solution of quinine passing much further into the liquid; and in still more concentrated solutions, the colour of the light given out is of a decidedly greenish hue. The fluorescence also of the animal substance begins to appear somewhat nearer to the red end of the spectrum than is the case with quinine; but both extend to the same distance beyond the violet end.

From two to three pounds of liver, only about fifty minims of a solution was obtained showing a fluorescence equal to that produced by two or three grains of quinine to the litre of water; and when slightly acidified, the following reactions were obtained with the solution. It gives a precipitate with solution of iodine, with a solution of iodide of mercury in iodide of potassium, and also with phosphomolybdic acid, bichloride of platinum, and terchloride of gold: this last precipitate is soluble in alcohol, like that produced in solutions of quinine.

A weak solution of quinine interposed in a quartz cell before the solution of the natural fluorescing substance, did not stop the fluorescence of this latter substance entirely; but when the solution of animal substance was placed before the solution of quinine, no fluorescence whatever could be perceived in the quinine. Ether is unable to extract the animal substance from an acid solution; the acid solution may be shaken up several times with ether; but the ethereal solution on evaporation yields a residue which, when taken up by dilute sulphuric acid, gives no blue fluorescence whatever.

The fluorescence of this animal substance is much less strong in hydrochloric acid solutions by the light of the coil-spark, and it is almost destroyed

by alkalies. The substance does not lose its fluorescence when treated with dilute sulphuric acid on a water-bath, nor even on the addition of a dilute solution of permanganate of potash. In an alkaline solution with permanganate of potash it is immediately destroyed. Quinine behaves in a precisely similar way.

Parts of the brain, kidney, liver, and heart, and the crystalline lens of a human subject dead for many hours, were boiled with dilute sulphuric acid, neutralized with carbonate of soda, and extracted with ether. The ethereal residue, dissolved in dilute sulphuric acid, was examined by the spark of the Ruhmkorf coil for fluorescence. From every part the extract fluoresced distinctly but very feebly. The fluorescence closely resembled that caused by a very weak solution of quinine.

The lenses from sheep's, bullocks', pikes', eagles' eyes, gave a distinctly fluorescent substance, and the extract from the sheep's liver fluoresced very strongly. Cod-liver oil also fluoresced very distinctly. The so-called pills of cod-liver oil gave no fluorescence.

The fluorescent substance could be extracted by treating the finely divided substance with alcohol, and the residue of the alcohol solution by ether, and finally dissolving the ethereal residue in water acidulated with sulphuric acid.

It follows from these experiments that there exists in the body of man and animals, fishes, and birds a substance which can be extracted from any of the tissues by the same process as quinine when present can be extracted. This substance has the same reactions with chemical agents as quinine has, and the action of light upon this substance is almost, although not altogether, identical with its action on quinine.

This substance is visible in the lens of the human eye during life. It is, from its mode of separation and reactions, an alkaloid bearing a close resemblance in its properties to quinine.

For the present we shall call this animal quinoidine. It is the cause of the blue fluorescence of weak acid extracts from any of the tissues of the body of men and animals. When concentrated, the fluorescent substance is bluish green.

On the Fluorescent Substance produced by treating Bile with strong Sulphuric Acid.

We were unable to insulate and extract the substance which causes the green fluorescence in bile when it is treated with strong sulphuric acid; nor could we separate that which forms in white of egg when a solution in water is exposed to the air.

The bile dissolved in strong sulphuric acid was transparent by transmitted light, and appeared as a brownish-yellow solution; by reflected light, even with the ordinary gaslight, it showed a strong green fluorescence, in much larger quantity than, and entirely different in appearance from, the blue fluorescent substance of the liver. Thus it was destroyed by diluting the acid with water, but returned on the addition of a larger quantity of strong sulphuric acid.

The solution of egg-albumen, exposed to the air, gradually after some days showed a strong green fluorescence, which, like esculine, disappeared on the addition of an acid, but was not destroyed by alkalies. The fluorescence gradually disappeared when the albumen began to putrefy.

Part II.

On the Increase of Fluorescence in the Textures of Animals and Man after Quinine had been taken.

Having proved that in all the different textures of an animal a natural alkaloid fluorescent substance was present when no quinine had been taken, and as no means could be found for separating the natural fluorescent substance from the quinine when it passed into the textures, it became necessary to make our analyses quantitative instead of qualitative.

For this purpose it was necessary to determine, by means of standard solutions of quinine, what was the greatest amount of naturally fluorescent substance that usually occurred and could be extracted from the tissues. Deducting this from the amount of fluorescence that could be extracted after quinine was given, we were enabled to measure the rapidity of passage of the quinine into or out of the tissues, the animals being destroyed at different periods after different quantities of sulphate of quinine had been taken.

So also by determining the amount of natural fluorescent substance in the textures, lenses, and urine of man before quinine was taken, and deducting this from the amount obtained after quinine was taken, we were enabled to show that quinine does pass into the textures and lenses, and how quickly it appeared in the urine and reached its maximum and began to disappear and entirely vanished.

First. Examinations of different textures of guineapigs when no quinine was taken, and comparison of the amount of natural fluorescent substance with standard solutions of sulphate of quinine. The amount of the different parts examined was as nearly as possible always the same:—

1. A guineapig that had taken no quinine was killed; the extract of the brain and nerves only was measured. The fluorescence of the nerves was very feeble, and about equal to one-twentieth of a grain of sulphate of quinine in a litre of water. The extract of the brain was exceedingly feeble, and it was less than one-thirtieth of a grain of sulphate of quinine in a litre of water.

2. In another guineapig the lenses and the nerves were dried, and boiled three times with dilute sulphuric acid. The acid solution was rendered alkaline by caustic potass, and it was then shaken up with ether three times. The ethereal solution was evaporated, and the residue dissolved in dilute sulphuric acid. The acid solution was made up to twenty-five minims. The solutions of the lenses and of the nerves showed some fluorescence.

These acid solutions were now again rendered alkaline and were shaken up with ether, and the ethereal solution was evaporated and the residue

dissolved in acetic acid, and the excess of the acid evaporated in a water-bath; the residue was dissolved in a little water, and the solutions were divided into two parts. The half of the solution from the lenses and nerves, when tested with a solution of iodine and a solution of iodide of mercury, remained perfectly clear. The bile, brain, and liver, tested in the same way, gave no precipitates with these reagents, although they also gave slight fluorescence.

The different parts of this pig were compared with the corresponding parts of two other pigs, one of which took sixteen grains of sulphate of quinine in nine doses in four days, and the other twenty-six grains in fourteen doses in six days.

3. Another guineapig had the different organs treated in exactly the same way; the liver, lenses, kidneys, urine, blood, brain, nerves, and muscle gave a fluorescence which varied from about one-twentieth to one-thirty-second part of a grain of quinine in a litre of water. This pig was bought at the same time and place, and fed in the same way as two other pigs (18 and 23), that were given six grains of sulphate of quinine in three doses with twenty minutes' interval. One pig was killed between five and six hours after the quinine, and the other in twenty-four hours.

4. Another pig was also treated in the same way, for comparison with three other pigs which took five grains of quinine, and were killed four hours, eight hours, and thirty-two hours afterwards. The lenses, humours, brain, blood, nerves, and muscle gave a fluorescence varying from one-twenty-fifth to one-fiftieth of a grain of quinine in a litre of water.

5. Another pig had taken no quinine. The brain gave a fluorescence equal to one-thirtieth of a grain of quinine, and the nerves fluoresced equal to one-twentieth of a grain of quinine.

6. Another guineapig had equal quantities of the liver, bile, kidney, urine, brain, lenses, humours, nerves, blood, and muscle treated in the same way. The fluorescence obtained from the liver was from one-thirty-second to one-sixteenth part of a grain of quinine. The fluorescence of all other parts was less than one-thirty-second part of a grain of quinine. The fluorescence of the humours was least of all.

7. Another guineapig was given no quinine. Equal quantities of dry liver, blood, bile, kidney, brain, nerves, lenses, muscle, and humours were taken. Of the bile and humours, which were taken entire, rather less than half a grain, of the other parts half a grain was used; the liver fluoresced equal to one-sixteenth of a grain of quinine. The bile, blood, kidney, brain, nerves, lens, and muscle showed somewhat less than one-sixty-fourth part of a grain to a litre; the humours of the eye rather more than one-sixty-fourth part.

8. Another pig, bought at the same time and place as 17, was given no quinine; and the fluorescence of every part was less than one-sixty-fourth of a grain of quinine in a litre of water. The fluorescence of each solution was rendered still less by the addition of common salt.

Secondly. On the increase of fluorescence that was observed when different quantities of sulphate of quinine were given to animals at different periods before they were killed:—

9. A guineapig was given sixteen grains of sulphate of quinine, in nine doses, in the course of four days. It was found dead more than twelve hours after the last dose. Its fluorescence was compared with pig 2, which had taken no quinine; the lenses and the nerves, treated the same way, showed much more fluorescence in the pig that had taken quinine than in the other which had had no quinine. The solutions of the lenses and the nerves also gave a distinct precipitate, which was least in the solution of the lenses with solutions of iodine and of iodide of mercury; whilst the solutions of the lenses and the nerves of the pig that had taken no quinine remained clear. The bile and the brain fluoresced brightly. The solution of the liver, when diluted even to one hundred minims, fluoresced distinctly in daylight, and very strongly in the light of the spark. The brain-solution gave a distinct precipitate with iodine and iodide of mercury. The bile gave a very faint turbidity. The liver gave an abundant precipitate, and moreover gave Herapath's test for quinine very distinctly.

10. Another pig took twenty-six grains of quinine, in fourteen doses, during six days. It was killed nineteen hours after the last dose, being apparently partially paralyzed. The solutions of the different organs were prepared in the same way as 9 and 2, and they were examined at the same time. The lenses showed the fluorescence very strongly when a cone of sunlight was thrown into them with a quartz lens. The humours showed no fluorescence at all in this manner. The solutions of the bile, brain, urine, nerves, lenses, spinal marrow, liver, gave more or less distinct fluorescence. The solution of the brain gave no precipitate with iodine or iodide of mercury; nor did the bile give a precipitate, but the liver gave a slight precipitate with both reagents.

Having thus satisfied ourselves that quinine does pass into the vascular and non-vascular tissues, we proceeded to determine how quickly four, five, or six grains of sulphate of quinine given to guineapigs could be detected in the different textures of their bodies.

11. A guineapig was given four grains of sulphate of quinine, and it was killed in one quarter of an hour; all the extracts from the different parts of the body were mixed with one-eighth of their bulk of dilute sulphuric acid, and were made up to twenty-five minims. The amount of fluorescence was compared with the fluorescence obtained in pig 6, and with standard solutions of sulphate of quinine with one-eighth of dilute sulphuric acid, containing one grain, three-quarters, half, one-eighth, one-sixteenth, and one-thirty-second of a grain of sulphate of quinine. The solutions of the extracts of pigs 19, 22, 25, and 26, which had taken four grains of sulphate of quinine and were killed six hours, twenty-four hours, forty-eight hours, and seventy-two hours after the quinine was taken, were examined at the same time.

The urine and the blood gave a fluorescence equal to half a grain of quinine to a litre of water; the extract of the kidney and the liver gave a fluorescence equal to three-fourths of a grain of quinine; the extract of the muscle gave a fluorescence between half a grain and one-fourth of a grain. The extract of the bile and the brain gave a fluorescence nearly equal to one-eighth of a grain of quinine to a litre. The nerves gave rather more fluorescence than one-sixteenth of a grain of quinine, and the lenses gave between one-sixteenth and one-thirty-second of a grain.

Comparing these numbers with pig 6, in which the fluorescence of the liver was greatest, amounting to from one-thirty-second to one-sixteenth of a grain of quinine to a litre of water, whilst in all other parts, urine, blood, kidney, muscle, bile, brain, nerves, and lenses, the natural fluorescence was less than one-thirty-second of a grain, it is evident that in a quarter of an hour sulphate of quinine passes into all the vascular and non-vascular structures of the body.

12. Another guineapig was given four grains of sulphate of quinine, and it was killed in half an hour; the nerves and brain were compared with pig 1, which had taken no quinine. The extract of the liver and kidneys gave a fluorescence equal to two-fifths of a grain of sulphate of quinine in a litre; the blood, the bile, and the muscle gave a fluorescence equal to one-fifth; the urine gave a fluorescence between one-fifth and one-tenth; the brain between one-tenth and one-twentieth; the humours of the eye fluoresced feebly, but a little more than the lenses, about one-twentieth; the lenses and the nerves less than one-twentieth of a grain of quinine.

13. Another guineapig took four grains of sulphate of quinine, and was killed one hour afterwards. The blood, the kidney, and the urine gave a fluorescence equal to, or rather more than, one-fifth of a grain of quinine to a litre; the liver fluoresced equal to between one-fifth and two-fifths of a grain of quinine; the bile and the muscles gave a fluorescence equal to one-twentieth of a grain of quinine; the brain fluoresced between one-twentieth and one-thirtieth; the humours fluoresced rather more than the lenses; and the nerves gave the slightest fluorescence.

14. Another guineapig was given four grains of sulphate of quinine; after three hours it was killed. It had been strongly affected, and the brain was much congested. The liver, kidney, blood, urine, bile, brain, and muscle gave very strong fluorescence, equal to between one and two grains of quinine in a litre of water; the nerves gave a fluorescence equal to one-sixteenth of a grain of quinine; the humours gave a fluorescence between one-sixteenth and one-thirty-second part of a grain; the lenses less than one-thirty-second part of a grain of quinine to a litre of water.

15. Another guineapig was given four grains of sulphate of quinine; after three hours it was killed. Of every part half of the dry substance was taken, except the aqueous humour, bile, and urine, of which the whole was taken; but when dry each of these was less than half a grain. Half the muscle gave a fluorescence equal nearly to one-sixteenth of a grain of quinine in a litre; half the brain fluoresced a little more than one-thirty-second;

half the kidney one-eighth to one-fourth of a grain; all the urine one-eighth; half the blood fluoresced one-sixty-fourth to one-thirty-second; half the liver a little more than one-sixteenth; all the bile a little less than one-fourth; half the lenses a little less than one-sixty-fourth; all the humours a little more than one-sixteenth; half the nerves one-sixty-fourth to one-thirty-second of a grain of quinine to a litre of water.

16. Another guineapig was killed four hours after five grains of sulphate of quinine, in two doses, with half an hour's interval. The fluorescence of the different extracts of the tissues was compared with that of pig 4, that had taken no quinine, and with pigs 21 and 24, that were killed after taking a dose of five grains eight and thirty-two hours previously. The liver, the kidney, the brain, and the muscle gave a fluorescence about equal to one grain of quinine in a litre of water; the blood rather less; the nerves rather more than the blood; the lenses and the humours less than the blood.

17. Another pig was killed four hours and a half after four grains of quinine. The whole of each organ was taken; the muscle gave a fluorescence equalling from one-half to one grain of quinine to a litre of water; the brain one-sixteenth to one-eighth of a grain; the kidney fluoresced nearly equal to one grain; the urine rather more than one grain; the blood one-eighth to one-fourth; the liver nearly one; the bile a little more than one-eighth; the lenses, humours, and nerves fluoresced less than one-sixty-fourth of a grain of quinine to a litre of water.

This pig was compared with one which was given no quinine.

18. Another pig was killed five hours and a half after six grains of sulphate of quinine, given in three doses, with twenty minutes' interval. It was very much affected. The extract of its tissues was compared with pig 3, which had taken no quinine; the liver, kidney, and muscle fluoresced very strongly; the brain fluoresced strongly; the blood fluoresced between one-fifth and two-fifths of a grain to a litre of water; the nerves and the lenses fluoresced much less.

19. Another pig was killed six hours after four grains of sulphate of quinine. The liver and kidney fluoresced equal to from one-half to one-fourth of a grain of sulphate of quinine to a litre of water; the urine from one-eighth to one-quarter; the blood fluoresced about one-eighth, the muscle a little more; the brain and the humours of the eye about one-sixteenth of a grain of quinine; the lenses between one-sixteenth and one-thirty-second, and the nerves rather less than one-thirty-second part of a grain of quinine; the fluorescence was compared with pig 6, that had taken no quinine.

20. Another pig was killed six hours after four grains of sulphate of quinine. The liver gave a fluorescence equal to between one and two grains of sulphate of quinine; the kidney and the urine gave a fluorescence equal to one grain of quinine; the blood fluoresced between one grain and half a grain; the bile equalled three-quarters of a grain; the muscles and the brain one-quarter of a grain; the nerves one-sixteenth of a grain; the

humours rather more than one-thirty-second of a grain; and the lenses between one-thirty-second and one-sixty-fourth of a grain to a litre of water.

21. Another guineapig was killed in eight hours after taking five grains of sulphate of quinine, in two doses, with half an hour's interval. The extract of its tissues was compared with pig 8, which had taken no quinine, and with pig 16 and pig 24, which were killed four hours and thirty-two hours after taking five grains of quinine; the fluorescence of the liver was very strong; the muscles, the brain, and the kidneys showed the fluorescence very distinctly; the fluorescence of the urine equalled from two-fifths to three-fifths of a grain of quinine; the bile was not more than one-twentieth of a grain of quinine; the blood fluoresced more distinctly; the lenses and the humours not so much, and the nerves least of all.

This pig was with young when killed, and the fluorescence of the fœtus was distinct; the fluorescence of the liquor amnii was less than that of the fœtus.

22. Another pig was killed in twenty-four hours after taking four grains of sulphate of quinine. The fluorescence of its textures was compared with pig 6, that had taken no quinine; the fluorescence of the liver and kidney was equal to half a grain of quinine; the blood and bile fluoresced equal to one-eighth of a grain; the urine between one-eighth and one-sixteenth; the muscle the same; the brain and the humours rather less than one-sixteenth of a grain; the lenses and the nerves about one-thirty-second of a grain of quinine to a litre of water.

23. Another pig was killed twenty-four hours after taking six grains of quinine, in three doses, with 20 minutes' interval. The fluorescence was compared with pig 3, which had taken no quinine; the liver showed the most fluorescence; the muscles, the kidney, and the brain were next; the nerves and blood equalled about one-tenth of a grain of quinine, and the lenses fluoresced least of all.

24. Another pig was killed thirty-two hours after taking five grains of sulphate of quinine. The fluorescence was compared with pig 4, which had taken no quinine; the liver fluoresced scarcely more than that of the pig that had taken no quinine, about one-twenty-fifth of a grain to a litre of water; the kidney fluoresced a little more than that of the pig without quinine; the fluorescence of the urine was scarcely perceptible, less than one-fiftieth of a grain of quinine; the muscles a little less than the pig without quinine; the blood, the nerves, the brain fluoresced very slightly; the lens and the humours more than any other part.

25. Another pig was killed forty-eight hours after four grains of sulphate of quinine. The fluorescence was compared with pig 6, which had taken no quinine; the extract of the liver and of the blood had a fluorescence equal to one-sixteenth of a grain of quinine in a litre of water; the bile, the kidney, the urine, the brain, the lenses, the humours, the nerves, and the muscles had each a fluorescence less than one-thirty-second part of a grain of quinine.

26. Another pig was killed seventy-two hours after four grains of sulphate of quinine. The fluorescence was compared also with pig 6, which had taken no quinine; the extract of the liver and of the brain had a fluorescence equal to one-sixteenth of a grain of sulphate of quinine; the lenses had a fluorescence equal to one-thirty-second part of a grain; the bile, kidney, urine, the nerves, blood, and muscle had a fluorescence less than one-thirty-second part of a grain; and the humours fluoresced much less than one-thirty-second part of a grain of sulphate of quinine in a litre of water.

Fluorescence without quinine, measured by the number of grains of quinine in 100 litres of water (176 pints).

	Pig 1.	Pig 4.	Pig 5.	Pig 6.	Pig 7.	Pig 8.
Liver....	....	....	....	6 to 3	less 6·2	less 1·6
Lenses ..	....	....	....	less 3	„ 1·6	„ 1·6
Kidney..	....	....	....	„ 3	„ 1·6	„ 1·6
Urine ..	....	....	....	„ 3	„ 1·6	„ 1·6
Bile	....	....	....	„ 3	„ 1·6	„ 1·6
Blood ..	....	4 to 2	....	„ 3	„ 1·6	„ 1·6
Brain ..	less 3	4 to 2	3	„ 3	„ 1·6	„ 1·6
Nerves ..	5	4 to 2	5	„ 3	„ 1·6	„ 1·6
Muscles .	....	4 to 2	....	3	„ 1·6	„ 1·6
Humours	....	4 to 2	....	least	more 1·6	„ 1·6

Fluorescence after quinine.

	Pig. 11. 15 min.	Pig 12. 30 min.	Pig 13. 1 hour.	Pig 14. 3 hours.	Pig 15. 3 hours.	Pig 16. 4 hrs.	Pig 17. 4½ hours.
Liver ..	75	40	20 to 40	100 to 200	6·2	100	100
Lenses .	6 to 3	5	..	3	1·6	..	1·6
Kidney .	75	40	20	100 to 200	12 to 25	100	100
Urine ..	50	20 to 10	20	100 to 200	12	..	100
Bile	12	20	5	100 to 200	25	..	12·5
Blood ..	50	20	20	100 to 200	1·6	..	12 to 25
Brain ..	12	10 to 3	5 to 3	100 to 200	3	100	6 to 12
Nerves .	6	5	least	6	1·6 to 3	..	1·6
Muscles	50 to 25	20	5	100 to 200	6·2	100	50 to 100
Humours	..	5	..	6 to 3	6·2	..	1·6

	Pig 18. 5½ hours.	Pig 19. 6 hours.	Pig 21. 6 hours.	Pig 22. 8 hours.	Pig 23. 24 hrs.	Pig 24. 32 hrs.	Pig 25. 48 hrs.	Pig 26. 72 hrs.
Liver ..	..	50 to 25	100 to 200	..	50	4	6	6
Lenses .	..	6 to 3	3 to 1	..	3	..	3	3
Kidney .	..	50 to 25	100	..	50	..	3	3
Urine..	..	25 to 12	100	4 to 6	12 to 6	2	3	3
Bile....	..	..	75	5	12	..	3	3
Blood ..	20 to 40	12	100 to 50	..	12	..	6	3
Brain ..	..	6	25	..	6	..	..	3
Nerves.	..	3	6	..	3	..	3	3
Muscles	..	12	25	..	12 to 6	..	3	3
Humours	..	6	3	..	6	..	3	least

From these experiments it is seen that the fluorescent substance which exists naturally in the tissues, at the very highest reaches to 6 grains in 100 litres of water, and usually is between 4 and $1\frac{1}{2}$ grains of quinine dissolved in this quantity of water.

When quinine has been taken, even in a quarter of an hour the fluorescence may become equal to 75 grains of quinine in 100 litres of water. It is found to be in greatest quantity in the liver and the kidney, and somewhat less in the blood, urine, and muscles; still less in the brain, nerves, and bile; and the increase is slightly perceptible even in the lenses. In three hours the maximum effect of the quinine may be reached, the fluorescence being then from 100 to 200 grains of quinine in 100 litres of water. This amount was found in the liver, kidney, urine, bile, blood, brain, and muscles. The increase was much less perceptible in the nerves and in the aqueous humour, and was least in the lenses.

In six hours the amount of fluorescence was rather less than in three hours; in twenty-four hours it was considerably less than half as much as in three hours; in forty-eight hours there was but little more fluorescent substance than naturally exists in the textures, except in the liver and the blood; and in seventy-two hours there was no increase except in the liver. Hence, in guineapigs, in fifteen minutes the quinine has passed to all the vascular and probably to the extravascular textures. In three hours the amount of quinine in the textures may be at the maximum, and for six hours it remains in excess; in twenty-four hours the quinine is much diminished, and in forty-eight hours it is scarcely perceptible anywhere.

In order, if possible, to obtain very decisive proof that quinine passed into the non-vascular texture of the lens, we gave two pigs three grains of sulphate of quinine, and half an hour afterwards three grains more; the animals were killed five hours after the first dose. One lens of each pig was put into glycerine, to be compared with the lenses of two other pigs bought at the same time and place, to which no quinine was given. In the electric light there was no apparent difference, either in the colour or in the brightness of the fluorescence, between the pigs that had taken quinine and those that had taken none. Examined by the spark of the coil, the fluorescence of all four lenses was less than one-sixty-fourth of a grain of quinine in a litre of water; and scarcely any difference was perceptible, though the fluorescence of the lenses of the pigs that had taken quinine was slightly the strongest. In all, the fluorescence was rendered less strong by the addition of a strong solution of common salt to the solution.

Two pigs were both given fifteen grains of sulphate of quinine in five doses of three grains each, with the interval of one hour between each dose. They were killed one hour after the last dose, being, however, almost dead from the effects of the quinine. One lens of each animal was examined in the usual way. The fluorescence in both was equal to one-thirty-second of a grain of quinine in a litre of water, or three grains per 100 litres.

Professor Donders has carefully investigated the time in which atropine and Old Calabar bean begin and cease to act on the iris in man.

A solution of atropine dropped upon the cornea began to act in fifteen minutes, and attained its maximum in from twenty to twenty-five minutes. In forty-two hours the pupil was rather smaller; and even after thirteen days the pupil had not returned to its natural size.

The solution of Calabar bean began to act in from five to ten minutes. It attained its maximum in from thirty to forty minutes. At the end of three hours it began to diminish, and its effect disappeared entirely in from two to four days.

After continued applications of belladonna to the eye of a rabbit, it was thoroughly washed by a full current of water. The aqueous humour was then evacuated and brought into contact for a long time with the eye of a dog (De Graefe injected the aqueous humour into the anterior chamber); then a notable dilatation of the pupil was observed. As one part in 120,000 of water acts very energetically, the quantity must be very little that produced the dilatation of the pupil.

When belladonna used internally produces the dilatation, the aqueous humour which is taken from the anterior chamber is inactive.

Thirdly. The fluorescence that naturally occurs in different parts of the human body when no quinine had been taken before death was determined, in order that the effect of quinine on the fluorescence in the same parts might be estimated:—

The different parts were dried in a water-bath, and equal quantities of the dried substance were taken, amounting to 0·6 grain, that being the weight of the dry lens. The same method of extraction was followed. The solution was in all cases made up to twenty-five grains.

Extract from	per 100 litres.
Cartilage fluoresced one 32nd of a grain of quinine to a litre ..	=3·1
Nerves fluoresced a little more than one 64th of a grain of quinine to a litre..................................	=1·6
Liver fluoresced a little more than one 64th of a grain of quinine to a litre..................................	=1·6
Kidney fluoresced a little more than one 64th of a grain of quinine to a litre..................................	=1·6
Lens fluoresced a little less than one 64th of a grain of quinine to a litre..................................	=1·6
Lungs fluoresced one 128th to one 64th of a grain of quinine to a litre..................................	=0·8 to 1·6
Muscle fluoresced a little more than one 128th of a grain of quinine to a litre..................................	=0·8
Spleen fluoresced one 128th of a grain of quinine to a litre..	=0·8

In another patient, who died after a surgical operation, the same quantity of substance, treated in exactly the same way, gave—

Extract from	per 100 litres
Cartilage fluoresced a little less than one 128th of a grain of quinine to a litre	=0·8
Nerves fluoresced a little less than one 128th of a grain of quinine to a litre	=0·8
Liver fluoresced a little less than one 64th of a grain of quinine to a litre	=1·6
Kidney fluoresced a little less than one 64th of a grain of quinine to a litre	=1·6
Lungs fluoresced one 128th of a grain of quinine to a litre	=0·8
Muscle fluoresced between one 128th and one 64th of a grain of quinine to a litre	=0·8 to 1·6
Spleen fluoresced a little less than one 128th of a grain of quinine to a litre	=0·8
Heart fluoresced one 128th of a grain of quinine to a litre	=0·8

When a much larger quantity of each organ was taken (whether from loss or destruction of substance in the process of preparation), no great increase of fluorescence was obtained.

Thus, of the different parts of a man who died of apoplexy, six grains were taken and treated as in the previous cases.

Extract from	per 100 litres.
Cartilage fluoresced one 128th to one 64th of a grain of quinine to a litre	=0·8 to 1·6
Nerves fluoresced one 64th of a grain of quinine to a litre	=1·6
Liver fluoresced one 64th of a grain of quinine to a litre	=1·6
Kidney fluoresced one 64th to one 32nd of a grain of quinine to a litre	=1·6 to 3·1
Lungs fluoresced one 64th of a grain of quinine to a litre	=1·6
Muscle fluoresced a little less than one 64th of a grain of quinine to a litre	=1·6
Spleen fluoresced one 64th to one 32nd of a grain of quinine to a litre	=1·6 to 3·1
Heart fluoresced one 32nd of a grain of quinine to a litre	=3·1
Brain fluoresced one 64th to one 32nd of a grain of quinine to a litre	=1·6 to 3·1

In a precisely similar way the different parts of the tissues of a woman who had taken small doses of quinine up to twenty-four hours of her death, were examined.

The tissues were dried in a water-bath, and 0·6 grain of the dry substance was taken for examination.

Extract from	per 100 litres.
Kidney fluoresced one 32nd to one 16th of a grain of quinine to a litre	=3·1 to 6·3

Nerves fluoresced a little more than one 64th of a grain of quinine to a litre.................................... =1·6
Liver fluoresced one 64th of a grain of quinine to a litre.... =1·6
Muscle fluoresced one 64th of a grain of quinine to a litre .. =1·6
Spleen fluoresced a little less than one 32nd of a grain of quinine to a litre .... =3·1
Lungs fluoresced one 128th to one 64th of a grain of quinine to a litre.. =0·8 to 1·6

Fourthly. On the increase of fluorescent substance in the human lens after different quantities of sulphate of quinine had been taken at different periods before the operation for cataract (for the means of making these experiments we are indebted to the great kindness of Mr. Bowman):—

The fluorescence of the human lens without cataract was about equal to one 64th of a grain of quinine in a litre of water; grs. per 100 litres.
That is, natural fluorescence about......................... =1·6
Sulphate of quinine was given for many days previous to the extraction of a cataract. After the operation the fluorescence was found to be less than one 16th and more than one 32nd of a grain of quinine to a litre of water........ =6·2 to 3·1
In four patients, aged respectively 75, 60, 60, and 72:—

the lens removed 1 hour	after 5 grains of quinine,	fluorescence	=1·6
„ $1\frac{1}{4}$	„	„	=1·6
„ 2	„	„	=1·6
„ $2\frac{1}{4}$	„	„	=2·1 to 1·6

Fifthly. On the rate of increase of fluorescent substance in the urine after quinine was taken, or on the rapidity of the passage of quinine, when taken by the stomach, into and out of the urine of man:—

A healthy man breakfasted at 8.30 A.M.; at 12 he emptied the bladder, and took four grains of sulphate of quinine in solution. The fluorescence of the urine at different periods after the quinine was taken was examined by rendering it alkaline with caustic potash and shaking it up three times with its own bulk of ether. Half an ounce of urine was taken for each examination.

Urine passed at	gr. of quinine.	water.
12 (just before taking the quinine), fluorescence	$=\frac{1}{128}$ to $\frac{1}{64}$	to 1 litre.
12.10, fluorescence	$=\frac{1}{64}$	„
12.20 „	$=\frac{1}{4}$ to $\frac{1}{2}$	„
12.30 „	$=\frac{1}{4}$ to $\frac{1}{2}$	„
1 „	$=\frac{1}{4}$ to $\frac{1}{2}$	
2 „	$=\frac{1}{2}$ to 1	„
4 „	$=\frac{1}{4}$ to	„
8 „	$=\frac{1}{8}$	„
24 hours after quinine, fluorescence	$=\frac{1}{16}$, little less.	
48 „ „	$=\frac{1}{32}$, little more.	
72 „ „	about $\frac{1}{128}$	„

The same man breakfasted at 8.30 A.M.; at 12 took four grains of sulphate of quinine.

Urine passed at	gr. of quinine.	water.
12 (just before taking the quinine), fluorescence	$=\frac{1}{128}$ to $\frac{1}{64}$	to 1 litre.
12.10, fluorescence	$=\frac{1}{128}$ to $\frac{1}{64}$	,,
12.20 ,,	$=\frac{1}{16}$	,,
12.30 ,,	$=\frac{1}{8}$ to $\frac{1}{4}$	,,
1 ,,	$=\frac{1}{4}$	,,
2 ,,	$=\frac{1}{4}$, rather more.	
3 ,,	$=\frac{1}{4}$ to $\frac{1}{2}$	,,
4 ,,	$=\frac{1}{4}$ to $\frac{1}{2}$	,,
8 ,,	$=\frac{1}{4}$	,,
24 hours after quinine, fluorescence	$=\frac{1}{16}$ to $\frac{1}{8}$	,,
48 ,, ,,	$=\frac{1}{32}$	,,
72 ,, ,,	scarcely perceptible.	

The same man, at 12 at noon, took four grains of sulphate of quinine. The same quantity of urine (half an ounce) was taken for each examination.

Urine passed at	gr. of quinine.	water.
12 noon (just before taking the quinine), fluorescence	$=\frac{1}{128}$ to $\frac{1}{64}$	to 1 litre.
12.10, fluorescence	=	,,
12.20 ,,	$=\frac{1}{4}$	,,
12.30 ,,	$=\frac{1}{2}$	,,
1 ,,	$=\frac{1}{2}$ to 1	,,
2 ,,	= 1	,,
3 ,,	$=\frac{1}{2}$ to 1	,,
4 ,,	$=\frac{1}{2}$ to 1	,,
8 ,,	$=\frac{1}{4}$ to $\frac{1}{2}$	,,
24 hours after quinine, fluorescence	$=\frac{1}{8}$	,,
48 ,, ,,	$=\frac{1}{32}$ to $\frac{1}{16}$	,,
72 ,, ,,	scarcely perceptible.	

Hence in from ten to twenty minutes the quinine is detectable in the urine, and in from two to three hours after four grains have been taken it is in greatest amount in the urine; and even in three or four hours the quantity in the urine may be diminishing, and for more than forty-eight hours it will continue to pass off. Before seventy-two hours are passed not a trace will be perceptible.

A boy passed urine at 12, and immediately took four grains of sulphate of quinine. The fluorescence was observed at different periods after the quinine was taken, half an ounce being taken for each determination.

Urine passed at	gr. of quinine.	water.
12 (just before the quinine), fluorescence not perceptible.		
12.10, fluorescence below	$\frac{1}{128}$	to 1 litre.
12.20, ,,	$\frac{1}{32}$	to ,,

Urine passed at		gr. of quinine.	water.
12.30,	fluorescence below	$\frac{1}{4}$	to 1 litre.
1,	,,	$\frac{1}{4}$ to $\frac{1}{2}$	,,
2,	,,	$\frac{1}{2}$ to 1	,,
3,	,,	$\frac{1}{2}$ to 1	,,
4,	,,	$\frac{1}{2}$ to 1	,,
8,	,,	$\frac{1}{4}$	,,
24,	,,	$\frac{1}{16}$ to $\frac{1}{8}$	,,
48,	,,	$\frac{1}{32}$	,,
72,	,,	scarcely perceptible.	

The same boy breakfasted at 8.30, passed urine at 12 noon, and immediately took four grains of sulphate of quinine. The fluorescence was observed in half an ounce of the urine passed at different periods after the quinine was taken.

Urine passed at		gr. of quinine.	water.
12 (just before taking the quinine),	fluorescence	$\frac{1}{128}$, little more,	to 1 litre.
12.15,	fluorescence	$\frac{1}{16}$ to $\frac{1}{8}$	
12.30,	,,	1	,,
1,	,,	above 1	,,
2,	,,	above 1	,,
3,	,,	above 1 (was at maximum)	,,
4,	,,	above 1	,,
8,	,,	1	,,
24,	,,	$\frac{1}{16}$	,,
48,	,,	$\frac{1}{128}$ to $\frac{1}{64}$	,,
72,	,,	not perceptible.	

Hence in fifteen minutes quinine is detectable in the urine, and in three hours the maximum quantity is present in the urine. In eight hours it begins to decrease; in forty-eight hours it is much decreased; and in seventy-two hours it has entirely disappeared.

Conclusions.

Part I.

From every texture of man and of some animals a fluorescent substance can be extracted, which is identical with the fluorescent substance that for some years has been known to exist in the lenses of man and animals.

This fluorescent substance, when extracted, has a very close optical and chemical resemblance to quinine, and when mixed with quinine it cannot be separated from it; we have therefore called it "animal quinoidine."

Part II.

By quantitative determinations of the amount of fluorescent substances naturally existing in the textures, we were able to determine the rate and time of increase of fluorescent substance in the vascular and non-vas-

cular textures of animals, and in the urine of man after quinine had been taken. By this means we have shown that in guineapigs, in fifteen minutes, the quinine has certainly passed into all the vascular, and most probably into the extra-vascular textures. In three hours the amount of quinine in the textures may be at the maximum; and for six hours it does not much diminish. In twenty-four hours the quinine sinks very considerably, and in forty-eight hours it is scarcely perceptible anywhere.

By similar experiments on cataracts in man, it appears that in two hours and a quarter traces of quinine may be found in the lens.

After quinine has been taken, it begins to appear in the urine in from ten to twenty minutes; in from two to three hours it has reached its maximum; in from three or four, or at longest eight hours, it begins to decrease; in twenty-four hours it has very much decreased; in forty-eight hours its presence is still detectable; but in seventy-two hours not a trace of it can be found.

April 19, 1866.

Lieut.-General SABINE, President, in the Chair.

The following communications were read:—

I. "Account of the Discovery of the Body of a Mammoth, in Arctic Siberia," in a Letter from Dr. Carl Ernst von Baer, of St. Petersburgh, For. Mem. R.S. Received April 17, 1866.

A la Société Royale de Londres.

Présumant que la Société Royale de Londres prendra peut-être quelque intérêt à la découverte nouvelle d'un mammouth avec sa peau et ses poils dans le sol gelé de la Sibérie arctique, je ne veux pas manquer de lui faire cette communication.

Déjà en 1864 ce mammouth a été trouvé par un Samoïède dans les environs de la baie du Tas, bras oriental du grand golfe de l'Obi. Ce n'est que vers la fin de l'an 1865, que j'en ai reçu la nouvelle. Mais comme dans ces régions les corps des grandes bêtes se conservent longtemps, s'ils ne sont pas pleinement mis à découvert, et que ce mammouth, au moins en 1864, restait encore enchâssé dans les terres gelées, l'Académie de St. Pétersbourg a expédié, avec l'aide du gouvernement, au mois de février de l'année courante, M. Fréd. Schmidt, paléontologue distingué, pour examiner non-seulement l'animal, mais aussi sa position dans la localité. Nous espérons que M. Schmidt arrivera avant que la destruction soit trop avancée, et qu'on aura non-seulement connaissance complète de l'extérieur de l'animal, mais aussi de sa nourriture par la dissection de l'estomac. Ce serait la première fois qu'un naturaliste soit venu à temps pour ces recherches, car Adams, comme on sait, est arrivé trop tard. Il a trouvé les crins tombés de la peau et a pleinement négligé d'examiner la nourriture.

Un rapport plus détaillé sur la trouvaille de ce mammouth et sur l'expé-