February 7, 1856.

Colonel SABINE, R.A., V.P. and Treasurer, in the Chair.

The following communications were read:—

I. "On the Vitality of the Ova of the Salmonidæ of different Ages; in a Letter addressed to CHARLES DARWIN, Esq., M.A., V.P.R.S. &c." By JOHN DAVY, M.D., F.R.S. Lond. and Edinb. &c. Received January 15, 1856.

MY DEAR SIR,—In a letter which I had the honour to address to you last year "On the Ova of the Salmon in relation to the distribution of Species," I have expressed the hope that some of the results of observations therein described may aid in solving the question as to the period, the age, at which the impregnated ova of fish are most retentive of life, and consequently are in the state best fitted for transport without loss of life.

Joining with you in considering the subject in need of and deserving further inquiry, I have taken the earliest opportunity that has offered of resuming it. The experiments which I have made, and which I shall now describe, have been more limited than I could have wished, having been confined to the ova of the Charr, as I was not able to obtain the ova of the Salmon or any of its congeners in a fit state for the trials required.

The ova of the Charr which have been the subject of my experiments, were from living fish brought to me from the river Brathay, a tributary of Windermere, on the 9th of November. They were obtained by the pressure of the hand on the abdomen of the females under water, and immediately after their expulsion a portion of liquid milt, procured in the same way from a male, was mixed with them for the purpose of impregnation.

The ova thus treated, 654 in number, procured from two fish,

were transferred, after little more than an hour, to a shallow glazed earthenware pan, of a circular form, about a foot in diameter, without gravel, the water in which, afterwards, was changed daily once, and once only. The vessel was kept in a room of a temperature fluctuating from about 55° Fahr. when highest, to about 40° when lowest. The water used was well-water of considerable purity, and before used it was allowed to acquire the temperature of the room.

Two modes occurred to me as likely to afford the means of testing the vital power of the ova, or their power of endurance without loss of vitality; viz. one by subjecting them for a limited time to a temperature raised above the ordinary temperature; the other, by having them conveyed to a considerable distance.

For the trials first proposed, the ova were put into a thin glass vessel half-full of water, which was placed in a water-bath and heated to the temperature desired.

The first experiment was made on ova taken from the general stock one day after their expulsion. Six, for two hours, were exposed to a temperature varying from 79° to 80° of Fahr. The result was, that they became opaque in the course of twenty-four hours, all but one, and that, some days after, underwent the same change, denoting loss of vitality.

The second experiment was made on the 10th of November. Six ova were similarly exposed for two hours to a temperature rising gradually from 70° to 78°; the result was similar: on the following day they were all found opaque.

The third experiment was made on the 11th of November. The same number of eggs were exposed for an hour to a temperature falling from 70° to 69°. Two shortly became opaque; four retained their transparency during a month, though in reality dead, which was denoted by their bearing no marks of development when seen under the microscope, those ova which retained their vitality being at that time well advanced.

The fourth experiment was made on the 1st of December; the ova, the same number, were exposed to a temperature rising from 75° to 78° for an hour and twenty-two minutes. Three became opaque, other three retained their transparency and vitality, and in due time were hatched, the first on the 31st of December, the last on the 7th of January.

The fifth experiment was made on the 13th of December. Six ova were exposed for an hour and twenty-five minutes to a temperature falling from 82°, which it was at the beginning, to 78°, which it was at the end. Two became opaque; in these no marks of progress could be seen of development, thus indicating that they were dead at the time of trial. Four remained transparent; in these, under the microscope, embryo-fish were seen with an active circulation of the blood-corpuscles. One of them was hatched on the 31st of December; one, the last, on the 6th of January.

The sixth experiment was made on the 20th of December, on six ova, containing living embryos. They were exposed for an hour and twenty-eight minutes to a temperature of about 98°, and this during the whole time. When taken out, they had not lost their transparency, but in each the heart's action was arrested, and death was the result: they all sooner or later became opaque, from the common cause, the imbibition of water.

The seventh experiment was made on the 21st of December, on six ova, in which the circulation was distinct in the fœtal fish. After an exposure for an hour and five minutes to a temperature of 70° rising to 82°, in five, on cooling, the circulation was found active; in one, stopped, which was dead; two were hatched on the 5th of January; three, the remainder, on the 7th of the same month.

The eighth experiment was made on the 23rd of December, on six ova, each containing a living fœtus. They were exposed to a temperature falling from 84° to 82° during an hour and twenty minutes. Examined after the water had cooled, in one, the circulation was seen pretty distinct; in two, very feeble; in three, the blood-corpuscles appeared to be stagnant. Examined on the following day, the circulation was seen active in all. One was hatched on the 5th of January, the other five in the two following days.

The ninth experiment was made on the 24th of December. Six ova were exposed for two hours and four minutes to a temperature falling from 72° to 70°. Examined a quarter of an hour after, and before the water was cold, the circulation was found vigorous in all. One was hatched on the 2nd of January, the remainder between the 5th and 8th.

The tenth experiment, and the last of its kind that I have to describe, was made on the 2nd of January. Six ova, in each of which

the circulation was distinct, were exposed for four hours to a temperature varying from 70° to 72°—the greater part of the time 72°. Examined immediately on being taken out, the circulation was seen uninterrupted in three, arrested in the other three. In three-quarters of an hour, when the water had cooled nearly to the temperature of the room, 55°, the circulation was found to be renewed in the latter. In the interval, one of the former was hatched, and a vigorous fish produced; on the following morning four more had come forth, and in the one remaining egg the fœtal circulation was vigorous; it was hatched on the 4th of January.

I beg now to pass to the other series of experiments referred to, those in which trial of the vitality of the ova was made by sending them to a distance. The method was briefly the following. The ova were lightly packed in wet wool contained in a tin-plate box perforated in its bottom to admit air, and covered with a wooden cover that had been soaked in water, with the intent of preserving moisture. The box was wrapped in tow, loosely covered with oiled paper, and the whole, in an envelope of common writing-paper, was well secured by a binding of thread. Thus prepared, the ova were sent by post to Penzance, in Cornwall, a distance exceeding 500 miles, with the request that they should be sent back by return of post unopened.

The first experiment was made on the 9th of November. The number of ova sent was thirty, taken from the common stock without selection. They were received on their return on the 14th of the same month. On taking them out, all were found transparent; but, with the exception of one, all became opaque on being put into water, and that one, after a few days, also underwent the same change.

The second experiment was made on the 14th of November. Twenty ova then sent were returned on the 18th. All became opaque on being put into water.

The third experiment was made on the 1st of December. Twenty ova then sent were returned on the 5th. Put into water, eleven became opaque within a minute; most of these were slightly shrivelled. After three hours, two more became opaque. After forty-eight hours, four only remained transparent; in these, under the microscope, the circulation was found active in two; in the other two it could not be detected. One was hatched on the 31st of December, the other died before hatching.

The fourth experiment was made on the 13th of December. Twenty-two ova then sent came back on the 17th. During the interval there was a severe frost; the thermometer here in the open air was constantly below the freezing-point, and it would appear to have been much the same throughout England. When examined, eleven of the ova immediately became opaque on immersion in water. In the other eleven there was no loss of transparency, and in these, under the microscope, the circulation was found active. Those which had become opaque were placed in a pretty strong solution of common salt, by which their transparency was restored, the saline solution dissolving the coagulum. Now examined, no traces of development could be detected under the microscope in any one of them,—showing that they had been dead before they were sent away.

On the following day, the 18th of December, the eleven transparent ova were repacked, and again sent the same distance. They came back on the 22nd; they retained then their transparency; placed in water, a feeble circulation was to be seen in two under the microscope; in nine the blood-corpuscles had ceased to flow; these became opaque. Of the two in which the circulation was perceptible, one was hatched on the 28th of December; the young fish in the other died, it would appear, in the act of breaking the membrane, its head, on the 29th, having been found protruding, but the heart's action stopped.

The fifth experiment was made on the 26th of December. Ten ova, in which the circulation was active, and the fœtus in each well advanced, were sent off on the day mentioned, and returned on the 31st. The weather, during the whole time, was mild, the frost having ceased. When opened, the ova were all found hatched, and the young fish dead, as might have been expected. When put into water, not one of them showed any signs of remaining vitality; they were all examined under the microscope.

The sixth and last experiment was made on the 6th of January. Six ova, in each of which the circulation was vigorous, were put into a glass tube of one cubic inch and a half capacity, with water to the height of about 1·4 cubic inch, the remaining space, after closure by a cork, being filled with air. The intention was to try the effects of conveyance to a distance on these ova in water with a small quantity

of air. Owing to a mistake, they were not forwarded. Examined on the following day, five ova were found hatched, the young fish dead; in the one ovum remaining unhatched, the fœtus was alive, the circulation active; on the 9th it burst its shell; the young fish was vigorous.

As I could not with any certainty determine, at the time the experiments were commenced, what eggs were impregnated and alive, and what were not, I had at the beginning thirty ova taken indiscriminately from the common stock, and put apart in a glass vessel, the water in which was also changed daily. Of this number, seven were found in progress of development on the 14th of December, or 23 per cent.; the rest had become opaque. One of the seven was hatched on the 31st of December, the others in succession, the last on the 8th of January.

Further to arrive at a proximate average of the proportion of impregnated and unimpregnated ova, or living and dead, on the 14th of December, when in the living ova the circulation was distinct under the microscope, and the embryos were visible even to the unaided eye, I examined the whole number then remaining, viz. 405, thus reduced, owing to 67 having been removed, one after another having become opaque, and 152 having been taken out for the purpose of experiments. Of these 405 remaining, 138 were found alive, each containing a well-formed embryo, and 267, though still transparent, without life, no marks of organization being to be seen in them, either with the naked eye or under the microscope. Hence, irrespective of the 152 experimented on, the proportion of living to dead on the 14th of December would appear to be as 138 to 364, or about 25 per cent. And, with the exception of two which died after the 14th, all those then alive were hatched, the first on the 31st of the same month, the last on the 9th of January.

What are the conclusions to be drawn from these results? From those of the first series of experiments, may it not be considered as proved that the power of resisting an undue increase of temperature is possessed in a higher degree by the ova in an advanced than in an early stage of development,—the degree probably being in the ratio of the age? From those of the second series, is it not as manifest that the power of bearing distant transport, and of retaining life in moist air, is in like degree increasing with age? And from both,

may not the general conclusion be drawn, that the strength of vitality of the impregnated ovum, or its power of resisting agencies unfavourable to its life, gradually increases with age and the progress of fœtal development? And as the Charr is one of the most delicate of the family of fishes to which it belongs, may it not further be inferred, with tolerable confidence, that the ova of the other and more hardy species of the Salmonidæ, were they similarly experimented upon, would afford like results, confirmatory of those obtained last year in some trials on the ova of the Salmon, and mentioned in my former letter to you?

The practical application of these results, and of the conclusions deducible from them, is obvious, and need not at present be dwelt upon.

I am, my dear Sir,
Yours very truly,
JOHN DAVY.

Lesketh How, Ambleside,
January 10, 1856.

II. "Note on a new Class of Alcohols." By M. AUG. CAHOURS and A. W. HOFMANN, Ph.D., F.R.S. &c. Communicated by Dr. HOFMANN. Received January 31, 1856.

On submitting to dry distillation glycerine, either alone or together with bisulphate of potassium or anhydrous phosphoric acid, M. Redtenbacher obtained a remarkable product, to which he gave the name of acroleine. Presenting all the characters of an aldehyde, and approximating more particularly to vinic aldehyde by the general aspect of its reactions, this substance changes under the influence of oxidizing bodies, especially of oxide of silver, an acid being formed, named by this philosopher acrylic acid, an acid which stands in the same relation to acroleine as acetic acid does to aldehyde.

The researches of MM. Will and Wertheim on the essential oils of mustard and of garlic, tended to indicate a relation between these substances on the one hand and acroleine and acrylic acid on the other, a result which was established by the more recent investiga-