has worked, perhaps for centuries, perhaps for millions of ages, to bring about some beneficent result, if we can but catch a glimpse of the wheels, its divine character disappears."

I agree with the writer that this first conclusion is premature and unworthy; I will add, deplorable. Through what faults or infirmities of dogmatism on the one hand and scepticism on the other it came to be so thought, we need not here consider. Let us hope, and I confidently expect, that it is not to last—that the religious faith which survived without a shock the notion of the fixity of the earth itself, may equally outlast the notion of the absolute fixity of the species which inhabit it—that, in the future even more than in the past, faith in an *order*, which is the basis of science, will not (as it cannot reasonably) be dissevered from faith in an *Ordainer*, which is the basis of religion.

VIII.—*Physico-chemical Investigations upon the Aquatic Articulata.* By M. Félix Plateau. Part II.*

The first part of my investigations, of which an abstract was published in this Journal in 1871 (vol. vii. p. 362), contained the results of my experiments on the causes of the death of the freshwater Articulata in sea-water, and of the marine Articulata in fresh water.

In the present memoir I take up three other interesting questions connected with the life of the aquatic Articulata—questions of detail indeed, the solution of which could not open any new vista in comparative physiology, but which, carefully treated, have led me by numerous experiments to curious and sometimes unexpected results.

I. *Experiments on the time during which the aquatic Articulata can remain in the water without coming to the surface to breathe.*

The swimming aquatic Articulata with aërial respiration (Coleoptera in the perfect state and Hemiptera) come frequently to the surface to renew their provision of air. If we prevent them from performing this operation, what will be the time during which they may with impunity be subjected to submersion? Is their resistance to asphyxia greater than that of terrestrial insects? or only equal or inferior to it?

The experiments were effected as follows: at the bottom of an open vase of the capacity of one litre, and full of ordinary spring water aërated, a smaller vessel containing about 200 cubic centimetres is placed; a piece of cotton net is stretched

* Bulletin de l'Acad. Roy. de Belgique, 2e sér. tome xxxiv. nos. 9 & 10, 1872. From an Abstract by the Author.

over the orifice of the latter, in such a way that an insect placed in this smaller vessel is actually in the general mass of water, but cannot rise to its surface.

Terrestrial insects placed in these conditions ascend, carried by their specific levity, till they rest against the lower surface of the net; the movements of their feet soon cease, they do not seem to suffer, and quickly become insensible. The aquatic Coleoptera and Hemiptera on the contrary, instead of submitting passively to their fate, seek to escape from their prison, swim about rapidly, endeavour to rise to the surface, and continue their agitation until their forces become weakened, and they finally remain as if dead at the bottom.

To cause an insect which has been subjected to a prolonged immersion to recover from its state of insensibility, it is necessary, after taking it out of the water, to dry it with bibulous paper. If the duration of the submersion has not exceeded a certain limit, the animal gradually recovers its original activity, the trial it has undergone leaving no sensible traces upon it.

These experiments were of course repeated as much as possible upon several individuals and with different durations, so as to ascertain for each species the limit of time after which the insect was actually dead. I have thus arrived at the following two curious conclusions, which are supported by a great number of experiments.

1. Terrestrial Coleoptera resist complete submersion during a very long time (from three to four days). For example,

Oryctes nasicornis	resists	a submersion of	96 hours.
Agelastica alni	"	"	72 "
Carabus auratus	"	"	71 h. 30 m.

2. Natatory aquatic Coleoptera and Hemiptera, far from presenting a greater resistance to asphyxia by submersion, are no better endowed in this respect than terrestrial insects, and even perish in most cases much more rapidly. I cite the following numbers from the tables in my memoir :—

A *Dytiscus marginalis* ♂	died	at the end of	65 h. 30 m.
An *Acilius sulcatus* ♀	"	"	24 hours.
A *Nepa cinerea*	"	"	31 "
A *Notonecta glauca*	"	"	3 "

The cause of this unexpected inferiority of the aquatic insects seems to consist exclusively in their greater activity in the water, and consequently in a more rapid expenditure of oxygen.

II. *Influence of cold: effects of congelation.*

What is the lowest temperature that the aquatic Articulata that we meet with in winter in these regioas can endure? can they remain with impunity fixed in the ice for a certain time? And, in the event of a negative answer, what is the cause of the mischief observed?

The aquatic Articulata of our latitudes exist indefinitely in water kept by means of melting ice at a temperature of 32° F. As soon as we have recourse to lower temperatures, the water freezes, and the question then arises to ascertain how long the animals can remain completely fixed in ice at 32° F.

All the experiments were made in winter upon the species which are met with in Belgium in December and January. They consisted in placing an aquatic insect or crustacean, together with the bulb of a Centigrade thermometer, in a thin glass tube containing a little water and surrounded by a freezing-mixture intended to produce the complete congelation of the liquid. Care was taken not to allow the temperature of the ice formed ever to descend below 0° C. After the lapse of a certain time the tube was taken out of the freezing-mixture and immersed in water of the temperature of the room, when, as soon as a commencement of fusion permitted, the lump of ice was extracted from the tube and put directly into water, in order to hasten the disengagement of the animal.

The analysis of the results which I have obtained shows that the time during which the aquatic Articulata may be fixed in ice without perishing is excessively short, the longest resistance not having reached half an hour. The following numbers will give an idea of the rapidity with which death ensues under these circumstances:—

	Imprisonment in ice at 0° C. (32° F.).		
	Maximum period supported without being followed by immediate death.		Period which inevitably causes death.
	minutes.	sec.	minutes.
Agabus bipustulatus	Between 15 and 20	0	25
Hydroporus lineatus	„ 25 „ 30	0	30
Gyrinus natator	„ 10 „ 15	0	15
Notonecta glauca	10	0	20
Corixa striata	2	0	3
Asellus aquaticus	10	0	15
Cyclops quadricornis....	1	30	2

I have endeavoured, by means of special experiments, to explain the cause of the rapid death of animals imprisoned in ice at 0° C.; but although these may, perhaps, be of a nature to interest the reader, I shall confine myself to referring for their description to my memoir. The primary cause of rapid death when Articulata are fixed in ice, seems to be the absolute privation of movement and the consequent absorption of the corporeal heat, without any possible restitution.

III. *Action of heat: maximum temperature.*

I have endeavoured to ascertain by experiment the highest temperature which our freshwater insects, Arachnida, and Crustacea can endure—in other words, what is the temperature of the hottest water in which they can live.

I have thus found that the highest temperatures endured without serious accidents oscillate between 33°·5 and 46°·2 C. (=92° and 115° F.), and consequently between very narrow limits.

These temperatures correspond with those of a certain number of known thermal springs, in the waters of which we may meet with articulate animals wherever the salts or gases in solution have no injurious action upon them.

If we compare the results with which the aquatic Articulata have furnished me with those which have been obtained by means of animals belonging to other groups, we find that the highest temperature that aquatic animals, whether vertebrate, articulate, or molluscous, are able to support probably does not exceed 46° C. (115° F.).

IX.—*Additional Notes on* Spatulemys Lasalæ. By Dr. J. E. Gray, F.R.S. &c.

[Plate II.]

Colonel P. Perez de Lasala has brought with him several very interesting specimens from his museum, and has kindly presented to the British Museum a fine adult broad-nosed alligator, and a freshwater tortoise from Rio Paraná, Corrientes, which is quite new to our collections, and the largest example of the family that has yet been brought to Europe; I have named it, from its very depressed form, *Spatulemys*, and dedicated the species to the enterprising collector, by calling it *Spatulemys Lasalæ* (Plate II.).

This species was characterized in the 'Annals' for 1872, x. p. 463, to which I wish to add the following particulars and comparisons with allied species, and also a figure of this very interesting animal.

The genus has many similarities to *Hydromedusa*; and I thought at one time that it might be the *H. tectifera* of Mr. Cope, brought from the Paraná or Uruguay river, and described