respiratory organs or lungs of other amphibious animals; but a similar viscus he has hitherto sought for in vain in the larvæ of water lizards or other animals of that description.

Concerning the habits of this singular animal, we learn from a friend of the author, who resides near the lake where it is found, and who had the good fortune to keep one of them alive during several days, that it seemed at all times very torpid; that though it would occasionally swim with the help of its broad tail, it was in general motionless at the bottom of the water. Sometimes it rose to the surface, stretched its head out of the water, seemed to take in air, but immediately returned to the bottom. It crept by means of its feet both at the bottom and on the side of the vessel, but so slowly that the circumstance may be thought characteristic of the animal. Sometimes, putting its head out of the water, it produced a hissing noise, louder than could have been expected from so small an animal.

The author, lastly, compares this singular production with the *Siren lacertina* of Linnæus, which has since been classed with the fishes under the name of *Muræna Siren*, and finds a considerable analogy between the two: and though he seems unwilling to determine whether the animal he describes be perfect, or only a larva of some unknown species, the facts he has adduced will probably be thought to favour the former of these opinions.

Observations tending to investigate the Nature of the Sun, in order to find the Causes or Symptoms of its variable Emission of Light and Heat; with Remarks on the Use that may possibly be drawn from Solar Observations. *By* William Herschel, *LL.D. F.R.S.* Read April 16, 1801. [*Phil. Trans.* 1801, *p.* 265.]

The principal object of this paper is to explore the causes or symptoms of the variation we observe in the emission of light and heat from the sun.

Considering the great influence of these agents on most of the concerns of life, it is scarcely necessary to point out the importance of the inquiry: not that any discoveries we may make on the subject will ever enable us to modify their operations, but that, by a due knowledge of them, we may be guided in our own proceedings, in the same manner as we frequently are by the meteorological instruments, on whose combined indications we have been taught to place a certain degree of confidence.

In order to obtain as intimate a knowledge of the sun as that which is required for the purpose here indicated, it is obvious that the first step must be to become well acquainted with all the phænomena that usually appear on its surface: and this accordingly is the subject of the first part of the present paper. Dr. Herschel premises his reasons for substituting a new set of names for those of spots, nuclei, penumbræ, faculæ, and luculi, hitherto used to denote certain appearances on the sun. Those he adopts are, openings, flats, ridges, nodules, crankles, shallows, dimples, and punctures.

The following definitions of these new terms, together with the principal circumstances relating to those appearances, as deduced from a long series of observations, will, it is hoped, sufficiently indicate the contents of this section. Whoever peruses this paper must, however, here recollect that Dr. Herschel has long considered the sun as an opake habitable globe, possessed of an atmosphere in which luminous clouds, ever varying in form and dimensions, are continually floating, and produce the appearances of which the following is an enumeration.

1. *Openings*, or places where the luminous clouds are removed.—When these are large, they have generally flats about them; and the small ones are without flats. They are also frequently attended by ridges and nodules. New and incipient openings frequently break out near former ones; and they often change their figure, run into each other, and turn into shallows, or other appearances of a different description.

2. *Flats*.—These are described as planes depressed below the general or brightest surface of the sun, or places from whence the luminous solar clouds of the upper regions are removed. Their thickness is visible at the edges of the openings: from the various changes they undergo, it is inferred that they are occasioned by some emanation, perhaps an elastic gas, coming out of the openings, which by its propelling motion drives away the luminous clouds from the place where it meets with the least resistance, or which by its nature dissolves them as it comes up to them.

3. *Ridges*, or elevations above the general surface of the luminous clouds of the sun.—These generally accompany openings, and often gather and disperse alternately. They are ascribed to some elastic gas, acting below the luminous clouds, which first lifts them up, and at last forces itself a passage through them by throwing them aside.

4. *Nodules*.—These are small but highly elevated luminous places. They may frequently be ridges fore-shortened, and are probably in all cases produced in the same manner.

5. *Crankles*.—These consist of elevations and depressions, which produce a mottled appearance that often spreads over the whole disk of the sun. They frequently change their shape and situation, and may perhaps be occasioned by the expansion of ridges or nodules.

6. The dark parts of crankles are here called *Shallows*.—The small ones have no openings; but in some larger ones apertures have been perceived, through which the opake part of the sun was discernible. They are thought to be of the same nature as flats, and are perhaps at the same depth below them as the flats are below the general surface of the sun.

7. *Dimples* are small depressions, or indentures, and often contain very small openings. They differ from crankles chiefly in size.

8. Lastly, the low places of dimples are called *Punctures*. These increase sometimes, and become openings, and at other times vanish very rapidly.

Having thus enumerated, according to his new nomenclature, the

phænomena from which he derives his inferences concerning the nature of the sun, Dr. Herschel proceeds next to treat of the *regions of solar clouds*. The point he here principally insists upon, is, that the above-mentioned appearances are wholly incompatible with the hypothesis of the shining matter of the sun being a liquid, or an elastic fluid of an atmospheric nature; since, by the laws of hydrostatics, all the depressions would be instantly filled up, and the elevations would as rapidly subside. The opinion he advances is, that this shining matter exists in the manner of empyreal, luminous, or phosphoric clouds, residing in the higher regions of the solar atmosphere. Of these he assumes two different regions, or a double stratum of clouds, whereof the lower, viz. that which is nearest the sun, consists of clouds less bright than those of the upper stratum. The lower clouds are also more closely connected, while the upper ones are chiefly detached from each other, and permit us everywhere to see through them.

A number of additional observations are here added; from which it is inferred, that the inferior clouds are opake, and probably not unlike those of our planet; and that their light is only the uniform reflection of the surrounding superior, self-luminous region. These lower clouds, it is thought, compose what the Doctor calls *flats;* and by a contrivance here described, he demonstrates, that the quantity of reflected light they transmit to us is to that of the superior and self-luminous clouds in the proportion of 469 to 1000.

By the same process he proves also that, adhering to the same proportion, the quantity of light reflected by the solid body of the sun at the openings is represented by a number no greater than seven. Speaking of the planetary clouds, it is shown of what eminent service they must be to the whole solar system; since, by their means, nearly one half more light is transmitted to us from the sun than we should receive from the self-luminous stratum alone.

In a section *on the solar atmosphere,* after showing that its existence cannot be denied,—since the clouds could not be kept suspended in the manner in which they are without an elastic atmospherical fluid to bear them up,—reasons are assigned why this atmosphere must be of a greater extent, of considerable density, transparent, and, like ours, subject to agitations by winds and other disturbing causes.

From these various observations and inferences is next derived a *theoretical explanation of the solar phænomena;* wherein the manner is described in which all the above-mentioned appearances on the surface of the sun are likely to be generated: after which follows an enumeration of the *signs from which we may infer a deficiency or abundance of luminous matter in the sun.* The former of these are a deficiency of empyreal clouds, of openings, and of ridges, nodules, and all that may be considered as prominences; whereas the opposite appearances are indications of increasing light and heat. The Doctor now does not scruple to assert that openings with great flats, ridges, nodules, and crankles, may induce us to expect a copious emission of heat, and therefore mild seasons; and that, on the con-

trary, punctures, dimples, and a poor appearance of the luminous clouds, the absence of ridges, nodules, large openings, and flats, denote a spare emission of heat, and may induce us to expect severe seasons.

Pursuing this last idea, Dr. Herschel subjoins, at the end of his paper, a comparative view of the best accounts that are to be met with of the appearances of the sun at particular periods as far back as the middle of the seventeenth century, with the state of the seasons during the same periods. Of the latter, the best information could only be gathered from the state of vegetation, particularly of corn, of the price of which registers have been kept many years back: and though this price be by no means an accurate criterion of the quantity of corn produced, yet it is recurred to as the least objectionable that could be obtained. The result of this review actually leads to the conclusion, that the price of wheat has constantly risen during the time the sun has been without spots; and that it has always fallen when those spots began to re-appear.

The Doctor seems aware of some fallacy in this mode of argumentation; but he adds some hints by which several of the objections might, he thinks, be obviated.

Observations on the Structure, and Mode of Growth, of the grinding Teeth of the Wild Boar, and Animal incognitum. *By* Everard Home, *Esq. F.R.S.* Read May 7, 1801. [*Phil. Trans.* 1801, *p.* 319.]

The author on a former occasion laid before the Society an account of certain peculiarities in the growth of the grinding teeth of the Sus æthiopicus, and pointed out the similarity of their structure to that of the elephant. Having since discovered that a like resemblance extends also to the dentition of the wild boar, though in a less degree, and at a later period of life, he is pleased to communicate to the Society, in his present paper, some further remarks on this curious subject.

We here learn, that in the species of the Sus, the first or temporary grinders are sixteen in number; viz. four in each side of the upper, and as many in the under jaw; that these are shed in the usual manner; and that their places are supplied by larger teeth, rising from the substance of the jaw, immediately under the old ones; that before these first teeth are shed, one of the more permanent grinders is formed in the posterior part of each jaw, which, although it be in its place with the first set, is yet to be considered as belonging to the second; that besides these five teeth, the rudiments of a sixth are formed in each jaw, which afterwards grows larger than the preceding ones, the jaw increasing in size, so as to make room for this as the posterior grinder; that this tooth, when perfect, is double the size of the other grinders, its masticating surface having eight fangs, so that it very much resembles two large grinding teeth incorporated into one; that, in time, the rudiments of a seventh tooth