able to bring about; it is this elimination, and nothing else, that constitutes the curative action.

I will now beg the reader to ponder over the two following facts, and see if he can reconcile them with Dr. Takaki's theory: 1st. The mountaineers of Japan, who have the reputation of being rice gluttons, eating, in fact, nothing else, are never afflicted with beri-beri. 2nd. There is, in the mountains of Japan, one beri-beri centre, and only one. What is more, this exceptional place is 800 metres above sea-level, it is called Shinano.[3] But see how strikingly, here, the exception confirms the rule. Shinano is again surrounded by higher hills, so that it is really a cup from which the carbonic gases cannot escape. The outbreaks of beri-beri in Shinano are explained by the latter circumstance, not by any extra rice-gluttony of the Shinanoans, or the excessive humidity of their climate.

THE ORIGIN OF GOLD.

BY PHILIP LAKE, CAMBRIDGE, ENGLAND.

THE subject of the origin of gold, or of the manner in which that metal has reached its present positions, is one which has at all times excited considerable attention, and the number of theories put forward has been almost as great as the number of writers on the question.

It is easy to understand the presence of gold in alluvial deposits, for this has clearly been derived from pre-existing rocks; but the difficulty lies in determining how the auriferous quartz-reefs and other rocks which we look upon as the home of the gold, became impregnated.

Sir Roderick Murchison, from his observations in the Ural Mountains, originally held that non-alluvial gold was only found in Paleozoic rocks, and principally in his Lower Silurian; but he believed that it was not introduced into these rocks until shortly before the Drift period. Subsequently he was led to modify these views to a certain extent, and to admit that Secondary and Tertiary strata when penetrated by igneous rocks or impregnated by mineral veins, might also contain gold.

More recent observations show that gold may be found in rocks of any age in metamorphic strata; but all the evidence seems to support Murchison's next contention, viz., that gold is of igneous origin.

There is probably no more instructive area to illustrate this than Southern India, where the distribution of gold has been carefully worked out by Mr. R. B. Foote, of the Geological Survey of India. Almost the whole of this part of India is made of crystalline and metamorphic rocks; and in it there are a large number of gold fields, more or less rich. A closer examination of the country shows that we have here a large mass of gneissic and granitoid rock which is crossed by a number of bands of schist, lava flows, hæmatite beds and conglomerates. Mr. Foote has shown that these bands belong to a system which is distinct from, and newer than, the gneiss, and to this system he has given the name of Dharwar. He has shown also that all the gold fields of Southern India, with the possible exception of the Wynaad, lie within these Dharwar bands.

As usual, the gold is found principally in quartz-reefs; and it is a remarkable fact that though quartz-reefs are by no means uncommon in the gneiss, as well as in the Dharwar beds, yet those in the gneiss are never auriferous. It is clear therefore that the gold cannot have been introduced into the reefs from below, for in that case there would be no difference in that respect between the reefs in the gneiss and the reefs in the Dharwar.

Only one other possible conclusion remains, viz., that the gold originally lay in the Dharwar rocks themselves, and that it has since, by some process of segregation, been gathered together in the quartz-reefs.

It has already been stated that lava-flows occur among the Dharwar rocks; and my own observations have led me to believe that many of the schists also are lava-flows. In fact a very large part, if not the greater part, of the system appears to be of volcanic origin.

It may be concluded therefore that the gold which we now find in the auriferous reefs of Southern India was derived from the rocks of the Dharwar system; and that it was originally brought up from the depths of the earth by the lava-flows which form so large a part of that system.

ON THE EXTREMES OF HEAT AND COLD UNDER WHICH THE LIFE OF SPECIES IS POSSIBLE.

BY HENRY DE VARIGNY, SC. D., MUSUEM OF NATURAL HISTORY, PARIS, FRANCE.

MARQUIS DE NADAILLAC contributed some months ago (January 27, 1893, page 49) to this paper an interesting note concerning the extremes of heat and cold endured by man, on the extremes of external temperature which man has been able to resist. The topic I wish to call attention to is entirely different. We all know that man, for instance, when resisting the extremes of heat and cold, hardly alters at all his internal temperature, and that when for some reason or other the latter decreases or increases, life is in great peril. To show the extremes of heat and cold man can endure is merely to illustrate the means he has at his disposal to fight heat and cold and to maintain his own internal temperature, and as these means are numerous and powerful, we may well feel assured that man may resist very extreme conditions by intelligent use of the offensive or defensive weapons he is provided with. The matter I wish to call attention to is the very reverse, in one sense, of the facts quoted by Marquis de Nadaillac. I wish to show which are the extremes of heat or cold which individuals may really undergo permanently, without damage to themselves and posterity. To answer the question, we need to consider organisms which have no proper heat to speak of, but assume the temperature of their environment; we want what generally goes by the name of *cold-blooded*, or *heterothermal* organisms, and we must have them aquatic, not terrestrial, because we very well know that terrestrial cold-blooded animals do not necessarily have the same temperature as the air which surrounds them; nor do plants. Air is a bad conductor of heat, and in air evaporation and transpiration prevent the temperature from going very high. So we want organisms living in water, because in this case, as they hardly produce any heat, they must necessarily have the temperature of the water they live in, moreover we want our organisms to be able to withstand heat or cold, not only individually, but specifically: they must resist as individuals and as members of a species, they must be able to proceed to reproduction. In fact, what we want is the permanent extreme degree of water (in heat and cold) under which organisms are able to live, and to give off posterity.

As far as I can judge at present, these extreme degrees are, in Centigrade scale, minus 2° and plus 74°.

Arctic explorations have shown that even within the

[3] "Even the rule that the disease does not overstep certain quite low levels is shaken now; for the province of Shinano, walled in by mighty mountain chains, forms a plateau which, in many Kakke-ridden places, is raised 800 metres above the level of the sea. But, although these regions are not near the sea-level, they have yet a comparative depression; that is, they are low-lying plains, by the side of the circumjacent mountains, a circumstance of vast significance." BAELZ.

"Within the cities, also, the deep-lying parts show more cases of the disease than those of an elevated situation." BAELZ.