tive to say that no other like it will ever be discovered.

But they seem to think that our earth is very much the best abode for life ever discovered by astronomers. Mars is the only other heavenly body yet known, with conditions approximately adapted to the maintenance of life such as we know it upon the earth; and it is probable that if a strong, healthy man could be suddenly transported to our sister planet, he would be able to breathe and live there for a time. It has a rare atmosphere, water, snow, and ice, day and night, and seasons very much like those upon the earth. But, of course, it is not possible to say that man could flourish on a planet like Mars any more than he can flourish on the tops of the highest peaks of the Andes or Himalayas.

THE FIRST TOOLMAKERS AND THEIR METHODS.

Of man's existence during the geological period known as the Quaternary, or diluvial, we have evidence in his exhumed bones as well as in his flint implements. The latter bear obvious and unquestionable marks of human workmanship and, in most instances, are specialized, or made for certain definite uses. From their varying character this long period has been divided into the palaeolithic or earlier stone age (*époque de la pierre taillée*) in which the tools are merely rough chips or splinters of flint, and the neolithic or later stone age (*époque de la pierre polie*), in which the flint implements are well finished and smooth. In recent years there have been found in still older or Tertiary strata objects of flint in which the evidence of human workmanship is so slight that when Bourgeois, in 1867, first exhibited them as proof of the existence of man in the Tertiary period, he was simply laughed at.

Therefore, as Virchow has said, the question of the existence of the Tertiary man resolves itself into the problem of discriminating between natural and artificial forms of flint. The methods employed by these primitive toolmakers are also of general interest because, to the uninitiated, their selection of so hard a material as flint, and the possibility of working it at all with their crude appliances, must appear incomprehensible.

But, though flint is very hard, it is also very brittle. It is easily broken by striking or pressing, even with a much softer substance, and the resulting fragments possess sharp points and edges which make them suitable for use as spear heads and cutting tools in general. Glass, and the comparatively rare mineral obsidian, have properties much like those of the widely-distributed flint, and both, as we shall see, have been put to the same uses. In this way gunflints were made in quite modern times. A good workman, armed with an iron hammer, could turn out several hundred in a day.

But the diluvial and Tertiary men did not possess iron hammers. Their probable methods of working flint may be inferred from those of races whose stone age has continued to the present day. Such are the natives of Australia, Papua, Alaska, and Tierra del Fuego.

The Australian holds the flint between his feet and strikes it repeatedly in the same direction, but not violently, with another stone, obtaining sharp and slightly-curved splinters of various lengths, suitable for knives and arrow heads. Edward Krause, probably the highest authority on the subject, has seen and described the methods of both Alaskan and Fuegan toolmakers. The Fuegans preferred broken bottles as material, employing flint only on request and reluctantly, because it is harder to work than glass. The piece of glass was first rough-hewn to shape—with the assistance of the teeth in some cases—and then finished with the aid of a tool made of walrus bone. The Alaskan Eskimos use a tool made of reindeer horn, with a handle of fossil ivory, which abounds in Alaska. When great pressure is required the end of the handle is put to the shoulder.

Krause's explanation of the action, in both cases, is that the soft tool is first indented by the sharp edge of the flint or glass. Then, as the tool is moved along the edge with a constant outward pressure, a splinter is forced off. Krause himself succeeded in splitting glass with a tool of hard wood.

At the time of the Spanish conquest of Mexico, the Aztecs, who were still in their stone age, worked obsidian in a similar manner. Torquemada describes the process as follows: "The Indian cutler holds a piece of obsidian, about eight inches long and as thick as a man's leg, on the ground between his feet, or in tongs or a vise, and with hands and breast forces against it a stick of wood with a rounded end. The great pressure breaks the stone, yielding a sharp, pointed knife, the edge of which is the original edge of the stone."

We may assume that the men of the European stone age made their flint implements by methods similar to these. The implements bear characteristic marks of blows or pressure. On the inner surface of the splinter appears a slight, rounded elevation, the *bulbe de percussion*, and the surface of the flint nucleus, or remnant, shows a corresponding depression. The little nicks, or *retouches*, made by blows or pressure on the edges of the fragments are still more characteristic. The recent researches of Rutot, Krause, and Klaatsch have proved that these marks cannot be simulated by simple fractures or by the effects of heat, cold, or water.

Many exceedingly crude flint implements, called "eoliths," have been found in the oldest diluvial strata in Belgium, France, Germany, and Egypt. Rutot, Klaatsch, and Capitan have found numerous eoliths, also, in Tertiary strata in France and England.

In order to put the existence of the Tertiary man beyond all doubt Dr. Max Verworn has been making extensive explorations near Aurillac, in Auvergne, where Capitan and Klaatsch have recently worked with success. In a paper read before the Anthropological Society of Göttingen, on June 30, 1905, Dr. Verworn gave an account of his investigations, the complete report of which will shortly be published by the Royal Scientific Society of Göttingen, which financed the undertaking. The strata explored are defined as belonging to the upper Miocene, or lower Pliocene, by the occurrence in them of bones of the dinotherium and the hipparion (a progenitor of the horse). Of the many flints exhumed, from 16 to 30 per cent (in various localities) showed unquestionable marks of human workmanship, and only from 15 to 20 per cent were as certainly not worked.

The large proportion which remains as doubtful is explained by the fact that Verworn accepts only the combination of the face marks with the edge marks already mentioned as incontestable evidence of human workmanship.

Many of the pieces show the typical elevations on one face and depressions, or "negatives," on the other, with very numerous marks, parallel and made by blows in the same direction, on one edge or side, while the remaining edges are very sharp. Nuclei, or flints from which chips had been taken, were also found.

It appears, therefore, that there lived in Auvergne, at the end of the Miocene, a race of beings whose skill in toolmaking implies a period of development which carries the first approximation to humanity back to a far remote antiquity. No remains of these creatures have come down to us. We do not know whether they made use of clothing, fire, or articulate speech, whether they may fairly be regarded as men or only as the ancestors of men.

LITERATURE FOR CONVALESCENTS.

For reading during convalescence the British Medical Journal would prescribe literature that cheers but does not inebriate, and would contraindicate writers "whose style, like that of George Meredith, puts a constant strain on the understanding of the reader, or, like that of Mr. Maurice Hewlett, irritates by its artificial glitter, or, like that of Marie Corelli, annoys by its frothy impertinence." Dickens should go well during convalescence—except "Pickwick," at least in surgical cases, because of the many side-splitting episodes which would play havoc with the union of parts. And for the same reason, in order that healing granulations may not be interfered with, we would absolutely interdict Mark Twain. Smiles's "Self Help" is quite innocuous; but we should be cautious in recommending it, in order that the patient may not thereby be led to meditate over a misspent career, and to have suggested to him all the opportunities in life he might have grasped but did not. A despondency might thus be induced which would delay a restoration to health, and which might even prove fatal. Thackeray (except "Vanity Fair," which is a pessimistic book) should go very well; "Pendennis" and "Barry Lyndon" will certainly entertain. The magazines of the day are placid and cheering enough; and in them one will seldom come upon a story sufficiently original or vigorous to excite anybody. Punch will, of course, be always in order—for its humor is of the soothing sort, which never arouses one's risibilities, but keeps him always within the decorous limits of a smile.

TWENTY-FIVE ELECTRIC LOCOMOTIVES FOR N. Y., N. H., AND H. R. R. CO.

An order for twenty-five electric lomotives has been placed with the Westinghouse Electric and Machine Company by the New York, New Haven & Hartford Railroad. These will be driven by alternating current, single phase. Each locomotive is to weigh 78 tons, and is to be equipped with four motors, each of 400 horse-power, making a total of 1,600 horse-power for each locomotive. This is 600 horse-power greater than steam locomotives in present use.

The motors will be able to maintain a speed of 26 miles an hour in local service, reaching a maximum speed of 45 miles an hour between stations, and hauling 200 tons. In express service a speed of 60 to 70 miles an hour can be maintained with a train weighing 250 tons.

SCIENCE NOTES.

A boiler furnace, as is known, works best when as little heat as possible escapes through the chimney. To some extent, says Technische Berichte, this escape is unavoidable, for if all the heat were utilized, the chimney would not draw, since it is the heat in the chimney which first produces the draft in the furnace necessary for burning the fuel. Nevertheless, too much heat escapes by the chimney in most cases. A patent recently granted professes to rectify this defect by bringing the flue containing the products of combustion to the place where the steam is applied before it passes into the chimney. The air, steam, or hot water and feed pipes are passed through this flue, so that the heat contained in the gases of combustion prevents radiation from the pipes in question and contributes to the heating of the air, water, and steam.

There are interesting and suggestive symptoms of a wholesome reaction against the evils of the sedentary life. Parks and open spaces are being liberally provided; public and private gymnasiums are rapidly coming into being; public playgrounds are thrown open in many of our cities, free of expense to the laboring, but, nevertheless, often sedentary, population; vacations are more than ever the fashion; sports and games are everywhere receiving increasing attention; while public baths and other devices for the promotion of personal hygiene are more and more coming into being. All this is as it should be, but all is as yet only a beginning. Here the science of education is sadly at fault, and in the direction of educational reform as regards personal hygiene lies immense opportunity for a contribution to public health science.

The growing of grapes in graperies furnishes quite a source of revenue in some countries, notably Belgium and the Channel Islands, where large quantities are annually grown and exported, the United States being a good customer for them, as high as 35 cents to 75 cents per pound wholesale, and $2 to $3 and even more per pound retail, being paid for the fruit. Grape growing in pots is much practised and in parts of Europe, and especially in France, where these are largely used for decorative purposes on festive occasions. The keeping of grapes in cool storage is deserving of more extensive practice and development. Shipping and keeping grapes in cork dust is quite an industry in some of the European grape districts, and a considerable quantity of such grapes, shipped from Spain, is annually consumed in this country.

If electric phenomena are different from gravitative or thermal or luminous phenomena it does not follow that electricity is miraculous or that it is a substance. We know pretty thoroughly what to expect from it, for it is as quantitatively related to mechanical and thermal and luminous phenomena as they are to each other; so if they are conditions of matter, the presumption would be strongly in favor of electricity being a condition or property of matter, and the question, "What is electricity?" would then be answered in a way by saying so, but such an answer would not be the answer apparently expected to the question. To say it was a property of matter would be not much more intelligible than to say the same of gravitation. At best it would add another property to the list of properties we already credit it with, as elasticity, attraction and so on. In any case the nature of electricity remains to be discovered and stated in terms common to other forms of phenomena, and it is to be hoped that long before this new century shall have been completed, mankind will be able to form as adequate an idea of electricity as it now has of heat.

THE CURRENT SUPPLEMENT.

The current SUPPLEMENT, No. 1556, opens with a splendidly-illustrated article on a vertical rolling-mill 18,000-horse-power engine, the largest of its kind that has ever been built. Among the many means that contribute to the evolution and better performance of machines, and that determine their endurance and economy of construction, there is one, sometimes ignored and in all cases underrated—the phenomena of their operation, which are not computable or learned by rule. This subject has been very interestingly treated in a paper by Mr. John Richards. A protected galvanometer is described and illustrated. Mr. J. H. Morrison's history of the iron and steel hull vessels of the United States is continued, the period of 1840 to 1860 being discussed. Mr. H. Percy Ashley tells how an improved ice yacht may be constructed. His article is accompanied by elaborate working drawings. Sir William H. White's sixth paper on submarines is presented. "How Our Senses Deceive Us," is the title of an article by Dr. Horace Wilson, in which many a curious bit of information is given. Prof. Richter writes entertainingly on the inhabitants of a piece of moss. Dr. Hugo de Vries, the man who gave us the mutation theory of the origin of species, a theory which is very likely to supplant that which has been advanced by Darwin, writes on the evidence of evolution in a way that cannot but impress even the reader who is not particularly interested in biology.