NEW KIND OF RAYS EMITTED FROM THE BRAIN AND NERVE CENTERS.

In continuing his researches upon the rays which are given off from living organisms, and especially the human body, M. Aug. Charpentier brings out some remarkable facts. He seems to have proved that the brain and nerve centers not only give off N-rays, but also a new form of radiation which is peculiar to them. The N-rays will pass through an aluminium screen, while the new rays will not. In a paper read before the Académie des Sciences he mentions his new researches.

The emission of the N-rays by living organisms is not confined to the human body. Different animals, such as the rabbit and frog, will produce them, and no doubt the inferior animals as well. Here, as before, it is the muscles and nerves which form the principal source, and the emission of rays is stronger as these are in a state of greater activity. The frog, in spite of its small size, is a good subject, and shows that the effect is not due to an increase of temperature. This can also be proved for warm-blooded animals by heating the phosphorescent test-screen to 40 degrees C. or more (when it becomes more luminous) and its phosphorescence increases as before when placed near the muscles, nerves or nervous centers, even in a state of rest, and the effect is still stronger when these are in a state of activity. The rays act upon all forms of phosphorescence. The N-rays from the sun were found to increase the brightness of the glow-worm. M. Charpentier finds that phosphorescent bacteria have their brilliancy increased when placed near the heart, muscles, and nervous centers, in about the same way as sulphide of calcium.

Seeing that solids under pressure generally emit the N-rays, the latter were sought for in the tendons during the muscular contraction, but no effect was found. On the contrary, the bony portions which were compressed by the tendons showed a decided action. The tendons have but few nerves, while the preceding points are abundantly supplied with nerve terminals, whose compression explains the effect. It is observed that even a slight compression of a nerve considerably increases its power of augmenting the brightness of the screen, but after a time the effect dies away. It is found that it is the nerve centers of the body which have the strongest action in emitting the N-rays. The path of the spinal cord can be traced by the proof-screen. At the upper part the effect is stronger. When the arms are contracted, a corresponding increase is seen in this part of the spinal cord, and if only one arm is contracted the effect is noticed on one side alone, due to the increased activity of this part.

To explore the rays, M. Charpentier uses straight tubes of lead, from 2 to 4 inches long, one end being placed against the body and the other containing a small disk of cork or cardboard covered with the phosphorescent sulphide. Large screens cannot be used, as each part is influenced by the others and the whole gives a uniform brightness when the rays fall upon it.* One of the most interesting experiments is made upon the brain, by localizing the different centers of its surface. For instance, the so-called *psycho-motor* zones of the brain surface should, according to these experiments, show a local emission of N-rays during their special activity. This was found true for some of the best-defined zones. Among the latter is the zone which was found by Broca to be the center for articulate speech. Its projection upon the skull has been determined with a certain precision by recognized rules. M. Charpentier found that when the subject spoke with a loud voice, or even in less degree, the proof-screen showed a greater activity in this region. He has reason to believe that even the action of thought, attention, and other mental effort gives rise to an increased emission of the N-rays from the brain, and is now making observations on this point. The same effect was found in the case of other centers allotted to the act of writing, movements of the upper members, etc. The conclusion is that a nervous center increases its emission of N-rays when in a state of activity. These rays are transmitted by divergence according to optical laws. They are refracted more or less by different media and are manifested by an increase of brightness in the proof-screen, which is variable according to the intensity of the emission and the distance.

In a second note, M. Charpentier brings out the interesting point that the rays given out by living organisms differ from the N-rays discovered by M. Blondlot in certain points, and he thinks they are formed of N-rays and another new form of radiation. This is especially true of the rays from the nerve centers or nerves, whose striking characteristic is that they are partially cut off by an aluminium screen. A sheet 1-50th of an inch is sufficient to cut down considerably the rays emitted by a point of the brain. The portion of the rays which passes through the screen is no longer cut off by new screens of the same metal, even an inch thick. This latter part therefore consists of N-rays proper. On the contrary, the rays from the heart, diaphragm, and different muscles are scarcely modified by the aluminium screen. This forms a characteristic distinction between the muscular and the nerve radiations. Other differences also separate the two. The effect from the nerves is strongly increased by compression; that of the muscles is much less so. A third characteristic of the nerve radiation is that it gives a much stronger effect over the other tissues upon a phosphorescent screen which has been heated to 40 or 45 deg. C. These facts show the predominant and special role of the radiation coming from the nerve tissues. It is the nerve radiation which shows the greatest differences from the recognized N-rays.

* It may be of interest to give some practical indications as to the method of observing these radiations. A quantity of sulphide of calcium (phosphorescent) is spread upon a piece of black cardboard and fixed by collodion so as to form a thin layer; the spot should be at least 0.8 inch in diameter. It is then solarized moderately. The screen is observed in a dim light, darkening the room according to the brightness of the surface. The screen should be observed by indirect vision without looking at it too strongly. It must be remembered that the variations of brightness are produced gradually, with an inertia which depends upon the thickness of the sulphide; it is therefore of advantage to diminish the thickness of the layer. The proper precautions should be taken for eliminating outside effects.

EXTENSIVE SUBMARINE CONSTRUCTION PROGRAMME FOR GREAT BRITAIN.

BY THE ENGLISH CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

Among the maritime nations of Europe there is a feverish anxiety to equip the respective navies with a large force of submarine vessels. When this naval fighting unit was at first conceived, it was regarded with skepticism by many of the powers, notably Great Britain, Germany, and Russia. But its rapid development in both France and this country, wherein the efficiency of the craft was demonstrated, has been such that there is a strong disposition among the more conservative nations to make up leeway, so as to reduce to a considerable extent the heavy lead that has been gained by France. Great Britain was the first to follow the lead of the two countries named. It did not try to design a new type of submarine vessel, but availed itself of the Holland boat, which had at that time even become a pronounced success.

This vessel was utilized as a basis of operations, and when one or two boats of this type had been built, native inventors and naval designers set to work to incorporate their own improvements and developments. Many such contrivances and devices have thus been secured, but in the main the vessels are Holland boats.

The English Admiralty has been conducting several severe experiments with the submarines so far constructed and highly satisfying results have been achieved. At first the construction of the submarines was only carried out in a tentative manner, but now the Admiralty has decided upon an extensive scheme.

The description of vessel decided upon is a submersible torpedo boat rather than a genuine submarine. When first devised it was intended to act merely as a weapon of defense. Now, however, its offensive capabilities are well established and the principal object is to design a vessel that can travel for a long distance on the surface at a fast speed, and capable of diving instantly below the surface when the necessity arrives.

The new vessels for the British navy are to be of 200 tons displacement. Experiments have shown, at least so far as the British Admiralty is concerned, that these vessels should have as great a radius as possible, and this result cannot be obtained with a less displacement than 200 tons. Yet this displacement is only half of what the two new vessels to be laid down by the French government are to be. Each of these boats is to displace 400 tons and will be twice as large as the "Gustave Zédé," which is the largest submarine yet constructed.

The projected submersible torpedo boats approach in displacement the older types of torpedo-boat destroyers in the British navy. Their most marked feature, however, will be their ability to dive from the surface to a submerged position in the short space of about six seconds. While submerged they will be propelled by light but powerful electric motors.

The capabilities of these new vessels may be summed up as follows: (1) Traveling on the surface, sufficient fuel being carried to run the gasoline engine 50 hours and propel the vessel 400 miles at a speed of 8 knots, and, in the larger and later type, for a greater distance; (2) Awash, the boat being almost completely out of view, but the large armored conning tower rising above the surface and serving as a lookout for the officer of the watch; (3) Entirely submerged, the vessels being of sufficient strength to permit them to sink to a depth of 100 feet if necessary.

Great Britain at the present moment has eight submarines at Portsmouth, which are serving as a training school for submarine navigation and management. Eleven other craft are almost completed and will be dispatched to Portsmouth to receive the full complement of officers and men. The exact number of submarines which it is now intended to construct is being maintained a secret at present, but it is anticipated that by the end of the present year Great Britain, owing to the more rapid means of naval construction, will be able to compare favorably numerically with France. The French navy this year will have thirty submarines in commission, while in the course of a few weeks Great Britain will possess nineteen boats of this type.

SCIENCE NOTES.

Sven Hedin has furnished additional evidence of the Chinese invention of paper. On his recent journeys he found Chinese paper that dates back to the second half of the third century after Christ. This lay buried in the sand of the Gobi desert, near the former northern shore of the Lop Nor sea, where, in the ruins of a city and in the remnants of one of the oldest houses, he discovered a goodly lot of manuscripts, many of paper, covered with Chinese script, preserved for some 1,650 years. The date is Dr. Himly's conclusion. According to Chinese sources, paper was manufactured as early as the second millennium before the Christian era. The character of the Gobi desert find makes it probable that the making of paper out of vegetable fibers was already an old art in the third Christian century.

The Bulletin des Sciences Pharm. says that the numerous assays which have been made of coffee berries, etc., have shown them to contain on the average about 1 per cent of caffeine, but the determinations recently made by Bertrand are interesting as showing the percentage in the berries of the plant when cultivated in different countries, and also the percentage in the berries of other species than *Coffea arabica*. In the former case percentages varying from 0.69 to 1.60 were found. Of species other than *C. arabica*, *C. canephora* was found to be the richest in alkaloid, the berries yielding 1.97 per cent, while those of *C. humblotiana* were remarkable by reason of their containing a bitter principle, cafamarin, but no caffeine at all. The berries of *C. mauritiana* contained only 0.07 per cent, and therefore these two species may be regarded as yielding berries practically free from caffeine. This fact is of some importance, as there is a demand for a beverage that shall have the agreeable aromatic taste of coffee, but be devoid of the stimulating effect due to the presence of caffeine.

The utilization of what formerly were considered waste products and the resurrection of materials from a used-up state to a new condition of serviceableness have in recent times been developed to such a degree of completeness that we are scarcely prepared to admit that anything is ever irrecoverably lost. In this respect we believe in the conservation of materials just as we have long been taught to believe in the law of conservation of energy. From a purely practical point of view, however, some things certainly may be so completely lost to further use that their loss may well be considered absolute, and one of these is the metal lost in the wear of railway rolling stock brasses. For the speculator in copper values, the promoter of a copper "corner," to use the broker's cant, the copper which has gone into railway brasses need have no terrors. It is not likely ever to be available again in full measure. It is dissipated so completely, in part at least, that its practical recovery is not likely to receive much serious consideration. From the best available deductions on the subject it appears that five per cent of the annual copper production of the world disappears in this way every year.—Cassier's Magazine.

Signatures are being secured by the Records of the Past Exploration Society, to a petition which they will present to Congress this winter providing for the protection of historic and prehistoric ruins of this country. Briefly stated, the petition contains the following articles: (1) That Congress pass a law prohibiting exportation of prehistoric objects from the United States; (2) that so much of all lands belonging to the United States as will assure the protection of its archæological monuments, ruins, etc., be withdrawn from settlement; (3) that all antiquities found on these lands be declared to belong to the government and the people of the United States; (4) that their removal from said lands, except on written authority of some legally constituted person or body, be prohibited; (5) that to injure or deface any of these archæological monuments, ruins, etc., or to take away any of these objects from government lands, be declared a misdemeanor, punishable by fine and imprisonment, unless done in pursuance of written authority from some legally designated person or body; and (6) that said authorities may grant such permission only to national, state, municipal, or legally incorporated museums of the United States, and that said objects be deposited in some legally designated depository, not to be removed therefrom unless in conformity to the law.