THE NEW SUBMARINES FOR THE BRITISH NAVY.

Although the British Admiralty was for some time disposed to regard with little favor the attempts which were being made by other nations, notably by France and the United States, to develop a practical submarine torpedo boat, now that they have themselves commenced the construction of this type of vessel, they are pushing forward their experimental work with characteristic thoroughness and activity. The first vessels, introduced some three or four years ago, were of the Holland type, with which we are familiar in this country. An order for five submarines was placed with Vickers, Sons & Maxim, at Barrow. These vessels were practically identical with our own boats of the Holland type. They are 63.4 feet in length, 11.9 feet in diameter, and 120 tons displacement. They have engines of 160 horse-power, and have a speed of 9 knots on the surface and 7 knots submerged. The vessels were launched in from 1901 to 1902. Following these came the A class, five vessels 100 feet in length by 10 feet in beam, and of 180 tons displacement. With 150 horse-power they are credited with a surface speed of 15 knots, a speed of 9 knots submerged, and a radius of action of 300 miles. It is one of these that was lost on June 8. The next order was for ten boats of much greater size and power. They are 150 feet in length and 300 tons displacement. Their engines of 850 horse-power are designed to give them a speed of from 15 to 16 knots on the surface and from 9 to 10 knots submerged. These vessels have a radius of action of 500 miles. Under the programme of last year, ten submarines were ordered, but the particulars of these vessels have not yet been made public. The first Holland submarines and the vessels of the A class are driven by gasoline engines when they are on the surface, and by electric motors when they are submerged. In the B class the motive power is said to be entirely electric—a rumor which we very much doubt. Great improvements have been made in the diving gear, by which the boats are enabled to dive at very short notice. Under the older system, as used on the Holland boats, it took about three minutes for the vessel to dive. Moreover, it was necessary for the boat to keep in motion as long as it wished to remain submerged. The older boats cost about $150,000 each, and the B class cost about $650,000.

It will be noticed from the dimensions given above that the ratio of breadth to length is much smaller in the new boats than in the earlier Holland type. In the first case the ratio is about 12 to 64, or say 1 in 5 1-3; whereas in the A class it is 10 to 100, or 1 in 10, and probably something finer in the vessels of the B class. The finer lines of the new boat are very noticeable in the accompanying views, as is also the high freeboard and considerable deck space when the vessel is in the surface position. It is probable that we shall see in the future developments of the submarine an increase in proportions and size, similar to that which has taken place in the torpedo boat and torpedo-boat destroyer, which have developed from the little craft of less than 20 tons up to seagoing craft of 550 tons.

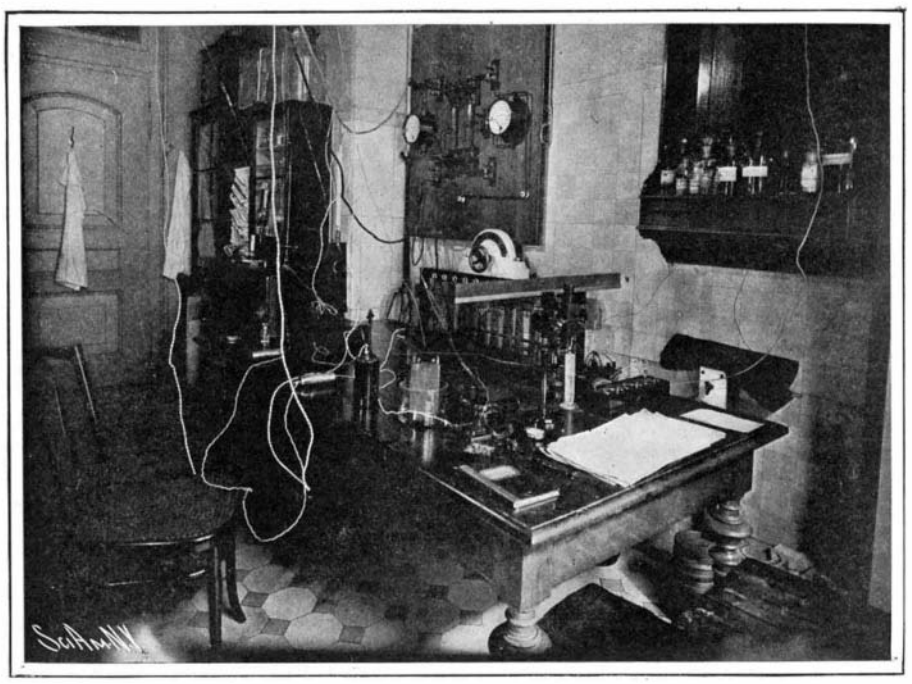


Fig. 1.—APPARATUS FOR MEASURING INDIVIDUAL RESISTANCE OF PATIENTS.

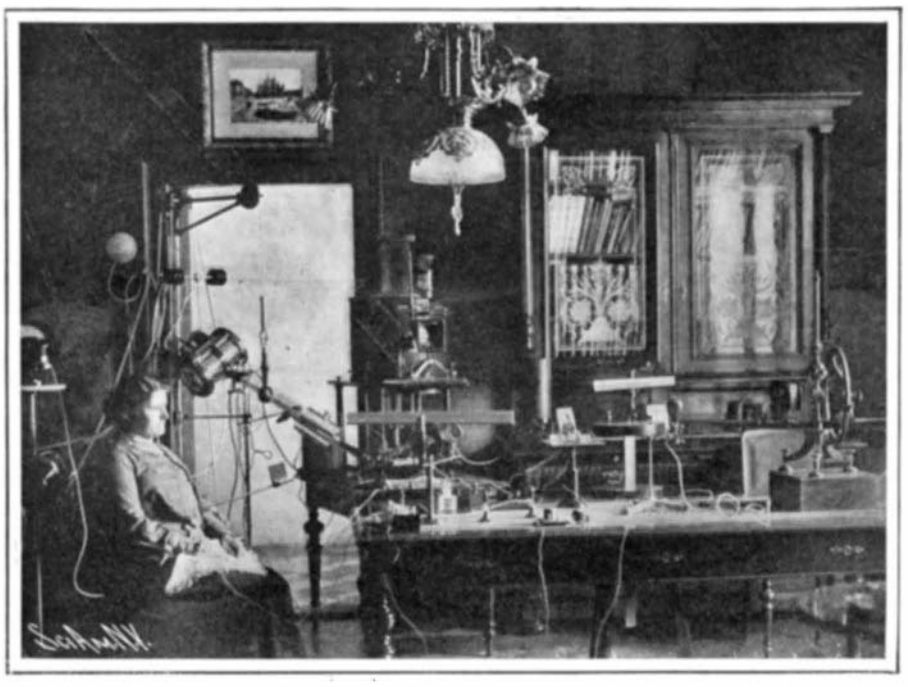


Fig. 2.—APPARATUS FOR CHECKING AN ELECTROMAGNETIC TREATMENT.

ON A PROCESS OF MEASURING NERVOUS SUSCEPTIBILITY.

BY DR. ALFRED GRADENWITZ.

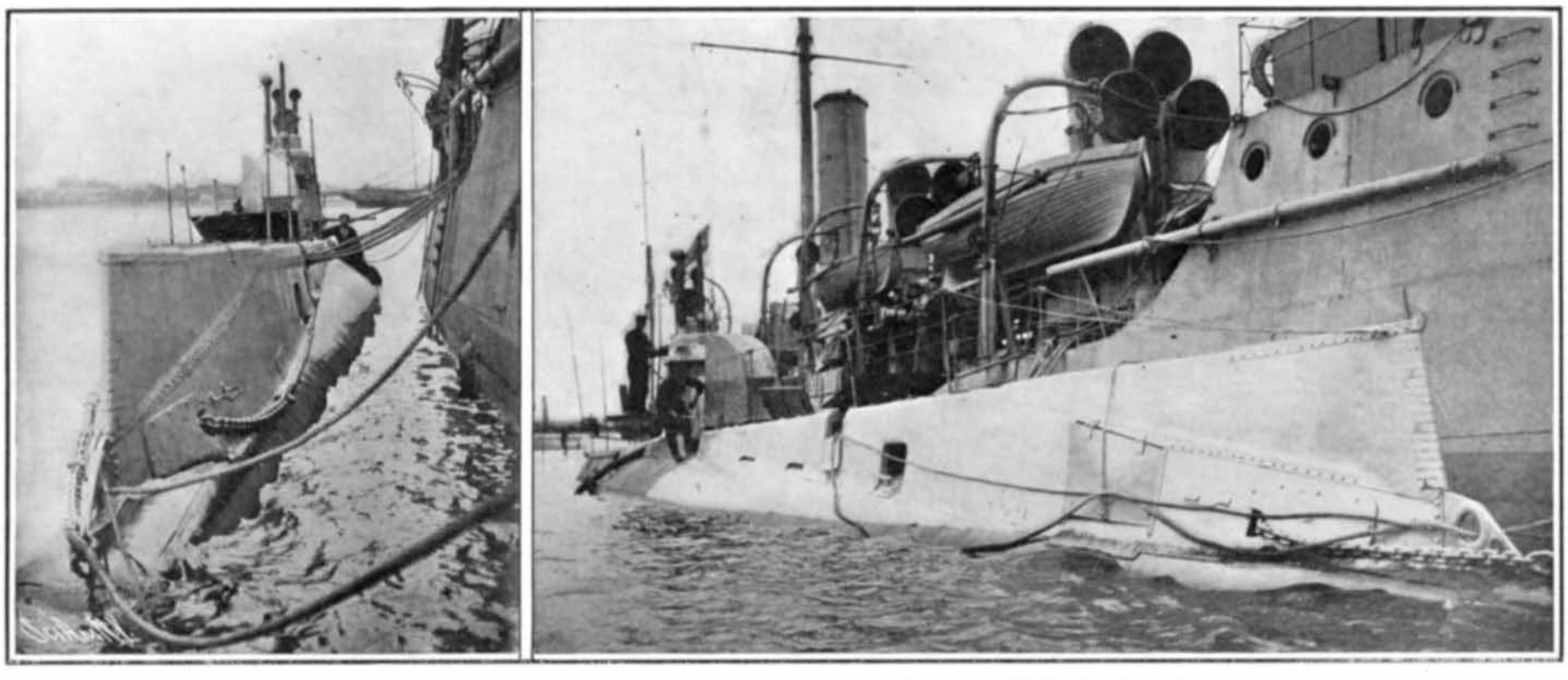
It is a well-known fact that any psychical process is attended by some alteration in the physical state of the body. The temperature of the blood is known to rise in the case of excitation, while chemical and physical actions of a nature yet insufficiently known will occur. There is on the other hand a mental state called *depression,* when the blood temperature falls and behavior of the body is in every respect the opposite of what is observed in the above case.

The physical changes just referred to form a criterion of the actual state of the mind, but it has not so far been possible to use them for an accurate determination of the psychical process going on. The much-discussed discovery of N-rays seemed to afford another outward sign of mental activity, Prof. Charpentier having shown that the amount of these rays given off by each nervous center is proportional to its activity. This outside manifestation of psychic activity would be of the highest interest, allowing as it would of explaining many phenomena hitherto enigmatic. Until, however, the existence and properties of these mysterious N-rays have become universally recognized, it would seem preferable to leave them out of account.

Now another physical criterion for the state of the human mind has just been found out by a Swiss engineer, Mr. E. K. Müller, of Zürich, Switzerland, and as this criterion is susceptible of accurate determination by the ordinary physical methods, we do not hesitate in describing the interesting results thus found.

Mr. Müller noted an interesting connection between the conductivity of the human body and its psychical and physiological condition. This conductivity, in the first place, undergoes great variation, according to the hour of the day at which the experiment is made and according to the meals taken by the person experimented on. Accurately identical figures will occur very frequently in series of experiments lasting from 10 to 15 minutes, with the same minutes and the same person, even in the case of experiments separated by an interval of some days.

The magnitude of the conductivity, as well as the regularity in the behavior of the different series, are highly influenced by the presence of a third person; whenever anybody enters the room or a noise is produced, the resistance of the person experimented on is found to undergo a spontaneous variation of extraordinary magnitude. Outside of objective



Bow View. As Seen from Aft the Starboard Bow.

Displacement, 300 tons. **Horse-power,** 850. **Speed:** Submerged, 9 to 10 knots; surface, 15 to 16 knots. **Radius of action,** 500 knots.

TWO VIEWS OF THE LATEST B TYPE BRITISH SUBMARINE. THE VESSEL LOST JUNE 8 WAS OF THE SMALLER A TYPE.

causes, any psychical influence, either internal or external, will result in an immediate oscillation of a sometimes enormous magnitude. Any sensation or psychical emotion of a certain intensity will reduce the resistance of the human body instantaneously to a value three to five times less.

Whenever the person experimented on is talked to or caused to concentrate his attention in some way or other, oscillations of the resistance will be produced. Any effort made for hearing a distant noise, any volition, any effect of self-suggestion, will exert a material influence, the same being true of any excitation of the senses, any light rays striking the closed eye, any body the smell of which is perceived (even where the smell or the body is fictitious). Any physiological action of some intensity such as breathing, stopping the breath, etc., is found to exert an analogous effect.

By making experiments both before and during the sleep, the author observed some characteristic variations according to the character of the latter and the vivacity of the dreams.

Any pain, either real or suggested, will modify the resistance, the feeling of pain being preceded and followed by an oscillation.

The individual resistance of the human body depends also on the nervous susceptibility and on the conditions the person is living in. Nervous persons, as well as strong smokers and drinkers, show an extremely low electrical resistance. The variability and temporary behavior of the resistance is also shown to depend on these factors.

Fig. 1 shows the measuring room which has been fitted out especially at the Salus Electromedical Institute, Zürich, for measuring the individual resistance of patients. The experimental outfit comprises a mirror galvanometer, having a strong damping coefficient susceptible of regulation, a scale for objective reading and electrical lighting, a standard resistance, an accumulator, commutator, and milliamperemeter, etc. This is put in connection by means of wires with "isolation rooms," where the persons to be experimented on put themselves in connection with the measuring outfit, by dipping their hands (during 10 to 15 minutes) into glass tanks containing a salt solution of low concentration or else by seizing cylindrical nickel electrodes.

The isolation room limits as far as possible any outside noise or processes liable to excite the attention of the person experimented on, thus altering the results of measurements. According to circumstances, the natural lighting of the insulation room is damped, softened by blue glass, or else replaced by glow lamps. The figures and curves thus obtained hardly ever show any alteration, so that they may be said to ascertain in a reliable manner the degree of nervous susceptibility (being inversely proportional to the individual resistance), the behavior of the person in question in regard to mental activity, and finally the frequency and intensity of painful feelings in the patient during measurements.

Fig. 2 represents the outfit for checking in an objective manner the action of an electromagnetical treatment, for instance in the case of a patient suffering from a headache. The head of the person is "radiated on" by an alternating magnetical field, thus becoming free from pain gradually, while at the same time the individual electrical conductivity of the body is found successively to decrease (the resistance increasing), and the oscillations in the measuring current, as observed before radiation, to disappear.

The behavior of the resistance curve corresponds to the state of pain and excitation of the patient, the purely subjective state thus being ascertained objectively by the measuring outfit.

Tube-shaped electrodes of zinc sheet, the bottom of which is perforated and coated with bladder, are filled with salt solution and tied to the palm of the person experimented on, thus insuring a perfectly uniform and safe contact, even in connection with prolonged experiments.

From the above the possibility is seen of ascertaining the nervous excitability of any given person and the alterations undergone by this factor under the most various conditions. It would seem possible also to find out from a number of investigations and measurements a given average resistance for what might be termed "standard" men. On the other hand, the action of electricity with therapeutical applications might be verified objectively.

Any experiments so far made bear out the hypothesis that in the case of the action of electromagnetic lines of force, an increase in the individual resistance occurs.

THE CREATION OF LIFE BY ARTIFICIAL MEANS.

(*Continued from page* 480.)

arouses the hope that it will soon be possible to undertake the solution of the various problems for which the raising of parthenogenetic larvæ in large numbers is a prerequisite.

Repeated experiments on the fertilization of the eggs of the sea-urchin with the sperm of starfish yielded the result that these eggs can be fertilized and caused to develop not only with the sperm of Asterias but also with the sperm of a brittle star and the sperm of the twenty-ray starfish. Furthermore, mollusks are added to the list of animals in which it is possible by physico-chemical means to cause the unfertilized eggs to develop into swimming larvæ. The hope of students of heredity, who have been looking for the means of raising animals in large numbers for experimentation, which should possess the hereditary traits of one parent only, has been at least attained.

The University of California has published from time to time the papers of Dr. Loeb in which is given at great length the progress of the experiments from which the results, often disappointing but at least convincing, have been finally attained. The immense labor involved can be understood only by advanced scientists, and do not appeal to popular interest. What the outcome may be, only the future, and not a very near future, can decide. The subjection of all Nature's forces has taken centuries to perfect, progressing little by little at a time. To create life may be one of the victories of science over nature for the future to achieve.

While occupying the chair of physiology in Chicago, Dr. Loeb had a laboratory at Holmes Holl, a site on the Massachusetts coast. In California, by the courtesy of the faculty of the Leland Stanford, Jr., University, the Johns Hopkins laboratory at Pacific Grove, located at the extreme southern point of the Bay of Monterey, has been placed at his disposal. At this point conditions the most ideal are at the command of the scientist. Probably no body of ocean water on the globe of similar extent is more prolific of marine life in all its forms. The buildings are close to the shore and equipped with every appliance for successful investigation.

MINES AND ENTANGLEMENTS IN THE RUSSO-JAPANESE WAR.

In the aftermath of correspondence that flows in from the seat of a great war subsequently to the occurrence of the leading battles and most decisive events of the struggle, there is nothing quite so interesting as the arrival of photographs taken on the spot by men who do not hesitate to risk life and limb in the pursuit of their profession. Sometimes with only a little pocket kodak, and at other times, as in the case of the veteran photographer whose pictures are shown on our front page, with a large 8 x 10 camera, the artist pushes his way up to the very front line of battle and snaps the shutter on the most critical scenes of the battlefield.

The Russo-Japanese war will always be noted by the historians as having seen the first practical test on a large scale of the many military and naval inventions which were produced in such prolific numbers in the closing years of the nineteenth century. But although many new weapons were put to the test, it was remarkable what an extended use was made by both belligerents of methods and implements of warfare that are as old as history itself. Port Arthur, which the Japanese expected to succumb to high-explosive shell, the hail of machine gun and rifle bullets, and the overwhelming sweep of charging battalions, proved to be absolutely impregnable against any such method of attack. It was only when Gen. Nogi resorted to the time-honored method of approach by digging parallels and approaches, and mining beneath the walls of the fortress that Port Arthur gave way; and it is a curious fact that in the assaults on the fortress, the soldiers on both sides when they got at close quarters made free use of that ancient missile, the hand grenade.

What could be more mediæval than our front-page picture showing the barriers thrown across the main road into Port Arthur from the north? Our minds are instantly carried to the curious old cuts in our school books showing the seemingly impassable barriers, by which in early times it was attempted to break up the charge of heavy cavalry or throw an assaulting body of men into confusion. In the immediate foreground of the picture is shown a series of "wolf-holes," concealed with diabolical skill among a forest of sharpened sticks. These holes are laid out on a diamond pattern and each is between three and four feet deep. In many cases a sharp stake is driven firmly in the ground at the bottom. Usually they have a wire entanglement running parallel with them. In some cases they were built without the usual forest of stakes being driven around them at the surface of the ground; in which case the openings were concealed by grass and brushwood, and the attacking force knew nothing of their existence until the men crashed through to be impaled on the stakes below.

Of the two extraordinary photographs, showing the explosion of mines, one was taken at the instant of setting off a Russian mine, containing 600 pounds of explosive in the siege line near the base of Nantezhan Fort. The other represents the explosion of a mine on one of the battlefields in Manchuria. The rocket-like threads of smoke and the black objects seen against the sky are flying pieces of burning powder and fragments of the boxes containing the powder. Although a considerable number of casualties of the war were due to the explosion of mines, the Japanese in several cases, when storming the fortified positions, succeeded in finding the wires leading to the mines, and by cutting them, rendered the ground perfectly safe for troops to pass over.

Correspondence.

Iron Used as a Money Medium.

To the Editor of the Scientific American:

I am a constant reader of the Scientific American, though not a regular subscriber, on account of the fact that I can get the paper at an earlier date from the news stand than if sent to me direct.

In your issue of April 22 I have read with interest an article by Prof. Alex. Del Mar, entitled, "Our Heritage of the Mechanical Arts." In giving the history of iron, its scarcity, usage, etc., the writer among other things says: "Both iron and steel were certainly very scarce in the West at the periods mentioned. Homer, tenth century, mentions poleaxes, shipwright's tools, plow shares, sheep hooks, and chariot wheels in the Troad; yet in Lacedæmonia, in the time of Lycurgus, ninth century, iron was still so valuable that he employed it as a material for money."

The writer seems to emphasize the point that Lycurgus used iron for money on account of its scarcity and value. It is true that Lycurgus did use iron for money, but not on account of its scarcity or value. On the contrary, he made use of iron for money to aid him in his new system, by which he wished to destroy the avarice of his people.

Plutarch says: "Not content with this [the equal division of the lands, etc., of the Lacedæmonians] he [Lycurgus] resolved to make a division of their movables too, that there might be no odious distinction or inequality left among them; but finding that it would be very dangerous to go about it openly, he took another course, and defeated their avarice by the following stratagem: he commanded that all gold and silver coin should be called in, and that only a certain kind of money made of iron should be current. A great weight and quantity was of very little worth; so that to lay up twenty or thirty pounds, there was required a pretty large closet, and to remove it, nothing less than a yoke of oxen. With the diffusion of this money, at once a number of vices were banished from Lacedæmonia; for who would rob another of such a coin? Who would unjustly detain or take by force, or accept as a bribe, a thing which was not easy to hide nor a credit to have, nor indeed of any use to cut in pieces? For when it was just red hot, they quenched it in vinegar, by that means spoiling it, and made it almost incapable of being worked."

Clare in his "Universal History of the World," vol. ii., page 585, says: "To render the state dependent only on its own territorial products, and to prevent any individual from accumulating an undue amount of wealth, he [Lycurgus] prohibited the use of any money except an iron coin, with so small a value in comparison with its bulk and weight, that the necessity of using it as a medium of exchange would make it difficult to carry on trade, especially foreign commerce. By subjecting this iron coin to a process rendering it brittle and unfit for a [an] other use, Lycurgus endeavored to destroy every desire to hoard it as a treasure."

Rollin, in his "Ancient History," vol. i., page 687, says: "First he [Lycurgus] cried down all gold and silver money, and ordained that no other should be current than that of iron, which he made so very heavy, and fixed at so low a rate, that a cart and two oxen were necessary to carry home a sum of ten minæ [five hundred French livres, about $88.80] and a whole chamber to keep it in."

This was done for the purpose of sapping the foundation of avarice.

From the above quotations, it would seem that while iron was much more valuable than it is now, still it was not so valuable as to justify its being coined into money. It seems that a team of oxen could haul about $88 worth of iron. I presume the same sort of team might haul one-fifth of that value of iron at the present date.

As stated, the idea conveyed by Prof. Del Mar in his article seems to be that iron was so scarce as to justify its coinage into money. I do not think that history will bear out this statement.

I do not know whether you care to have letters of criticism of this sort or not, but at any rate, venture to give you the facts as stated by ancient historians.

L. M. Neblett.

Fort Worth, Texas, May 25, 1905.

News comes to us from the Harvard Observatory at Arequipa, Peru, that Eros has been photographed there with the Bruce telescope. Eros, be it remembered, is the nearest of all the heavenly bodies, with the exception of the moon.