MEDICINE IN MOROCCO.

BY

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In the Middle Ages medicine, arts, and sciences had attained a high degree of splendour in Morocco. The town of Fez, capital of the empire, was considered to be the centre of civilization; the learned of the then known world met there to work in the great university, the library of which was renowned. It contained translations of the Greek authors, such as Galen, Hippocrates, Paul of Aegina, etc. Illustrious physicians such as Avenzoar (1161) and Averroes lectured there and were held in universal repute. Since then the sciences have remained stationary in Morocco, which has kept itself obstinately closed to all outside progress, so that the medicine of the natives is now only an echo of the medical art of the tenth century mingled with gross superstitious and other practices. At the great University of Fez which had thousands of students, no science, not even astronomy, held of old in such honour in the Mussulman world, is now taught. The only teaching is in theology, the interpretation of the Koran and Mussulman laws. Astrologers, soothsayers, and sorcerers teach the art of forecasting the future, casting horoscopes and seeking for buried treasure. The French Government would certainly do a useful work by raising from its ruins the celebrated University of Fez and establishing courses of lectures to be given by Algerian Arab professors. In this it would find a powerful means of civilization for the Moors, who still retain a great respect for the intellectual centre of Fez.

At the present day medicine is practised by native healers called *tabibs*, who are believed by the Moors to possess wonderful supernatural secrets for the cure of diseases, but they hold European doctors in high esteem. A certain number of these *tabibs* hold certificates and diplomas given to them at Fez by masters who have judged them to be sufficiently instructed. They then scatter through the country, going about from town to town, and installing themselves in the market place in tents, where they sit surrounded by strange drugs. Some of them have a little knowledge and can read, but the others are utterly ignorant. In general their treatment is harmless; there are some, however, bold enough to amputate, to do laparotomy, and to operate for cataract.

Minor Surgery.

The native doctors practise bleeding and wet cupping apply sutures in haemorrhage, and open abscesses. In wounds of the intestine caused by the use of the knife they have recourse to a curious method of suture. The lips of the intestinal wound are pinched by an ant called *Agrab terbioun*, whose abdomen is then cut away, the mandibles remaining closed (*Agrab* in Walloon means a clasp or clip). The actual cautery and bleeding as well as cupping are held in great honour. The *tabibs* know the use of splints and starched bandages for fractures. The fragments are reduced and massage has been employed from time immemorial. Ruptures are kept up by means of very ingenious bandages. Lastly, they practise urethral catheterism and perform circumcision. Their knowledge of dentistry is summed up in the extraction of teeth and the application of dressings in cases of caries. The obstetric art is in the hands of ignorant and dirty midwives. They do not know the use of forceps or the vaginal syringe. They do not intervene in any case of abnormal presentation.

Principal Affections.

The principal affections met with in Morocco are those commonly found in temperate regions; the diseases peculiar to the tropical zone are for the most part unknown. Cholera (*Conlira*—*Bau Guclib*) was unknown in Morocco before 1834. Since then there have been numerous epidemics, sometimes of terrible intensity; that of 1878, for instance, carried away nearly three millions of inhabitants. From remote antiquity Morocco has periodically been devastated by terrible epidemics of plague (*Bou Kebar*—*Taoun*—*Habouba* or *bubo*) which generally follow periods of famine. In 1237 cannibalism was practised. It was

always from the East that the disease was imported, after pilgrimages to Mecca. The ravages among the people were great. In 1791 there died at Marakesh 50,000 out of 60,000 inhabitants, at Fez 55,000, at Rabat 20,000 out of 30,000, and in the other towns in the same proportion. In certain villages only four inhabitants were left out of 600. Terror reigned everywhere; the Arabs awaited death with the fatalism of Islam, and bought themselves grave clothes. Many of the towns of Morocco never recovered from this disaster; their ruins still exist. Typhus fever is always present endemically, giving rise periodically to epidemics. In the Morocco campaign the French troops suffered from the disease. Malaria is found to some extent throughout Morocco, in the towns of the coast, in the valleys, near marshes and stagnant waters (*Merdja*). Certain river valleys are uninhabitable, and the ruins of abandoned houses may be seen in them. Sporadic recrudescences occur, and the disease seems to have increased in intensity since the last wars with the French. Natives and Europeans are equally attacked.

Syphilis (*El Nouar*—*Meura*—*El-Kebir*) rages in Morocco, and it may be affirmed that most, if not all, Moors have, or have had, syphilis or come of syphilitic parents. They speak of it as if it were no more than having a cold.

Native prostitution is very widespread. Arab and Jewish public women are counted by the hundred in the smallest towns, and Spanish, French, and Algerian prostitutes swell the number. All the towns of the coast and the interior are frequented by troops of French singing women, who combine art with prostitution. New French brothels have been established in the principal towns, and clandestine prostitution grows daily more widespread, especially at Casablanca. Pederasty is a vice held in great honour among the Arabs. In the Moor syphilis seems to be attenuated, its manifestations being confined to the skin, the bones, and the eyes. Nervous phenomena are rare; it is exceptional to meet with tabes or general paralysis. This statement does not hold good for Europeans who contract syphilis from native women. The attenuated virus transported into a new and immune culture medium takes on an extremely active virulence, and manifests itself especially by nervous symptoms which rapidly become serious. Many European residents are attacked. Gonorrhoea is also very common among natives and Europeans. It is generally accompanied by complications involving the testicles, joints, and eyes. In European women metritis and salpingitis are very common.

Leprosy has been known in Morocco from remote antiquity. It has always been endemic there. Leper houses have always existed, and lepers were obliged to wear a special dress and to shake a clapper to warn the public of their presence. The number of stray dogs in Morocco is vast; most of them feed on carrion, and hydrophobia is frequent, even among Europeans. Fortunately, the Government has ordered becatombs of dogs and has created a Pasteur Institute. Among the other diseases found in Morocco may be mentioned elephantiasis, itch, psoriasis, prurigo, small-pox, diphtheria, measles, tuberculosis in all its forms, gastro-intestinal affections, pulmonary diseases, rheumatism, eye diseases, abscess of the liver, and affections of the kidney.

Mental disorders are very common. Mad folk are venerated. They are looked upon as possessing supernatural powers and are consulted in many circumstances. It is not uncommon in towns to meet with lunatics of both sexes completely naked, walking about the streets in perfect liberty and respected by every one. Only if dangerous are they shut up in filthy prisons, ill nourished, and without medical treatment.

Although the Koran strictly forbids Mussulmans the use of fermented drinks, the Moors addict themselves more and more to alcohol, and since the establishment of the Protectorate the example of the European tends to generalize the use of strong drinks throughout the country. In all the towns European cafés are multiplying. There the natives see foreigners at table on the terraces sipping the *apéritif* and various liqueurs new to them. The native Jews have always made wine and alcohol, and alcoholism has always been widespread among them. They extract alcohol from grapes, dates, and even from the Indian fig. A large quantity of spirits is also imported from Europe. The use of strong drinks is very widespread among the

higher classes of Moors. The Arab women passionately love alcohol. Cases of delirium tremens are frequent as a consequence of drinking impure alcohol mixed with aniseed. The evil consequences of these habits in a race already syphilized can readily be understood. It is therefore to be hoped that the French Government will do what is needed to check the development of this vice in its new colony.

The use of opium is very widespread. It is taken in the form of pills; it is also smoked with *kif* (*cannabis indica*). But the hypodermic syringe has already made its appearance in Morocco. The great majority of natives, including many women, are devoted to smoking Indian hemp, a habit which brings them to a state of utter brutishness. Means must be found to uproot this habit, which has a very bad effect on the mental condition of the natives. Before the coming of the French the Moors smoked tobacco very little; now the use of the cigarette tends to become general.

Premature impotence is common in the Arab as a result of the excesses to which polygamy leads; therefore the Moors make an immoderate use of all the known aphrodisiacs, and of the strongest condiments. The European doctors are pestered by impotent people who ask of them remedies to cure the affection which they call *El beurd*—that is to say, cold. The Germans have imported immense quantities of preparations, among which is *Johimbine*, which is found in the possession of most Arabs. The native doctors sell preparations which they declare to be of sovereign efficacy. Unknown to their husbands the women mix drugs with their food, and the effects on the health of the master are often serious.

Native Therapeutics.

Native therapeutics rest on no scientific foundation. The substances chiefly used are senna, euphorbia, aloes, colocynth, ipecacuanha, croton, centaury, mint, lavender, thyme, saffron, cinnamon, ginger, aniseed, cumin, caraway, rue, camomile, gall-nut, castor oil, sarsaparilla, asafoetida, and rhubarb. Among substances belonging to the mineral kingdom may be mentioned alum, corrosive sublimate, mercury, copper sulphate, sal-ammoniac, nitre, arsenic, petrol, sea-salt, oxide of iron, etc. All these substances are used in the manufacture of complicated formulae, the origin of which goes back to the night of time—old recipes transmitted from generation to generation.

Organotherapy plays a large part in native therapeutics. Thus they employ the suprarenal bodies in the treatment of certain eye diseases. Bates of New York has obtained good results with suprarenal extract in the treatment of kerato-conjunctivitis and episcleritis. They treat hydrophobia by making the patient eat the liver of the rabid animal. The Aissaouas, in order to make themselves immune against the bite of poisonous serpents, swallow the venom and devour the reptiles raw. The researches of Calmette on snake poison are well known. Extracts of testicle are used in the treatment of impotence; it is the theory of Brown-Séquard. It is clear that these methods of organic therapeutics come from the school of ancient Greece, Hippocrates, and other old physicians. Among the organs most employed may be mentioned the liver, the heart, the lung, the spleen, osseous tissue, bone marrow, fat, hair of the head and other parts, testicle, ovary, penis, ova. These organs are taken from many animals—horse, cow, sheep, dog, goat, gazelle, hyena, hedgehog, snake, cock, boar, scorpion, pig, frog, swallow, mouse, etc. Human fat is much sought after. Among secretions used are: Urine, milk, bile, faeces, semen, virgin's saliva, menstrual blood, biliary and vesical calculi. When a man wishes to excite love in a woman he gives her without her knowledge his semen mixed with sugar to drink. When a woman wishes to make herself loved by a man she mixes with his food love philtres made by sorcerers or healers who draw a good revenue from them. Poisoning is frequent in Morocco. Arsenic is much used; it is the cup of "bad coffee." This is why when an Arab offers tea to his friends he prepares it before them and drinks the first cup himself.

Without knowing it, the Arab physicians often practise antiseptics when they use hot tar, boiling oil, resin, henna, copper sulphate, salt, etc. On the one hand, suppuration is rare in the Arab, and on the other the sun is the great antiseptic.

There are numerous mineral springs in Morocco; some were known in the time of the Romans, and the Arabs still make large use of them.

When the *tabibs* wish to perform a serious operation they give their patient hyoscyamus. Thieves also mix this with the food of their victims before robbing them. The native doctors also employ nutmeg—in circumcision, for instance. Lastly, the anaesthetic effect of hypnosis is well known.

In addition to all these remedies, there is a therapeutic arsenal of religious character—incantations, magic spells, prayers, talismans, amulets, verses of the Koran, magical objects, precious stones, rings, strings of beads, earth from Mecca, water from the Agar well, etc. Finally, there are the innumerable marabouts, dead or living, whose influence is regarded as sovereign for the cure of disease. There are numberless tombs of saints to which sick folk go to invoke the shade of the dead man. These mausoleums are often covered with ex-votos. There are also old sacred trees, stones, and even old guns, which are credited with the power of curing certain diseases. The Arab women frequently make pilgrimages, sometimes in search of a cure for illness, sometimes of a remedy for barrenness which is generally due to the impotence of the husband. The prayer of these women is often answered, as the pilgrimage is a pretext for passing several days in the company of a lover.

Hygiene.

The Arab has his own notion of hygiene, which is usually the opposite of ours. In his home he is much cleaner than the native Jew, whose filthiness is inconceivable. Most Arab towns are provided with drains and systems of water supply, but their condition is deplorable. All the dejecta and decomposing refuse remain in the obstructed drains where there is no fall of water. The drinking water conduits are open, and in many places women are seen washing their linen and men making their ablutions in them. The fountains used in common by beasts and human beings are polluted; the street waters run into the wells, while the liquid matters from the drains reach them by infiltration. All the springs in the interior are polluted. The women do their washing in the spring itself; sheepskins are washed in it, and the people who dwell down stream drink this contaminated water. Filth lies everywhere about the streets and accumulates in enormous heaps at the gates of towns, rising higher than the embattled walls; on the foul charnel heaps the bodies of horses, cows, mules, and other animals rot, and dogs and flies dispute the remains. The charnel heap of Fez was a nameless horror. I have seen domestic animals still alive among the fleshless carcasses, for the Arab leads his dying beast there in order not to have to carry its dead body. Millions of flies, after sucking the infected juices from the dead bodies, scatter themselves about the town, where they swarm over foodstuffs exposed for sale and invade the houses. The Sultan when he goes out is accompanied by official fly-hunters, who keep on shaking cloths to protect the face of the august emperor.

To sum up: the towns of Morocco are in general hotbeds of pestilence, their soil from time immemorial having been impregnated with all kinds of dejecta. The streets are narrow and winding, airless, crowded with people. In winter they are sewers, along which one can only go on horseback; in summer whirlwinds of dust arise to such an extent that at Marakesh, in the month of August, I have seen that dust as thick as a London fog. Moreover, the towns of Morocco are surrounded by high walls, which prevent the aëration of the streets. In short, these towns are uninhabitable by Europeans, and the French have built outside the towns superb dwellings, which are very healthy, and they have even constructed new towns, as at Marakesh.

The consuls and foreign settlers in Morocco have at all times made every effort to induce the Moorish authorities to take steps to remedy their sanitary conditions. In 1792 the consuls formed the *Junta de los consules* (Consular committee) at Tangier, which was the origin of the "maritime health council." The consuls were charged by the Sultan "to see to the safeguarding of the public health along the shore, and to take all steps to secure that object." The initiative of the consuls was, however, continually hampered by the ill-will or inertia of the

Moorish administrations. It marked some degree of progress for the coast towns, but the influence of the consuls did not make itself felt in the interior of the country, where the towns continued to be nameless sinks.

With the establishment of the French power in Morocco radical measures were at last applied. But the task was gigantic. On the one hand the French authorities have to struggle against ancient customs and prejudices and against the ill-will of the natives; local interests and susceptibilities had to be considered, and action taken gently and tactfully, for ancient customs could not be upset in a few days. There was, besides, religious sentiment to be considered and Mussulman fatalism to be fought against, for the native is convinced that all the epidemics and diseases which attack mankind are a manifestation of the will of Allah. Hence they are inclined to believe that measures of prophylaxis are opposed to the decrees of the Almighty.

In spite of all these difficulties the French authorities have already achieved immense progress, and, notwithstanding the war, important sanitation works are being pushed on with energy. Systems of drainage and water supply have been established in most of the towns; they are still defective, but the defects will be remedied. It has been necessary everywhere to remove enormous heaps of filth and to prevent the inhabitants from throwing their refuse into the street. Wide avenues have been opened in overcrowded and unhealthy quarters; squares, public gardens, and parks have been made and public fountains erected. The Jewish quarters have been as far as possible made sanitary. True European towns have been built outside the walls, as at Casablanca, Rabat, Marakesh, where the Guelliz quarter will prove a great development. New towns, completely European, such as Kenitra, have been founded. Improvement of ports is actively pushed on; a network of superb roads is in course of completion for use until railways are constructed. Fine public buildings, schools, hospitals, barracks, lazarettos, etc., are being built in all the towns. In short, under the impulse of French civilization Morocco is daily becoming transformed and metamorphosed to such a degree that travellers who return there after a long absence are startled, and in many places find themselves in a strange land.

The scheme drawn up by the Protectorate Government is vast and well thought out. There is a "service of health and public assistance" with the following functions: Native assistance, general hygiene and prophylaxis, communal sanitary services, visitation of prisons and dispensaries for prostitutes, inspection of schools, judicial requisitions, future organization of the maritime sanitary service, special sanitary missions, assistance for Europeans in general. The "mobile medical formations" will undoubtedly render great service. The personnel of each consists of one or two doctors, two male nurses, and three drivers; and it is provided with six mules, one tent for consultations, one tent for the personnel, four panniers for medicines, six draw sheets, one dressing case, a miscellaneous assortment of drugs, three *chouaris* (large panniers carried by beasts of burden), six sets of harness. There is a centre at Rabat for the manufacture of anti-variola vaccine. There is also a Pasteur Institute for the treatment of persons attacked by hydrophobia.

The medical service of Morocco has decided on the

creation of hospitals, lazarettos, isolation camps, shops for the supply of material and drugs, research laboratories, and lunatic asylums. There are already in most of the towns hospitals and medical dispensaries where natives receive gratuitous treatment. The hospital of Mazagan is a superb building, though it has defects from the practical medical point of view, since the architect's main idea seems to have been to erect a fine building. It would have been better to have built further outside the town, on the height overlooking the sea. Many indispensable things are still lacking, such as a radiographic apparatus, a completely equipped operating theatre, etc., and it is to be hoped that after the war the money necessary will be provided.

The native hospitals or dispensaries which exist in most of the towns of Morocco, principally on the coast, render invaluable service in the prophylaxis of syphilitic affections. In particular the numerous prostitutes who have now been placed under the supervision of the police are examined and treated there. Several of these dispensaries have medical women attached to the establishment. All natives who present themselves for consultation are treated.

The native hospital of Mogador is a model of its kind, and it has the merit of having been created with scanty

means. The Arabs are fatalists, and to induce them to go into a hospital founded by "Christian dogs" it is necessary that they should receive a special welcome from persons who thoroughly understand their mentality and know their customs and particularly their language. The part of the head doctor is all-important and decides the reputation of the hospital among the Arabs. Dr. Bouveret, head of the Mogador hospital, speaks not

New Hospital at Mazagan.

only Arabic but the special dialect of the hillmen of the Atlas. He has succeeded in winning their confidence, and they come to the dispensary in large numbers, some of them from places many days' journey away. On admission the patient is bathed and disinfected; he is given clean clothes and is placed in an irreproachable bed, which is a novelty for him. He is taken care of by trained nurses, is supplied with abundant food, and accustomed as he is to the indifference and roughness of his co-religionists, finds all his needs gratuitously attended to. All diseases are treated at the dispensary and minor surgery is practised. It is particularly in antivenereal prophylaxis, which has to be carried out without delay, that the work of Dr. Bouveret is important, for he has been able without compulsion, which is always avoided, to induce prostitutes not only to submit themselves willingly to examination, but also to attend daily for an antiseptic vaginal injection. The happy effects of this rational treatment were soon seen among the men of the military garrison, where cases of syphilis have almost disappeared. When a woman is infected she is kept at the hospital and treated by the most modern methods. The very encouraging results obtained by Dr. Bouveret make enlargement of the hospital buildings necessary. The equipment needs to be considerably improved; there are also wanting indispensable things, such as a radiographic apparatus, a microscope, surgical instruments, operating table, etc.

Every day the Moorish natives feel more confidence in European methods of treatment, and when they have placed their trust in a doctor they never change. Therefore it is most necessary that the French authorities

should understand that the transference of doctors from one town to another when they were well known by a whole native *clientèle* greatly annoys patients. These moves, which are for the most part quite unnecessary, are calculated to hinder the spread of European medicine among the natives.

To sum up: The French Protectorate in Morocco has already made great progress in the sanitation of the new French colony, but much still remains to be done. It is quite competent to accomplish the considerable task which will be its work "after the war."

ON THE ORIGIN OF ELECTRIC CURRENTS LED OFF FROM THE HUMAN BODY, ESPECIALLY IN RELATION TO "NERVE-LEAKS."

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DURING the last two or three years certain theories propounded by Mr. Arthur E. Baines have received considerable attention, and have been applied in practice by a number of medical men who have accepted these views. I propose to examine the scientific basis on which they are founded.

The basis of the system lies in the fact that, by leading off from different points of the body by means of silver electrodes, currents of various degrees of magnitude can be detected when the electrodes are connected to a very sensitive galvanometer of high resistance. In a case of shell shock, for example, a particular area of skin may give a large deflection compared with that normally obtained by holding the electrodes in the hands. This is called a "nerve-leak," and is interpreted as an escape of "neuro-electricity," or "nerve energy," from a place where the insulation of the nerve fibres has broken down, similarly to what happens in a submarine telegraph cable.

In the first place, we must remember that the animal body does not contain any metallic conductors; the conduction of an electric current is of a different kind from that in a wire. We must examine therefore the possible sources of potential difference, giving rise to currents, in such methods as those used by Mr. Baines.

The human body is a system of solids and liquids intermixed. The solids are, when dry, non-conductors, but become conductors when soaked with the solutions in which they are immersed. These liquids contain salts, and it is by means of the salts that the current is conveyed. Hence they were called by Faraday "electrolytes."

How is this done? When salts are dissolved in water they are split up into two or more atoms or molecular groups which have electrical charges of opposite sign. These products of dissociation are known as "ions," and the unit electrical charge carried by an ion is called an "electron." Electrons do not exist in such solutions free from the chemical atoms with which they are combined. In Mr. Baines's book, *Electropathology*, ions and electrons are said to be identical, and this fundamental error runs through the whole theory. Ions and not electrons are the source of electrical differences in the body and serve as the only means of conduction of electrical currents. This they do by their actual movement, conveying electricity much as a horse and cart carries stones. Being actual material existences and non-volatile, they do not escape from the surface of the body to the air; as we are told that "nerve-leaks" do. Mr. Baines holds that electrolytic dissociation of salts in water is accompanied by an actual disintegration of the atoms themselves, by which free electrons are formed, as in the case of radium. No proof has ever been given that the salts actually present in the body do this. If it were so, the astonishing equivalence between the amount of energy supplied as food and that given out in various forms by the organism would not be obtained experimentally. This fact is one of the most significant results of modern physiology.

The body therefore is full of ions, but not of free electrons, and any explanation of electrical differences must be on this basis.

As a first step, let us see what happens when two places

on the surface of such a moist conductor as the body is are led off by silver electrodes. We will suppose that the two places are at the same potential, and this is most easily obtained experimentally by taking a dilute solution of sodium chloride and immersing the electrodes in it. Now, unless the two electrodes are not only of the same metal, but also have their surfaces in precisely the same physical and chemical state, there will be found to be a potential difference between them. The exact origin of this potential difference would take too long to explain, and it is a somewhat difficult question, depending on the tendency of the ions of the electrode to pass into the solution or those of the solution to pass into the electrode; but in practice I have found it impossible to get two silver electrodes which are equipotential in salt solutions. I have taken the greatest care and spent much time in the attempt, but have never obtained less than 0.006 volt. This potential difference would give, with Mr. Baines's galvanometer through the ordinary dry skin, a deflection of just about the order of that regarded by him as the normal hand-to-hand effect. Since the deflection obtained by the use of such electrodes on the skin depends on the resistance of the circuit, if one of them be moved to a place where the skin is moist the deflection will be greater, and the greater deflection indicates no more than that the resistance is less. This is the first kind of "nerve-leak," and I would emphasize the fact that no test of the equipotentiality of the electrodes is made in Mr. Baines's practice. In any normal person it is quite easy to find areas where the skin is moist and to compare these with drier places, and it is an omission that so few tests for "nerve-leaks" have been made in normal cases.

The simple state of affairs just described, although always present, is, however, not the whole story. Since the source here is in the electrodes, it is plain that if they are reversed in position, so that the one previously on the right hand is changed to the left hand, and vice versa, the direction of the galvanometer deflection is unchanged, whereas if the galvanometer connexions are changed, without altering the position in the hands, the direction is reversed. This, indeed, is usually the case, but not always. In the latter case it is clear that there must be a source of potential difference in the skin itself, which overpowers that of the electrodes. This can only be investigated by the use of electrodes which do not themselves produce a potential difference when in contact with the skin; in other words, the so-called non-polarizable electrodes must be used. The contact with the skin is made by a salt solution similar to that of the tissues themselves. It is familiar to all physical chemists that such phenomena as those with which we are concerned can only be investigated by the use of such electrodes, but it is unnecessary to describe here the details of their construction. For the present purpose their more important property is that they can be made equipotential, or rather the one electrode has a potential exactly equal and opposite to that of the other, so that in use they give rise to no current. Mr. Baines gives a series of extraordinary objections to their use, based on his view of the importance of static charges and inductive capacity in phenomena of electro-physiology. I shall have occasion to discuss this point presently, and will merely refer here to the instructive photographs taken by Dr. Thomas Lewis with the string galvanometer, showing the distortions produced by metallic electrodes. They were published in the *Proceedings of the Physiological Society in the Journal of Physiology*, vol. 49, p. li.

The most obvious source of electrical changes in the skin is the activity of the sweat glands, long known to be accompanied by such effects. Moreover, Tarchanoff showed that all kinds of mental states produced localized activities of these glands. Shell shock and neurasthenic states are undoubtedly conditions of mental instability and easily induce activity of sweat glands. There may be also other sources of electrical changes in the skin in addition to this.

The explanation of electrical changes in cells is beyond the limit of this article; the most acceptable view is that they are due to the separation of the positive from the negative ions by the interposition of a membrane through which only one kind of the ions is able to pass. Thus we have a Helmholtz "double-layer," which can be best realized by the comparison of a field containing ewes and