will entitle him to a *licence-ès-science*, and upon the presentation of a satisfactory thesis he will be eligible to the French doctorate. If he has the ability, he can, at his pleasure, discharge all three subjects in one year; or he can do so in successive years, migrating, if he wishes, from one university to another, and studying at the same time whatever other subject he may choose.

The French system as modified possesses one distinct advantage over that of Germany. In the latter country the student must present his thesis before he is admitted to examination for the doctor's degree, and if he fails to present a satisfactory dissertation he is without a degree or diploma. In France, however, the examination precedes the presentation of the thesis, and the student receives independent credits for every portion of his work. If he acquits himself in one branch only, he has his certificate, three of which, as has been explained, give him the *licence-ès-science.* If interrupted in his work before securing a degree he may withdraw with honorable credentials for at least that portion of his work which has been accomplished.

The degree rendered by the Conseil has reference only to the faculties of science. It is hoped, however, that a similar arrangement may be had in the Department of Letters. Important concessions have already been made in connection with the admission of American students to the faculties of medicine, and Mons. Bréal, in a letter to Prof. Furber, writes that the Faculty of Protestant Theology manifests a most liberal disposition in this regard. The changes which the French have made are of very great value. It now rests with the students of America to manifest their appreciation and to avail themselves of the facilities which are placed within their reach, in the same warm spirit in which they are offered.

G. BROWN GOODE,
*Secretary of the American Committee.*

## APPLICATION OF THE X-RAYS TO SURGERY.

THE manifold uses to which Röntgen's discovery may be applied in medicine are so obvious that it is even now questionable whether a surgeon would be morally justified in performing a certain class of operation without having first seen pictured by these rays the field of his work, a map, as it were, of the unknown country he is to explore. It may be well to consider first what has already been accomplished in this direction, and then briefly to enumerate a few achievements we may expect when the time of exposure is lessened, the intensity of this form of radiation increased and, possibly, the rays brought to a focus.

Mosetig, of Vienna, was the first to make a practical application of the new discovery in surgery. The case was one of double phalanges at the tip of the big toe. It was impossible, by the usual means of diagnosis, to decide which of these bones communicated directly with the middle phalanx, thus forming the joint, and which was the supernumerary bone. It was, therefore, deemed advisable to amputate at the distal articulation, but a picture secured by the Röntgen process revealed very clearly that one of the phalanges formed a portion of the true joint, the other being merely connected therewith by means of an osseous union. It was then a very simple matter to remove the extra phalanx, the surgeon having before him a complete picture of the osseous parts involved. The satisfaction of the patient may also be imagined, for he could see for himself the advisability and simplicity of the operation. The next case of Mosetig was one in which a bullet had lodged in the fifth carpal bone and there become encysted. Various means had been previously tried, but unsuccessfully, to locate the bullet. In the picture in this case may also be noticed a sessimoid bone; and here attention should be called to the fact that these extra bones should not be mistaken for foreign bodies. Neusser's experiments were made upon objects outside of the body, and of these the first telegraphic newspaper reports were most confusing, many persons being lead to believe that a calculus had been photographed within a kidney in the living subject. Prof. Neusser was able to obtain a distinct picture of a phosphatic vesical calculus through four centimeters of calf's liver. Haschek and Lindenthal have shown the fibrous bands uniting old injured bones. Having injected the arteries in the hand of a cadaver, they have shown a method of making a plate which will be useful for anatomical instruction. Lannelongue, of Paris, has diagnosed by this process tuberculous arthritis. Cox, of Montreal, early in his investigations, secured the picture of a bullet in the calf of the leg; the bullet, which was afterward removed, being located between the tibia and fibula. Buckshot has been found by Pupin; needles and glass have been pictured by several observers and afterward removed. Robb, of Trinity, diagnosed a luxation and fracture in the hand of a patient who was under treatment for another condition. Röntgen has recently prepared a picture of a fracture of the forearm with much displacement. Lodge has a picture showing a bullet in the wrist. Of the tissues of a cat, Reid finds bone the most, and cartilage the least, opaque. It is reported by the *Lancet* that a thigh bone attacked with osteomyelitis has been pictured. A skiagraph of a suppressed and a rudimentary phalanx is shown in the *Boston Medical and Surgical Journal* of February 20, 1896. The writer has been able to discover in a living subject a doubling of one of the carpal bones and those of the corresponding first row of phalanges, in a case of polydactylism, with webbed fingers. The same picture also showed osseous union at the tips. In another case ankylosis of the terminal and middle phalanges of a finger is seen. And so the list might be increased by observations made throughout the civilized world, as wherever these experiments have been repeated physicians have naturally seized upon the opportunity to benefit the patient.

Carbutt, of Philadelphia, suggests that celloidin films may be moulded to the contour of the body, thus facilitating the taking of a picture of the thicker portions of the arm, the leg, or the trunk. He is also preparing plates which will be peculiarly suitable to the action of this form of energy.

In conclusion, let me cite a few of the many instances in which this discovery may be useful in medicine and surgery. First. In the diagnosis of luxations and fractures, at times a difficult or impossible procedure, it will be possible, in certain cases, to picture a fractured bone, reduce and dress it, and afterward secure a skiagraph through the bandages, thereby demonstrating beyond doubt whether there has been proper approximation of the ends of the bones. Again, it may be practicable to fix the time at which union has taken place, and to determine accurately the amount of osseous deposit that has occurred on the bone, it being a well known fact in surgery that this union takes place in a longer or shorter time, depending upon age and individual peculiarities. The distortion of bones when pictured upon different planes might doubtless be overcome by the use of mirrors, or other apparatus.

Second. Certain foreign bodies, as glass, bullets and needles, may be diagnosed not only in the extremities, but in other parts of the body. A jackstone lodged in the larynx, or a set of teeth, penknife, coin, intubation tube, etc., in the intestinal tract might be revealed by a careful study of the plate. Renal and urinary calculi may possibly be located under favorable conditions.

Third. It may be possible to distinguish in certain cases an adulterated from unadulterated drug, *e. g.*, some tinctures permit the rays to pass much more readily than others. Flaws in instruments, especially those made of aluminum, might be detected by these rays. Experiment alone will decide whether bacteria will be influenced by the rays in the same manner as certain colonies of organisms are injured by exposure to the direct action of the sun. Park, of New York, has exposed a culture of the diphtheria bacillus for thirty minutes to the rays from a Crookes tube without any result being noted. He who is able to secure a picture of the brain will accomplish more than can be expected from the present state of our knowledge of the X-rays.

The suggestion has been made that in our large cities skiagraphic institutions should be erected and equipped, to which physicians or surgeons could send patients, and where, under their direction, pictures of the desired portion of the body could be prepared, just as a physician now writes a prescription which is sent to the druggist to be compounded. Our large hospitals where numerous accident cases are brought should have in the near future a plant sufficient to prepare skiagraphic reproductions at short notice.

HENRY W. CATTELL.
UNIVERSITY OF PENNSYLVANIA.

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## *CURRENT PROBLEMS IN PLANT MORPHOLOGY.*

### ON SOME CHARACTERS OF FLORAL GALLS.

THE growing interest in ecology which is so marked a feature of botanical investigation during the last five years has occasioned new and valuable work on galls, so that now for the first time compendious works have begun to appear, in which a really scientific and adequate account of these curious structures is attainable. An excellent resumé in popular style is that given in Kerner and Oliver's *Natural History of Plants*, Vol. II., pp. 518–554. That upward of 1,600 different kinds of galls have been described is noted, and an attempt is made to classify them. With characteristic looseness Kerner divides galls into fungus galls and insect galls, but this is quite inadequate, for algæ, among plants, also produce galls, *e. g.*, Phytophysa treubii W. v. B.,* which attacks the leaves of Pilea at Buitenzorg. And "insects," under which Kerner includes Arachnoidea, are not at all the only gall-producing animals, for nematodes (afterwards mentioned by Kerner) and rotifera are well known as efficient causes in cediciogenesis.

Kerner's classification of galls from a plant anatomical point of view is, however, excellent and is reproduced with some slight modifications in Ludwig's *Lehrbuch der Biologie der Pflanzen.*† Fundamentally galls are either simple or compound, as one or several organs take part in their production. Each class is divided into a number of subclasses, but the details need not be gone into here. The account given by Ludwig is compact and clear.

The changes produced in flowers and inflorescences when they are subjected to stimulus from a cecidiogenic organism may be classified as: 1. Chlorosis. 2. Multiplication of parts. 3. Metamorphosis of parts. 4. Suppression of parts. 5. Hypertrophy, general or restricted. 6. Antholysis. 7. Fusion of parts. 8. Fasciation. Examples of these are as follows: 1. Green flowers of Veronica. 2. Double flowers of Rhododendron. 3. Flowers of Valerianella in which petals are substituted for stamens. 4. Flowers of Anemone nemorosa inhibited by *Puccinia fusca.* 5. Flowers of Lychnis in which a parasitic Ustilago stimulates the growth of the vestigial stamens of pistillate flowers until they rival in structure the normal stamens of staminate flowers. 6. Flowers of gentians in which the carpels

* Weber: Zoolog. Erg. Reis. Niederl. Ost-Ind. Hft. I. 48–71. Leiden, 1890.

† Ludwig: l. c., pp. 98–110. 1895.