maps of Europe on the same plan. Nothing could throw more light upon the mazes of mediaeval and modern French, and particularly German history, than such a method of illustration as is here offered. Where the pupil now possesses an unmanageable congeries of facts, names, and dates, he could then carry away with him a vivid picture of the intricacies caused by the constant series of wars and dynastic contests. These maps are virtually the object-method applied to history, social science, geology, ethnography, and their related sciences. They are in every way commendable, and no teacher of those subjects should fail to apply the method which they suggest.

ALTHOUGH SENATOR ALLISON'S commission which is investigating the surveys reported the evidence taken some weeks since, no conclusions have yet been made public. Nothing officially authenticated can therefore be said as to what legislation the commission will finally recommend. But those who have most closely followed the proceedings, and watched the effect of the evidence upon the minds of the members, feel entire confidence that no very radical measures will be proposed, and especially that the integrity of the coast survey will not be threatened. It is scarcely believed that the commission will even recommend its transfer to the interior, or any other department than that under which it is now placed. The impression that no change will be made has become so wide-spread, that candidates for the position of superintendent are again coming forward. The friends of Gen. W. F. Smith are said to be the strongest, but it is not well to predicate any thing upon newspaper reports of the prominence of Smith, Rosecrans, or any other candidate. It is safe to say that the President is fully conscious of the importance of the position, and of the small value to be attached to recommendations secured by the candidates themselves. We believe that he will make the best selection he can from the names presented to him, disregarding their influence, and that the standing of the candidates as scientific experts will not be disregarded in the choice.

ELECTRIC RAILWAYS.

AMERICA seems to lag very much behind Europe in the matter of electric railways. Indeed, our lighting systems seem to have absorbed all our energies; and perhaps the most appropriate and lucrative use of dynamic electricity, its application to locomotion, has been overlooked, or been treated in so superficial a manner as not to have resulted in commercial success.

Every American supposes himself capable of intuitively doing his own engineering, regardless of the fact that he may have neither experience in any of its various departments nor education in the fundamental facts and methods of computation of technological application of scientific truths. Inventors with good ideas regarding electrical work gravely spin for us complete systems for electrical railways, drawing only on their intuitions for every thing save the dynamos and motors. Do they realize that a vast number of problems of organization and system still remain unsolved upon the steam-railroads? Do they realize that they are not engineers, but only electricians, with a vast deal yet to learn in their own field? They do not: they are in possession of one good idea, and they recklessly proceed to surround their invention with all sorts of engineering crudities, thus rendering their chances of success almost nothing.

Germany has been more fortunate in having its first electric railway undertaken by Siemens & Halske. This firm brought to bear upon the problem the profound researches and the engineering education of its staff, and, acting in the cautious and thorough manner resulting from its wide experience in many fields of engineering, has been successful. In the exhibition of Berlin, 1879, they established a circular railway of 350 metres length, one metre gauge, and, placing a three-horse power motor in a car capable of carrying thirty people, transported passengers at a rate of fifteen to twenty miles per hour. The current was taken along one rail, and by an insulated tire was conveyed to the positive pole of the motor, and thence to the other rail, by which it returned to the generating-dynamo. No special care was taken to insulate the rails, which were placed high above the ground on wooden ties. The current was of low electromotive force, and therefore did not require special means for insulation. This road was exhibited in Düsseldorf and Brussels, and finally in London in 1881.

The success of this experimental plant was uniformly so great as to make Messrs. Siemens & Halske desirous of building an elevated electric railway in Berlin, for which the plans and estimates were made with great care, but unfortunately this enterprise was not carried out, because the Emperor William would not permit 'The Linden' to be marred by being crossed at one point, and because the citizens objected to having people looking into their second-story windows.

The carefully made estimates of this road may be of interest as showing the minimum of cost of good work, upon the authority of engineers thoroughly conversant with their profession.

ELEVATED RAILWAY IN BERLIN, ONE METRE GAUGE, 6¼ MILES LONG, WITH SEPARATE MOTOR FOR EACH CAR.

Railway structure and 10 stations		$305,000
10 carriages, seating 15 persons each		15,750
Steam-engine, boilers and dynamos		9,750
Buildings		5,925
Land		22,500
General labor		3,575
		$362,500
Current expenses.		
Wages	$10,950	
Fuel	5,550	
Oil and waste	250	
Lighting	400	$17,150
Depreciation and repairs: —		
3% on $312,500	$9,375	
16% on $25,000	4,000	13,375
Interest on capital ($377,500) @ 5%		18,875
		$49,400

It was proposed to run two hundred trips each day at a fare of two cents per mile, and would have proved a paying investment had it obtained the equivalent of six passengers for a whole trip for each car.

Failing in this, Messrs. Siemens & Halske obtained a charter for a surface electric railway from the Berlin military academy to Lichterfelde, a distance of a mile and a half, which was opened in May, 1881. This road was constructed upon the ground after the manner of ordinary roads, save that a bowed fish-plate connected the rails so as to permit contraction and expansion. Again, only two rails were used, — one conveying the current out from the dynamo, and the other returning the current to the dynamo. Very little resistance was found, owing to the large cross-section of the rails used as conductors, and consequently low potentials were found practicable. Very great success has attended the running of this road, and it has been extended to Tetlow and Potsdam, making, in all, some eight miles of road in successful operation upon ordinary roadbed with wooden ties and steel rails. Insulated wheel-tires are used to take off the current.

At Paris the law required flat tram-car rails, not projecting above the street-level; and the presence of dirt would have interfered with the passage of the electric current from the rails to the wheels: so overhead copper conductors, and trolleys running along the conductors, and connected to the car by flexible wires, were used. In the mines at Zankerode, Prussia, Messrs. Siemens used two overhead rails for conductors, as the condition of the track prevented its use. A separate motor, weighing a ton and a half, drew loads of eight tons at a rate of seven or eight miles per hour. In other cases, Messrs. Siemens & Halske have found it advisable to use a third rail, or separate copper conductor connected with the positive pole of the generating-dynamo, and have connected the negative pole with one or both rails of the roadbed. The Portrush and Bush mills electric railway, six miles long, has used a third rail so placed as to be free from dirt, and has been in successful operation for several years. Besides the Portrush railway, there are now in successful operation electric railways at Brighton and Blackpool. Dupuy, at Lisieux, France, has arranged a locomotive for use in the bleaching-fields of a bleaching-works. The power is carried in Faure accumulators on the locomotive. Recently we have the experiments upon the Reckenzaun secondary battery tram-car at the Antwerp exhibition, which proved itself the superior, in many ways, of the steam and compressed-air motors entered in competition with it. When we compare the indicated power of the engine charging the secondary batteries with the power developed in moving the car, we find an efficiency of from thirty to forty per cent in this case. It is impossible to doubt the ultimate success of electric railways when built with sufficient knowledge and engineering skill to assure their adaptation to the purposes which they must subserve. The successful outcome of the work of Siemens & Halske prove this beyond a doubt. The possibility of attaching a motor to each car enables us, with very little loss of space, to have each car independent of any separate locomotive, and to utilize the adhesion of all the wheels, and load. The counter electromotive force of a dynamo used as a motor, being proportional to its speed, renders it to a certain extent automatic; so that, being at rest, the current passing is the most intense, the torsion is a maximum, and the car starts with a great pull. If the car slows on an up grade, the pull at once increases, and, if it goes faster on a down grade, the counter electromotive force increases, the intensity of the current diminishes, and the demand for power upon the generating-dynamo and engine is reduced. The application of power to each car avoids the necessity of an extremely heavy locomotive, and allows of a great diminution of the weight and strength of bridges and viaducts.

A large number of electric railways have been projected in this country, and some tried with a moderate degree of success, as at Toronto, New Orleans, Baltimore, and other places. The experiment which has of late attracted the most attention has been the substitution of electricity for steam on the New York elevated railways. That this experiment has not succeeded as well as could be wished is not due to any inapplicability of electricity to the purposes of locomotion. All that has been attempted in New York has been successfully carried out in Germany, and a more careful copying of the details and methods of Messrs. Siemens & Halske would have produced success. The enormous traffic on these roads taxes to the utmost the carrying-capacity of the steam-plant, which is the result of half a century of study and modification of machinery of locomotives and cars. The substitution of electric motors for steam-locomotives will be a gradual process, and will progress just in proportion to the engineering skill brought to bear upon the problem. W. D. MARKS.

CARTWRIGHT LECTURES ON PHYSIOLOGY.

WHILE physiological science has made rapid advances in recent years, there are still many problems which it has as yet failed to solve, notwithstanding the fact that many patient and skilled investigators have devoted their entire time and energy to their solution. Among these problems, none is of greater interest and importance than the life-history of the blood, and to its elucidation the best minds in Europe and in this country have been directed. Prof. William Osler, M.D., of the University of Pennsylvania, was invited to deliver the fifth course of the Cartwright lectures of the Alumni association of the College of physicians and surgeons of New York, and selected as his subject, 'Certain problems in the physiology of the blood.' The course of these lectures began the evening of March 23, at the hall of the Young men's Christian association.

The first lecture dealt with the blood-plaque, which is also known as the elementary corpuscle of Zimmerman, the haematoblast of Hayem, the third corpuscle and blood-plate of Bizzozero. In blood withdrawn from the vessels, in addition to the red and white corpuscles, are seen grayish granular masses, being from ten to fifteen times the size of a red corpuscle. These are known as Schultze's granule masses. They are made up of small bodies, which are of uniform size, and, seen in face, have a disk shape, and in profile appear as rods. These bodies are the blood-plaques. Their diameter is from 1.5 micro-millimetres to 3.5 micro-millimetres. They are always found in mammalian blood, though their number is subject to considerable variation, in health averaging one to twenty red corpuscles. The estimates of their number, made with the haemacytometer, give about two hundred and fifty thousand of them to each cubic millimetre of adult blood. In the new-born this may be doubled, as also in consumption. In fact, in all wasting diseases their number is much increased, as not only in consumption, but also in cancer and in anaemia; and they appear sometimes to occupy nearly the whole field of the microscope. During acute fevers they are much diminished in number, and again increase during convalescence.

When the blood is withdrawn from the blood-vessels, these plaques have a tendency to conglutinate, forming the granule masses of Schultze; and so rapidly does this occur, that it would appear to be the condition in which they exist while within the vessels. This is, however, not the case, but is a property which they possess analogous to the nummulation of the red corpuscles. That this state of conglutination is not the natural one may be shown by examining the blood while circulating in a living animal, as in the omentum of a guinea-pig or rabbit, or in the subcutaneous tissues of a new-born rat, which is admirably adapted to the purpose. Or, if a drop of a solution of osmic acid (one per cent) or Pacim's fluid be placed upon the tip of the finger, and then the finger pricked, so that a drop of blood will flow directly into this solution, and then the whole transferred to a microscope-slide and examined, it will be found that the plaques are isolated, and the tendency to coherence has been overcome.

There are some investigators who hold to the opinion that these blood-plaques are disintegrated white corpuscles, but the objections to this explanation are numerous and incontrovertible. It may therefore be considered as established that the blood-plaque is a separate entity, and distinct from the mature red and white corpuscle.

The history of these corpuscles may be divided into three periods. In the first, prior to 1877–78, a number of investigators were at work upon it, among them Donné, Zimmerman, and Erb. In 1874 Osler pointed out that the granule masses of Schultze only formed after the blood was withdrawn from the blood-vessels. In the second period, 1877–78, Hayem demonstrated the existence of this third corpuscle, and called it haematoblast. In 1882 additional researches were made by Bizzozero, who described it as a blood-plate. In the third period, from 1882 to the present time, a number of investigators have been at work, and there have appeared some twenty different articles upon the subject. Kemp has been investigating the question at the Johns Hopkins university, and his paper will contain a full bibliography.