women and two soldiers who got in the way were run down and killed instantly.

The best time from Paris to Bordeaux was made by Gabriel on a Mors racer. His running time was 5 hours 13 minutes 31 1-5 seconds, which made his average speed about 66 miles an hour. Louis Renault, on a Renault car, was second in 5 hours 22 minutes 59 seconds; and J. Salleron on a Mors, third, in 5 hours 46 minutes 1 4-5 seconds. Jarrott, the Englishman, on a De Dietrich, arrived fourth about five minutes later.

PROF. GOODSPEED ON SECONDARY RADIATION INDUCED BY X-RAYS.

The first printed statement issued over his own signature by Prof. Arthur W. Goodspeed of the University of Pennsylvania concerning secondary radiation induced by X-rays since his announcement of important discoveries in this direction is published in the university's official organ, The Pennsylvanian. The article reads:

Having occasion last winter to examine critically some radiographic records, I was surprised to find the clear outlines of some metallic bodies that had been behind the plate during exposure. This recalled that I had been consulted once by somebody who had found similar anomalies, and that I had been unable to throw any light upon the subject. For obvious reasons, I determined now to spare no trouble to hunt down the cause of the effect which I had observed, and after a series of upward of one hundred progressive experiments I was convinced that when an X-ray tube is in operation not only is every particle of matter which is impinged by the X-rays secondarily radiant, but that also in some cases this secondary radiation had in all probability imparted activity of some sort to air particles and to portions of the wall which had not been impinged directly by the primary rays.

The cause, then, of the impressions on the plate of articles behind it was established. All of the later experiments leading up to this conclusion had been made with the Crookes tube completely inclosed in a dark box, eliminating thereby every trace of fluorescent emanations which one usually does not take the trouble to cut off and which are always emitted by the glass with which the bulb is made.

Next, from a portion of the space outside the box, the X-rays, which, of course, passed freely through the wood, were completely cut off by heavy lead plates, properly placed on the top of the box, and it was on these plates, screened thereby from the X-rays, that the radiographic films employed for receiving the records were placed. Above this, and to one side, freely accessible to the X-rays, the various bodies to be tested for secondary activity were arranged, including zinc, brass, wood, my hand, and a variety of articles too numerous to mention. In every case unmistakable evidence of secondary action appeared upon the plate.

Presuming, of course, that others besides myself may have been working along similar lines, I proceeded to look up carefully the literature on the subject in order, if possible, to determine what parts of the investigation, if any, might claim priority as well as originality. Two Frenchmen, Perrin and Sagnac, I found had demonstrated the property of secondary activity induced by the X-rays, and along some lines of investigation had given some interesting quantitative values; and still a third Frenchman, Guillox, had demonstrated the possibility of using the hand as a secondary source.

None of these three, however, seems to have excluded the optical fluorescence which always accompanies the X-rays, unless special care is taken to cut it off, as already explained. Inasmuch as I found that an Englishman of the name of Townsend had demonstrated that some differences in the numerical values given by Perrin and by Sagnac must have been due to a difference in the primary rays they employed, it seemed to me that putting everything in absolute darkness, from an optical point of view, and then experimenting in the night, thereby cutting off every trace of optical light, was a distinct step in advance of the work of the men referred to.

In brief, then, it has been shown possible to produce secondary radiograms on a sensitized film, inclosed in a perfectly dark receptacle, by means of absolutely invisible emanations from various articles, including the human body, which have been excited by X-rays generated within a black box in a perfectly dark room.

This apparently startling conclusion loses much of its mystery when we contemplate that it is entirely proved at the present time that only about 2 per cent of the radiant energy that comes to us from the sun is capable of affecting the human eye. That bodies on the earth, therefore, while bathed in a portion of the other 98 per cent may be capable of diffusing some of it is what any thoughtful person will admit.

A piece of white paper in a beam of sunlight, or even in a space diffusely illuminated, as is the room of a house, receives a small portion of the 2 per cent of the total energy incident upon its path, and diffuses again a small portion of what it receives, thereby making it visible to the eye. Why, then, might we not expect that a piece of zinc or copper favorably posed to receive a portion of the other 98 per cent, i. e., of the dark energy, should be capable of diffusing some part of that in such a way as to be objectively visible to some appropriately devised apparatus for observing it?

It is to be noted in passing that the most favorable location for getting some of the 98 per cent without some of the visible 2 per cent is in a dark room. We have been using the word dark, of course, as applied to the human eye. It is quite possible, to my mind—entirely probable—that a mouse, and very likely a cat, could, if it had the proper intelligence, give us valuable assistance in rooms to us totally dark which are doubtless to them comfortably illuminated.

In connection with the work just referred to, a somewhat painful personal experience seems to me to be suggestive as to the possible cause of the well-known inflammation which sometimes follows prolonged exposure to the X-rays. A year ago I had occasion to sleep in the same room in which experiments had been conducted during the day. At the end of that time I left town, but developed at once an aggravated attack of inflammation of the eyes and throat, which yielded to treatment after a few days. During the first week of this month again I found it convenient to sleep in the same room where I had been conducting experiments during the day and evening. At the end of about the same time all the symptoms reappeared with which I had suffered a year ago, with same result—on changing sleeping rooms the difficulty at once disappeared.

In drawing conclusions from these experiences, it must be noted that no trouble has been experienced in the meantime nor before, although I have frequently, during the last six weeks, spent several hours each day for a week or two at a time around the X-ray apparatus. In the night the room had been nearly or quite closed, preventing free air circulation, and the potent protection of eyeglasses was wanting.

I am forced, under the circumstances, to believe strongly that the immediate cause of the troublesome inflammations was the secondary emanations from the air or bodies in the room, or the human body itself, rather than the primary X-rays. This theory would, of course, necessitate the assumption that the activity lasts for an appreciable time after the exciting cause has ceased.

To prove this by objective experiment would indeed be difficult, since the ions developed by the passage of the X-rays through the air are, of course, present for a considerable time after the cessation of the rays, and the electroscope, which would be expected to indicate the activity sought, would be discharged by these ions, and we would still be in the dark.

ALKALI MANUFACTURE BY ELECTRICITY FROM NATURAL SALTS.

The first six months' working of the electrolytic process of manufacturing alkali from natural salts in England has proved so successful that a wider adoption of the process is to be carried out. The general system of manufacturing the alkali from the natural product is by the decomposition of the two fundamental constituents—chlorine and soda—by complicated and not expensive chemical processes, in which sulphur plays an important part. The methods invented by M. Leblanc, a French chemist, more than 120 years ago have been generally followed ever since that time. During the past few years, however, Mr. James Hargreaves and Mr. Thomas Bird have been conducting an elaborate series of experiments, with the object of devising some simpler and more economical method of bringing about the decomposition of the salt with the aid of electricity.

For the purposes of these experiments a small plant was laid down at Middlewich, Cheshire, the center of the salt industry of England. The salt abounds in the form of brine in large subterranean lakes. In the electrolytic process, the brine after being pumped to the surface is conducted into rectangular cells, through which is passed a strong current of electricity. The effect of this is to release the chlorine, which escapes in the form of gas into pipes, and is conducted into other chambers, where it is brought into contact with lime, and produces chloride of lime. The solution of sodium which is left in the cells passes out through a diaphragm, and is converted by a bath of steam into soda solution. By a very simple arrangement in the construction of the chambers, carbonic acid gas, from the furnaces which supply the power, meets this soda solution and its properties are absorbed, with the result that a strong solution of carbonate of soda is formed. Then it flows away into vats, where the soda gradually hardens into crystals, and the processes are complete. It is then only necessary for the great blocks of soda carbonate to be broken up to a suitable size for sale.

A battery of only 56 cells has been at work, but the profit upon six months' experimental work is $37,500. The main features of this new process are economical production, with very little waste, and the reduction in price to the consumer of the finished products.

SCIENCE NOTES.

The anti-diphtheria serum discovered by Prof. Roux, of the Pasteur Institute, is now being made in the form of lozenges for use during convalescence. The professor had observed that bacilli found in the mouths of patients several weeks after recovery were liable to convey the disease to others. The lozenges overcome this and also render preventive inoculation unnecessary.

The Greeks and Romans paid special attention to the physical culture of their youth, to public water supplies and baths, and Athens and Rome were provided with sewers early in their history. During the middle ages, sanitation received a decided check. Ignorance and brutal prejudice prevailed and this was the most unsanitary period in history. Most European towns were built compactly and surrounded by walls. The streets were narrow and winding, and light and air were excluded. The accumulation of filth was frightful. Stables and houses were close neighbors. The dead were buried within the churchyards or in the churches. Wells were fed with polluted water. All conditions were favorable for the spread of infectious diseases, and in the fourteenth century alone the Oriental or bubonic plague—the Black Death of recent historians—carried off a fourth of the population of Europe. The birth-rate was much less than the death-rate normally. The cities had to be continually repopulated from the country. These sentences from a review in Science of new works on sanitation in our own times illustrate, by provoking a comparison, the improvement in our day.

H. D. Richmond points out that it is quite fallacious to endeavor to test the acidity of milk with litmus-paper, since it is possible to condemn all fresh milk as the result of applying that test. Litmus-paper may be either red containing only the acid, or blue containing the acid with such an amount of alkali that no red ions are formed, or at some intermediate stage. If those papers be used to test a partially neutralized mixture of acids of various strength, contradictory results may be obtained. Phosphoric acid is a good example of three different acidities in one molecule; the first acidity is strong, the third is very weak, and the second is intermediate between the two, and about equal in strength to the acid of litmus. It has been shown that milk contains phosphates with the third acidity completely neutralized and the second only partly so, and therefore milk is an excellent substance to show the peculiar behavior of litmus. If blue litmus-paper be dipped into milk, the blue litmus, having the acid completely neutralized, is more alkaline than the milk, and the two tend to come into a condition of equilibrium by a portion of the alkali of the litmus passing to the milk; the consequence is that the litmus becomes less alkaline and turns slightly red. If red litmus-paper, which is more acid than the milk, be used, alkali will tend to pass from the milk to the litmus, and turn it slightly blue. This is the so-called amphoteric reaction. A litmus-paper of some intermediate stage would be unaffected.—Chemical News.

A German chemist, Herr Gerold, has discovered a means of preventing the ill-effects which sometimes arise from the excessive use of tobacco, which is liable to produce attacks of vertigo, a particular form of dyspepsia, palpitation, and diseases of the chest. His procedure consists in steeping the leaves of tobacco, before being made up, in a solution of tannic acid, which combines with the nicotine and forms a substance quite inactive and harmless. In order to increase the flavor of the tobacco, it is then treated with a decoction of marjoram. The flavor of the tobacco prepared as above described differs in no way from that of ordinary tobacco; and experiments made with it on weasels, frogs, and even human beings, have demonstrated that its use produces no toxic effects on the organism. The pressure of the blood remains normal, the heart beats regularly, and the paralysis which overtakes animals who have been poisoned with nicotine is entirely obviated. Our contemporary adds that all smokers will hail with satisfaction the discovery of Herr Gerold. We fear that, as a smoker, we can scarcely agree with this optimistic statement. Supposing that Herr Gerold succeeds in removing all the nicotine, what is left? We doubt that the vast proportion of tobacco smokers suffer from consequent dyspepsia, palpitation, and diseases of the chest, and believe that they will prefer to continue the use of tobacco than to adopt Herr Gerold's substitute. If, on the other hand, a smoker does suffer as our contemporary suggests, he would do well to refrain from the "noxious weed" altogether.