from predacious fishes by gluing to his sides small sticks, somewhat longer than his body, until he is encased in an irregular wooden cylinder—a jagged and clumsy boat in which he alternately floats and crawls. This carpenter worm leaves an orifice for his head and legs, and his artificial shell seems a thorough shield.

The medusa or jelly fish of our seacoast is well known to all sea bathers; and its phosphorescence often reveals its whereabouts to steamboat travelers. It is as large as a tea plate, flat, gelatinous, and translucent; with the convex portion forward, it pushes its way through the water as if it were a small parasol—a white fringe a yard long, waving backward from the edge, assisting the resemblance. This creature has hardly any life; it seems to have only one organ, which receives and ejects food, and its movement through the water is by a series of convulsive jerks. Lift it out of the water and it drops through the fingers like thin jelly. But in its native element it has the power of sharply stinging with its fringe, from which it is called nettle fish. This fringe, when microscopically examined, is found to be filled with minute sacks, each of which contain a microscopic arrow ready to discharge. Friction bursts the cells and causes the discharge of myriads of arrows into any soft flesh that may be the cause of the disturbance. The harm is not great to any robust organism, but it must be sufficient to shock and paralyze some of the inferior fishes.—*Graphic.*

Correspondence.

How to Straighten a Shaft.

We frequently receive letters from our subscribers detailing some experiment they have made, or some new wrinkle in the detail of manufacture, or concerning a novel device they have found to answer for some particular purpose; for all such communications our correspondents have our thanks.

Although the large number of such communications precludes the possibility of our answering or publishing all, yet we convert as many as possible to the benefit of our readers. We are sometimes surprised to observe how completely the information forwarded to us on a given subject will answer an inquiry made on the same subject by some other correspondent. For example, A. F. writes: "You will do me a great favor if you will tell me how to straighten an iron shaft, 2¾ inches in diameter, that is slightly bent, and will not work without binding in the bearings."

The same mail brought a letter from J. J. H., who writes:

To the Editor of the Scientific American:

"The following is a good way to straighten shafts that have been sprung by heat or otherwise. Lay the shaft on bearings at each end, with the arched side up, about 1 foot from the ground; then build a fire (wood will answer) under the part or parts to be straightened. When hot, chill the the top side, which is to be straightened, with water, which can be best done with a swab; continue the heating and chilling till the work is complete. Allow the heat to come back to the top side between each chilling, to quicken the process, and to ascertain when complete. After the shaft is hot, a very little fire will be required to continue the heat. I think that any kind or size of metal shafting can be straightened by this process. I made the experiment on a wrought iron shaft 5 inches in diameter and 12 feet long, that was sprung 3 inches by being burnt in a mill. It was was only 2 hours from the time I built the fire under it till it was perfectly straight. J. J. HILL.

Hayden's Ferry, Arizona, July 1, 1876.

[For the Scientific American.]

THE DEVELOPMENT OF SPEECH.

As the seventeenth century was preëminently one of revolutions, the present is one of evolution. Everything is supposed to have been evolved from something else, man from monkeys, articulate speech from inarticulate cries, writing from hieroglyphics, etc. A few weeks since the American Philological Society met in New York city, and among their discussions were some of much interest. Professor Harkness read a paper in which he stated that comparative philology had proved that all the known languages and dialects have been evolved from one parent tongue, whether by differentiation, natural selection, and survival of the fittest, or by other processes. Darwin, in his "Descent of Man," draws some of his most forcible arguments from the resemblance of the human fetus to the full grown ape and other animals. The unspoken language, the inarticulate cries of infants, has not, so far as we are aware, been carefully studied, and compared to the cries of birds and animals. H. Taine has recently directed attention to this subject by an article on "Lingual Development in Babyhood," published in the *Revue Philosophique.* But M. Taine passes over the multitude of different cries and exclamations, consisting, as he says, exclusively of vowel sounds, and expects articulate speech. Some of his observations are, however, valuable and interesting, as being the first that have been accurately made and intelligently recorded. We hope that these observations will be repeated by others, so that in time the mass of facts will be large enough to enable us to generalize upon them, and eliminate the personal factors which vitiate the conclusions drawn from too limited a number of facts. Idiosyncrasies in children are probably as common as elsewhere; abnormal development must not be mistaken for a normal condition; one child will differ so greatly from some other child that we shall at first incline to think there is no common ground between them; but as observations increase, the facts will gradually fall into system, and order come out of chaos.

From a study of the speech of babyhood we shall learn not only how language is formed, but shall see in it the gradual unfolding of the intellect. Babies' selections of words are instructive to the biologist; the order in which they acquire the power of pronouncing the consonants is an interesting study for the phonetic scholar. Why, for instance, can every infant pronounce the word no, for several months before it can say yes? That the English sounds of th are difficult for our children is not surprising; but why are our sounds of j and ch, which few foreigners ever succeed in uttering correctly, easier for a child to pronounce than w, or f, or g? Yet we have heard a boy of three years say jay for way, chun for fun, and jajy for wagon. Again, an American child, who has heard no language but English, will sometimes introduce into our words the most difficult vowel sounds of other languages, such as the unpronounceable German ö and ü, or French eu and u, which he has never heard.

M. Taine says that the little girl on whom his observations were made began to attach a meaning to certain words before she pronounced any word to which she attached any meaning. This will, we think, agree with the experience of most parents, and is not strange, for animals learn to understand our language which they can never speak. The first word pronounced by her was papa, but for a time she did not comprehend its meaning. At the age of fourteen months and three weeks, he says, she could pronounce mama, tété (nurse), oua-oua (dog), koko (hen, cock), dada (horse wagon), mia (cat), kaka, and tem. To the latter word she gave a very extensive signification, such as give, take, see, look; it seemed to be a word coined to express her principal desires. Another child, observed by the writer, began with the word no, which was spoken very emphatically in reply to any question, and without a definite idea attaching to it. The same may be said of another common expression used by her, "don't do it;" she soon after learned to say mama, bow-wow (dog), and dink (drink). At the age of fifteen months she began to imitate, repeating almost everything she was told to, and here the habit of generalization was again apparent. She was told, on seeing an ice wagon pass, to say ice. She can pronounce it nicely, and says it every time she sees a horse and wagon, showing that she has extended its meaning to all wagons, and probably to horses also. Another curious case came under our notice sometime since of a little boy who applied the term dady to every man he saw, and also to chickens, dogs, horses, etc., much to the annoyance of his mother.

In a paper read at the Bristol meeting of the British Association, D. A. Spalding advanced the idea that the progress of the infant is but the unfolding of inherited powers. He makes no application of this principle to the power of speech, although he might have done so, and we are inclined to believe that, just as a child learns to walk as soon as his limbs are strong enough to safely support him, so he will learn to talk as soon as the brain is sufficiently developed to evolve ideas requiring expression, subject, of course, to the law that perfection is only gained by practice. E. J. H.

[For the Scientific American.]

THE FIRST CHINESE RAILWAY.

The Japanese have readily taken to the mechanical, scientific, and other improvements to which intercourse with the rest of the world has introduced them. For ages they were more exclusive than the Chinese; but now that the barrier is broken down, the Japanese make the most of their opportunity; and they really seemed to have learned and adopted more foreign notions in a few decades than the Chinese have acquired in centuries.

But the iron horse has at last been domesticated in China; and if the old conservatives of the Celestial Empire ever read anything but Chinese classics, they would class the locomotive with that wooden horse which stands as the representative of treacherous gifts. If the locomotive does not revolutionize China in the end, its power has certainly been overrated. The trial trip was taken on a short road out of Shanghai, on June 30 last, and on July 3 regular travel commenced, six trains running each way daily, and the receipts being highly satisfactory. Six daily trains over a road only five miles long is not a very heavy day's work; but with the Chinese, in making innovations, it is wise to make haste slowly.

The first railroad in China, from Shanghai to Woosung, is ten miles long; but the road was only completed to Kangwan, half the distance, when it was opened with much ceremony, the pleasantest part of the programme being on the second day, when the natives were allowed to travel free, and appear to have received that proposition as heartily as any dead heads among the outside barbarians could have done. It is three years or more since the British and continental ironmasters, in session at Liége, took China into their calculations as a possible market for iron, locomotives, cars, and all the mechanical paraphernalia of railways. The first idea was to present the Emperor of China with a small specimen railway; but Chinese red tape—as much more complicated as a Chinese puzzle is more puzzling than any other—prevented the plan from being successful. The next movement, and it would seem a feasible one, was for the foreign residents to buy ground for a carriage road, from Shanghai to Woosung. Englishmen must have their drives, and there could be no harm in that. Then railroad estimates were made; but the first were at too high a figure. It would not do to risk much on an enterprise upon which the Chinese dragon might pounce, and, with a whisk of his tail, demolish. So the estimates were cut down to a single track, of very narrow gage, 2 feet 6 inches, very light rail, 27 lbs.; a toy locomotive, weighing only 1½ tuns, running at a maximum speed of only 15 miles per hour. The road was commenced in January, and in the months which have elapsed the projectors have gained in confidence. They have built for the road two engines, the "Flowery Land" and the "Celestial Empire," weighing each 9 tuns; they have eight inch cylinders and ten inches stroke, have each six wheels, and side tanks.

With a sagacious eye to the consequences of an explosion upon the Chinese temperament, the boilers were tested to 200 lbs. to the square inch. And, for a little while at any rate, the speed will be kept down, and the chances of collision or track jumping will be studiously guarded against. Even to cut off a Chinaman's queue would be fatal to the enterprise; and at this late day in the history of railroads, the problem of safety is made prominent above that of speed. It were much to be wished, for the sake of the public, that Britons and Americans were so far Chinese that to kill one would be a disaster worth consideration, as well financially as morally. If we learn safety in railway traffic from the first Chinese railway, it will be a first class investment for the traveling world. And if, from this small beginning, the iron interests should receive a much needed impetus, that, too, would be a welçome event. *

THE IMPACT OF LIGHT.

ABSTRACT OF A LECTURE BY CAPTAIN ABNEY, R. E., F. R. S., AT THE LOAN COLLECTION, SOUTH KENSINGTON.

Astronomy was the religion of the world's infancy, and it can hardly be a matter of surprise that untutored yet inquiring minds, unaided by any distinct revelation, should have attributed to the glorious orb, the center of our solar system, the possession of divine attributes, and, as they gazed upon the wondrous effects of his magical painting, that they should have offered to him their adoration and worship, and carefully noted any phenomena due to him. Thus probably

THE FIRST PHOTOGRAPHIC ACTION

noticed would be at a very early period of human existence, when the exposure of the epidermis to his rays caused what is known to us as tan, whilst the parts of the body covered would remain of their pristine whiteness. A photographic action which would be remarked at a later date would be the fading of colors in the sunlight. Ribbons, silks, curtains, and similar fabrics of a colored nature undergo a change in tint when exposed to it.

RIBBONS CHANGED BY LIGHT.

I have here a specimen of a pink trimming used by the fair sex, and the lady who presented me with it informed me that it was "a most abominable take-in," as the color "goes" after two days' wear. Her ideas on the subject and my own somewhat differed, for to me it presented a capital opportunity of using the material as a means for obtaining a photographic print in a moderate time I have here two results of the exposure of this stuff to the sunlight. One was exposed beneath a negative of an anatomical subject, and we have the image represented as white upon a pink ground. The other subject is a map. An ordinary map was superposed over a square piece of the stuff, and placed in sunlight whilst in contact. We have in this case the lines of the map represented as pink on a white ground, from which the color had faded.

CHEMICAL CHANGES CAUSED BY LIGHT.

The general opinion is, I believe, that the color is given off somewhat similarly to the scent from a rose. Were this entirely the case, the light would not act as it does, but, beneath the negative or map, the color would bleach uniformly.

The bleaching seems to be a really chemical change in the dye, due to the impact of light. There are many other bodies besides dyes which change in light, and some of them are of the most unlikely nature. I had intended to show you to-night the change that takes place in glass by exposure to light for long periods. My friend, Mr. Dallmeyer, has in his possession specimens of brown and flint glass, which have markedly changed color in those halves of the prisms purposely exposed to solar influences. In some cases there is a "yellowing" of the body, and in others a decided "purpling."

WHAT LIGHT IS.

It is, however, only those bodies which change rapidly in the light that are utilized in photography. The most common amongst these are various compounds of silver, for they are peculiarly sensitive to the action of light. Nearly every silver compound is more or less changed by it, and when I say changed I mean altered in chemical composition When we reflect what light is we can better understand its action. Light, as experiment, confirmed by mathematical investigation, tells us, is caused by a series of waves issuing from the luminous source, not, indeed, trembling in our tangible atmosphere, but in a subtler and infinitely less dense medium, which pervades all space, and which exists even in the interior of the densest solids and liquids. These waves of ether, as this medium is called, batter against and try to insinuate themselves amongst the molecules of any body exposed to their action, a good many millions of millions of them impinging every second against it. Surely it is not surprising to think, small though the lengths of these waves be, that this persistent battering should in some instances be able to drive away from each of the molecules some one of the atoms of which they are composed.

HOW LIGHT ACTS UPON SILVER CHLORIDE

Take as a type that salt of silver which was, perhaps, the first known to change in the presence of light-silver chloride. For our purpose we may represent each of its molecules as