

For the Scientific American.
Light and the Human Eye.

There are various theories regarding the precise character of light. By some it is described "as very minute particles thrown off in all directions with immense velocity from luminous bodies." Others consider it as the effect of an undulation produced by luminous bodies in the elastic medium of the atmosphere, and producing an effect upon our organs of sight like sound on the air by vibrations of the atmosphere.

The former theory of material particles is called the theory of emission, the latter the undulatory theory.

Our opinion is in favor of the two theories combined, namely, that light is thrown off luminous bodies in all directions with great velocity and by a vibration. Whatever may be the absolute nature of light, we cannot tell, for we cannot handle it to dissect its anatomical structure. It is too subtle for the crucible of the chemist and the philosopher only knows that it is a remarkable property of luminous bodies that it enables us to perceive luminous objects themselves as well as other objects and that its absence produces darkness. All visible bodies may be divided into two classes, the self luminous, and the non-luminous. The former class possess in themselves the property of exciting the sensation of light; among these may be mentioned the sun in the heavens and phosphorescent bodies on the earth. The non-luminous bodies, although they may not emit light, yet they may possess the remarkable property of reflecting it and communicate the original emitted ray to a third, and so on. In ancient times it was believed that light was propagated from the sun and other luminous bodies instantaneously, but it has been discovered that although its velocity is great, yet it takes time to travel. It travels at the rate of 200,000 miles in one second. It proceeds in a direct line from the luminous body which produces it, and owing to this fact, all shadows are observed behind opaque objects and this is what makes the night season, for during that period we are in the shadow of our own world and this shadow reaches so far into space, that when the moon plunges into it in her course she undergoes what is called an eclipse. An eclipse of the moon is simply the shadow of the earth thrown so far into space as to darken for a brief period to us the face of the satellite.

As light advances from a candle or gas light it diminishes in intensity, and this diminution increases to the square of the distance at the rate of $4X^2=16$. In other words, if it would take the condensed light of four candles to reach one mile it would take the condensed light of 16 candles to reach 2 miles, but we must remember that as we lose the intensity of the ray, it fills a wider space.—Any parcel of rays passing from a point, is called a pencil of rays. An optical medium is a transparent body like glass. When rays of light are passing from one body to another of different density, they are bent from their former course and are said to be refracted. A ray of light which strikes the surface of a body and is thrown back again from the said surface, is said to be reflected. A looking glass is a reflector, and here let us mention a common error respecting the looking glass. When we look on a mirror, we behold a facsimile of ourselves. Now it is a popular error to suppose that our image has been in or that we see it on the mirror. The image never existed on the mirror and could not. The mirror simply throws back the reflected rays of light from our body upon the retina of the eye and the image is conveyed from thence by the optic nerve to the brain, or seat of sensation. Another popular error is, to suppose that the mirror turns about our image and shows us a left hand for a right one. In appearance this is the case, but this is an optical illusion. The hand which appears in contradistinction to our good right hand, to be our left in the looking glass, is still our right hand. When we move our right hand, the hand opposite to it in the glass (apparently the lefthand) moves likewise. I have explained this optical illusion, because I once remember to have seen a philosopher nailed to the dilemma of not being able to tell the reason,

"why a looking glass turned round about the image of a person looking therein." He had not previously thought of this, or he would have said that "the image was not turned at all, or else the right hand in the looking glass would optically have appeared as the right hand of the person looking therein." It is upon a knowledge of the refraction and reflection of light, that all those instruments are constructed, which may be said to have brought heaven down to earth. The human eye is an optical instrument of rare and wonderful powers, and a brief description of it will not be uninteresting.

The eye is composed of three membranes and three chambers filled with humors. The outer membrane is named the *schlerotic*. It is thick, firm and white, except its anterior portion called the *cornea*, which is set in the opaque portion like a watch glass in its rim. The outer coat is lined with a thin dark membrane named the *choroid*, which is brown in some people and blue in others. That part which is seen and gives color to the eye is called the *iris*, and it has an opening in the centre called the pupil, which readily contracts or dilates according as more or less light is desired. In this respect the natural telescope surpasses all those formed by art.—The pupil of the eye is round in man and elongated sidewise in a sheep, while vertically it is an oval in a cat. The inner and third membrane of the eye is called the retina and this is formed by the optic nerve which enters the back part of the eye through the schlerotic and choroid coats and expands upon the interior into a whitish and most delicate membrane. It is upon the retina that the images of objects are received and produce impressions which are conveyed to the brain by the optic nerve. How this is done no man can tell—it is an action which proclaims man to be fearfully and wonderfully made. The fluids which occupy the cavities of the eye are of different densities. The cavity in front of the pupil and behind the choroid, is a clear watery liquid named the *aqueous humor*, and the chamber inside is filled with the *vitreous humor*. Behind the pupil there is what is called the *crystalline lens* a spheroidal body, firm, transparent and composed of a number of layers. This apparatus of the eye is to receive the rays of light which diverge from different points and to bring them to a point again upon the retina. There is one thing curious about the eye, namely, that the image formed upon the eye is inverted, which can be proved by the transparent eye of a white rabbit soon after it is dead, which if we place in a tube with the cornea outwards and look through the other end, we will see objects pictured upon its retina but in a reversed position. Some philosophers have contended that we perceive objects in this manner, but there can be no doubt about the optic nerve conveying the right position as well as the form of objects to the mind.

In man the eye performs a more exalted office than that of mere vision—it is the window of his soul. From the inmost recesses of the heart, we may behold looking out there, "fear, hope, disdain, revenge and love in every shape." What inspiration is displayed in its construction—what a wisdom and divinity in the offices it performs. R. M.

The Coast Survey.

From the Report of Prof. Bache, Superintendent of the Coast Survey, we gather the subjoined results of the last four years labors. The work has been carried into every State on the Atlantic and the Gulf of Mexico, with one exception, and surveying parties are now on their way to the Pacific Coast.

The differences of longitude of New York and Cambridge, New York and Philadelphia, and Philadelphia and Washington, have been ascertained by telegraph. The primary reconnaissance and triangulation have been carried from the southwest part of Rhode Island in to Maine. A base line of verification, of eleven miles in length, has been measured. The topography has been carried from Point Judith to Cape Cod, and has included the shores of Boston harbor and its approaches.

The map of New York bay and harbor and its environs, in six sheets, and the smaller

map in one sheet, have been published. Five charts of harbors of refuge &c. in Long Island Sound, have been published. One large sheet of the chart of Long Island Sound has been published, and another is well advanced towards completion. The complete chart of Delaware bay and river, in three sheets, has been published. The off-shore chart, from Cape May to Point Judith, is nearly completed. One sheet of the south side of Long Island delayed for work of verification, is nearly completed.

The primary triangulation has been extended across from the Delaware to the Chesapeake, and down the bay to the Virginia line. The triangulation of all the rivers emptying into the Chesapeake, north of the Patuxent, and part of the Patuxent has been made. The triangulation has extended over Albemarle, Croatan and Roanoke Sounds. The triangulation of the rivers emptying into the north and south sides of Albemarle Sound has been made, and the topography of the shores (with one exception) and of the Sound, has been completed.

A general reconnaissance has been made of the coast of South Carolina and Georgia. Also a part of the coast of Florida. A complete reconnaissance has been made of the coast of Alabama, Mississippi, and part of Louisiana. The topography of the shores of Mississippi Sound, as far West as Pascagoula, is complete, and of Dauphin Petit Bois, Round, Ship and Cat Islands. The hydrography of the entrance to Mobile Bay, and Cat and Ship Island Harbors, and their approaches, and of part of Mississippi Sound is complete. The computations and reductions have been kept up, and charts of the entrance to Mobile Bay and of Cat and Ship Island Harbors are in preparation.

During this period, an area of 17,554 square miles has been triangulated; the topographic surveys with the plane table have covered 2,318 square miles, and embraced an extent of shore line, roads, &c. of 7,179 miles. The hydrography has covered an area of 20,086 sq. miles, of which 16,824 were principally off-shore, or deep sea work. Four thousand four hundred and four copies of maps and charts have been distributed to literary and scientific institutions in our country, and to departments of our own and Foreign Governments. In the estimates for the next fiscal year, the total sum asked is \$188,000.

Curious Reminiscence of California.

Capt. George Shelvocke, in his account of the adventures of the "Speedwell," a ship of a 24 guns and 106 men, fitted out by certain merchants in London, for a cruise in the South seas, that sailed from Plymouth, February 13, 1799, in company with the "Success," under the command of Captain John Clipperton, says he visited the peninsula of California, which he thus described:

The eastern coast of that part of California, which I had a sight of, appears to be mountainous, barren, and sandy, and very like some parts of Peru; but, nevertheless the soil about Puerto Seguro, and (very likely) in most of the valleys, is a rich black mould; which, as you turn it fresh up to the sun, appears as if intermingled with gold dust; some of which we endeavoured to wash and purify from the dirt; but though we were a little prejudiced against the thought, that this metal should be so promiscuously and universally mingled with common earth, yet we endeavoured to cleanse and wash the earth from some of it; and the more we did, the more it appeared like gold. In order to be further satisfied, I brought away some of it, which we lost in our confusion at China. But, be that as it will, it is very probable that this country abounds in metals of all sorts, though the inhabitants had no utensils or ornaments of any metals whatever; which is no wonder, since they are so perfectly ignorant in all arts.

Public Libraries.

The United States contains 182 public libraries. The aggregate number of volumes in these libraries is 1,294,000. In the number of public libraries, France is the only country in the world which excels us. She has 841.

In the aggregate number of volumes Germany has five and a half millions, France five, Great Britain two and a half, and Russia one and a quarter millions of volumes.

The Way to Melt the Ice on the Side Walk.

Last week a gentleman in the upper part of our goodly city having been informed that salt thrown upon the ice on the sidewalks would rapidly melt it, resolved to rid himself of the annoyance in front of his own dwelling. On reaching home in the evening, after dark, he entered his store room, took a peck measure, and filled it with what he supposed to be fine granular fragments of genuine salt, and without saying anything to the dwellers in the house, slipped out through the area and scattered it freely on the walk, over an extent of ice of some two hundred feet. He retired to rest in excellent humor with himself, calculating upon the agreeable surprise awaiting the family and domestics when they discovered that the ice was entirely gone from the walk and steps. Judge then of his surprise on being told by one of the domestics, almost as soon as he got down stairs in the morning, that "some mischievous persons had been sprinkling rice all over the door steps and the sidewalk," coupled with the domestic's sagacious remark, that "she only wished the policeman had caught the rascal." The gentleman made no reply, but he came down to business rather earlier than usual that morning, and his family remarked that he must have something on his mind.

A Terrible Case of Suffering.

Mr. Richard Mosher, of Dutchess County, N. Y. has been confined to his bed for twenty five years, a victim to disease and intense suffering. During the first year of his attack his knees were dislocated and ossified, and subsequently other joints in his lower limbs were drawn asunder and ossified. Two years after these disastrous afflictions his pain became less acute, and being naturally industrious and ingenious he commenced making shoes, whips, and such other articles as he could, while lying in bed. He thus helped to maintain himself, and for eleven years he continued to work until his arms were dislocated and became ossified. For the last eleven years he has been unable to help himself in the least. His jaws were set some years since, and his teeth have been broken out, that food might be placed in his mouth. The only joints which he is now able to move are the extremities of his index fingers and one or two joints of his toes.

Habit.

Parents should endeavour to form good habits in their children—it makes all difficulties easy. Make sobriety, says Lord Brougham a habit, and intemperance will be hateful and hard; make prudence a habit, and reckless profligacy will be as contrary to the nature of the child grown or an adult, as the most atrocious crimes are to any of your lordships. Give a child the habit of sacredly regarding the truth, of carefully respecting the property of others, of scrupulously abstaining from all acts of imprudence which can involve him in distress, and he will just as likely think of rushing into an element in which he cannot breathe, as of lying, or cheating or selling.

To found these habits in children, however, is no easy task. But there are many men of splendid minds, those lives exhibit great struggles to break up and overcome bad habits formed in youth either by parental neglect or indulgence.

Funds for the Pope.

It is not improbable that Roman Catholics throughout the world will be called upon to contribute money to relieve the Pope from his present difficulties, and place him in an independent position. Something of this kind is hinted at by Bishop Hughes, of this city, who says: "Sooner than we should see him (the Pope) subject to any Sovereign, or President or petty Prince, or King, we should have recourse to the old institution, and Peter-pence from every point of the compass would constitute a treasury to raise him above that subjection, even though he should occupy an island in the Mediterranean Sea a single square mile in extent."

At the late meeting of the Paris Institute, M. Bernard and M. Bareswell presented a sample of alcohol which those physiologists had obtained from the fermentation of sugar extracted from the human liver.