LIGHT AND VISION--MORE ESPECIALLY HOW LIGHT IS CONVERTED INTO THOUGHT.

[Being one of the Cooper Union Lectures for the Advancement of Science and Art, delivered in the Great Hall of the Cooper Institute, in New York, on the 26th of February, 1870.]

BY H. KNAPP, M. D.

[Concluded from page 264.]

We have now two things to consider more closely: first, in which way the rays of light pass through the eye, and secondly, what becomes of them after their arrival at the retina.

The capsule of the eye has a beautiful transparent window, the cornea, for the entrance of the rays of light. Its anterior surface is the most important of the whole refractive apparatus. It was, therefore, considered of high scientific interest to determine its physical properties, above all, its curvature. At first, the method was very imperfect. Two hundred years ago, a French physician of great renown, S. L. Petit, endeavored to ascertain the curvature of the cornea by applying to frozen eyes taken from the cadaver, pieces of card board into which he had cut circular notches, fitting them upon the cornea as nearly as possible. This procedure could give only an approximate measurement.

In a similar way the curvature, thickness, and position of the crystalline lens, the second part of the refracting apparatus, was examined.

But the minute parts, with their delicate structure, appeared so infinitely beyond the scope of the imperfect methods of investigation, that a great many properties of the eye, requisite for discharge of its functions as an optical apparatus, had to be supplied by hypothesis, that is, imagination.

The less instructed a man, the more he is given to admiration and superstition. Is it astonishing, therefore, that the eye was supposed to be the most perfect optical apparatus, quite beyond the reach of our comprehension? God being the Creator, how can it be possible that there are short-comings and defects in one of His most wonderful works?

For a long time all investigators were convinced, *a priori*, that an analytical study of the eye could only reveal its perfection. This preconceived idea, however, was forced at last to give way to the unambiguous results of exact methods of inquiry.

As every new truth, overturning an old prejudice, carries with itself the remedy for the prejudice, so the optical defects of the eye were detected, and no religious feeling was wounded.

If, on earth, there be a power, it is the progress of science. Religion, the search of the human soul after the divine, pursues the sublimest object; but has always had too many egotistic exponents, who led the multitude astray; threw the noblest minds into prison; employed torture machines, and all the horrors of the Inquisition, only to gratify the sway of their own hierarchy. The history of science has no such horrors to record; all its conquests have been ennobling steps of civilization.

In our day, a scientist, arriving at a conclusion at variance with orthodox creed, can no longer be tortured or imprisoned, or burned as a heretic; but in most countries, this one included, he may incur persecution, not by law, but by the zealots of society. Germany at the present time, is the country where the greatest religious liberty exists. No scientist, by declaring openly his dissension on certain points of dogmatic Christianity, or orthodox Judaism, will loose a minimum of his social position. Therefore, pure and independent science now flourishes more in Germany than in any other country of the world.

The progress of our knowledge of the healthy and diseased eye, during the last decades, is nearly exclusively the work of German genius and labor. Holland, a sister country, having one prominent investigator.

The greatest name in natural science, of the present age, is that of Helmholtz, Professor in the University of Heidelberg. His discoveries and inventions count by the dozen. For the study of the eye, he is the originator of a new epoch. Relating to the point under consideration, I here show you an instrument devised by him, on the principle of the heliometer of astronomers, wherewith the curvature of the cornea can be determined on the living eye with wonderful accuracy, By his researches, and those of other observers, a great many irregularities of the eye have been detected, demonstrating beyond doubt its imperfections as an optical instrument. The curved surfaces of the cornea and crystalline lens are far from being perfect in form, they are, even in the best eye, unsymmetrical, the system is not central, not achromatic, nor aplanatic either; all of which are shortcomings a good optician now-a-days knows how to avoid. You say, be that as it may, the eye is nevertheless an admirable instrument, adequate to all the purposes of common life, and more is not needed. This seems, at first glance, very plausible, but we must consider that the purposes of life are suited to, and governed by the power of the organs of our body. And this power is limited. If we could fly, we would need no railroads; if our eyesight were more acute, another kind of writing would exist, and you may be sure, to cite an example, that the *N. Y. Herald* would be printed still worse. As it is, its type is just on the verge of visual acuteness, perhaps a little beyond it, to be read for any length of time without injuring the eyes, and therefore it deserves a premium from oculists.

The irregularities of the dioptric apparatus of the eye have one defect common to them all; they prevent the rays of light from being regularly refracted. Were the eye a perfect optical apparatus, all the rays emanating from one luminous point, would be united in one point again on the retina. But this does not take place even in the best constructed eye.

The most conspicuous imperfection of the normal eye is its want of symmetry. The meridians differ in curvature, and, therefore, in refractive power.

This is the cause that the pencil of refracted rays has a peculiar shape, being what mathematicians call a skew surface, for instance like a winding staircase. I have represented the peculiar shape of the way the rays of light take within the eye by a model of silk threads. It will interest you, furnishing a tangible illustration how far exact science, guided by mathematics, may penetrate the mysteries of nature.

At the first dawn of science, the investigator is overpowered by the discovery of a general law, which he then represents by a diagram. So it is with the eye. The law of refraction was found, and the eye called a living camera obscura of unimpeachable perfection and diagramatic regularity. Astronomers having found the general law of gravitation, immediately had a diagramatic system of the world built up. This undoubtedly was correct, but then came the perturbations in the orbits of the celestial bodies, which had to be accounted for, and they were accounted for by the progress of astronomical research. The same development took place in the science of the eye. There were disturbances of vision, unexplainable as long as the organ of sight was supposed to be perfect. The onward march of science found means to discover the causes of these disturbances and instruments to measure them to one-thousandth of an inch. Some years ago, while experimenting on these subjects, I told a certain mathematician, that we are now able, not only to recognize, but also to measure the irregularities of the eye. He, as many wise men, had always been a great skeptic with regard to the true scientific character of medicine, but could appreciate so fully the value of these investigations, that he exclaimed: "Then sir, you command all conditions to introduce astronomical accuracy into your researches."

Many persons who like to hear themselves, called practical people, but who in reality are only slow thinkers, do not like pure scientific questions, the noblest that can ever be discussed. These would-be practical persons ask what is the advantage of such obscure investigations? People had better devote their time, they say, to more useful pursuits than to scrutinizing the imperfections of nature. I answer these practical people, that the discovery of every truth, of what kind soever it may be, is the most useful fruit of human labor. This subject we have just been considering, proves this conclusively. You can easily imagine, that if all eyes have irregularities, some will have them exaggerated to such a degree as to diminish the power of sight. Such eyes are weak, and not capable of performing the duties our present state of civilization demands of them. The educated of today, however, know not only how to discover the optical irregularities which cause weakness of sight, but to determine their nature and degree with such nicety, as to give the practical optician directions, in what manner he has to grind a new kind of spectacles—I mean cylindrical—by the aid of which thousands of weak eyes are now enabled to do any fine work, as well and as long as perfect eyes. I think this is a splendid reward to the scientist who invented the instrument by which we are able to measure the irregularities of the eye.

We have now accompanied the rays of light into the eye, but I have not mentioned that wonderful opening of the deepest black color in the middle of the iris, I mean the pupil. Through this inlet, all the rays of light must pass before they reach the retina. How is it that this ray of light is so black?

This question, again seemingly impractical, was much discussed some 30 years ago in German Universities, and resulted in one of the most brilliant and beneficial discoveries of modern science. The first impulse to these investigations was given by a sad and criminal deed, in a country town of the kingdom of Saxony, by a clergyman in discord with one of his parishioners. One dark night the minister on his way home was attacked and severely beaten. Being convinced that the perpetrator was no other than the man with whom he was at enmity, he entered a complaint against him, but the judge objected that self-testimony and moral conviction although they might do very well in religious matters, could not be taken as evidence in courts of law. Whereupon the priest, who was well versed in legendary and scientific lore, replied: "During the affray I received a severe blow upon the eye which caused a brilliant light to flash out of it, so that I could recognize the features of the assailant, who was the man I accuse." The judge was so surprised by the novelty of this assertion and the positiveness with which it was uttered, that he declared himself incompetent, and appealed to the opinion of experts. The question was brought before the forum of the medical faculties of the Universities of Leipsic and Berlin, and was studied profoundly by the celebrated physiologist Johannes Müller. The result of his researches was a most valuable acquisition to science, the discovery of the so-called specific energies of the nerves of sense, according to which a nerve of special sense, excited in any way whatever, invariably answers by causing the sensation peculiar to it alone. The optic nerve, when pricked, burnt, cut, hit, electrified, etc., will invariably cause a sensation of light, but this light is subjective, due to an abnormal condition of the nerve, and not in the least capable of being perceived by another person, or illuminating the objects around the irritated eye Any one can repeat on himself the truth of these statements. Therefore the complaint of the priest was dismissed, his assertions being in contradiction to the laws of nature.

This celebrated case was the starting point of scientific inquiries into the cause of the darkness of the pupil of the eye, and the peculiar condition under which the pupils of certain animals, and sometimes also of men, may become luminous. After a good deal of preparatory labor Prof. Helmholtz solved the problem and invented the ophthalmoscope, or eye-mirror, an instrument by which it is possible to look into the depth of a living eye and see its marvelous interior structure in all its details and brilliancy, as if it were a picture spread out before us. The optic nerve expanding into the retina, with its wonderfully ramifying net of arteries and veins, on which you can see the pulsation of the blood as well as you can feel it on the wrist; the choroid with its shades of pigmentation and intricate interlacing of blood vessels; nay, even the miniature images of outward objects can be seen portrayed on the retina, and their reversal, for centuries a topic of lively discussion, directly observed on the back-ground of the living eye.

This was a triumph of science so great and important in its results as the instrument itself is small, and of admirable simplicity. It was at once made practical by the combined efforts of many illustrious physicians who discovered with it a great number of diseases hitherto unknown, and which, as soon as they were recognized, became amenable to treatment. The little instrument proved not only a mirror for the eyes, but revealed many of the other evils which flesh is heir to. It did not only inaugurate a new epoch for the study of the organ of sight, which in the short interval of two decades has become the most cultivated, reliable, and beneficial of the various branches of medicine, but led to the study of other organs in the same way. Mirrors for the ear, the throat, and other parts of the body, opened so many fertile fields for the progressive labor of physiologists and physicians. There may be hardly any one among you but has been, or will be, benefited by the practical results of these investigations. Even the French, the proudest of all nations—the present company as representing the American, of course, excluded—recognized the value of the ophthalmoscope, by giving it the highest praise a Frenchman is capable of. A French reviewer naively said: "The ophthalmoscope is such an admirable German invention that it deserves to be a French one."

It takes a certain time to render a great name popular, but the name of Helmholtz as a creator of new science, will live as long as the names of glorious Newton and Humboldt, and as that of a benefactor of mankind, it will be unsurpassed even by the blessed names of Dr. Jenner and the one over whose ashes this country is still weeping, George Peabody.

But let us continue, that we may see how waves of light are converted into nervous fluid and ultimately into thought. We followed them to their collection in the image upon the retina. This membrane has a very complicated structure, which again, has been investigated nearly exclusively by German anatomists. Of the many layers which compose the thin transparent retina, one, the outer, is distinguished by a peculiar arrangement and utmost subtilty of its elementary parts. These are called rods and cones, and each of them posseses an inner and outer portion. Three years ago these details were at the limit of the power of the strongest microscopes; but the invention of a new system of lenses, the immersion system, adds so much magnifying power, while preserving good illumination, to the former microscopes, that it is now possible to distinguish further details in the rods and cones. The surface of the minute staves is covered by infinitely fine nervous fibers, finer than have been observed anywhere else in the animal organization. The outer portion of the little staves consists of extremely delicate disks, cemented together by a glue, the refractive power of which differs from that of the disks. In, around, or between these disks—which, is not yet clearly made out—terminate the delicate nervous fibers which run over the surface of the inner portions of the little staves. Until within the past two years, nobody had definite ideas how the nerve fibers were acted upon by light.

Physiologists contented themselves with the knowledge that the outer layer of the retina contained the percipient elements. Now it is supposed, or rather on the way to be proved, that the waves of light enter the little staves and are repeatedly reflected in the little disks. A remarkable coincidence exists between the size of these disks and the length of the light waves. The latter vary between ·00003 to ·00008 mm., according to the different colors, and the thickness of the retinal little disks lies between the same limits. You all know that the different colors which compose the sunlight, are due to ether waves of different length, and may be isolated by means of a prism. If now a ray of light, the undulations of which are of a certain length, say ·00005 mm., meets on its way a substance composed of different layers, the thickness of which is equal to, or a simple multiple of the length of the light wave, the latter will not proceed in its course, but be repeatedly reflected from the two surfaces of the layer corresponding in thickness to the length of the light wave. Waves thus repeatedly reflected are called standing waves, and possess a much greater force than the simple passing or flowing waves. Standing waves are, therefore, fit to impart far greater commotions to the nerve fibers in or on the disk, than the flowing waves. It is evident that the latter will be converted into standing waves only in disks corresponding to their length. They will only excite the nerve-fiber of these disks, having passed the others without acting upon them. Suppose, for instance, the light wave of blue color, being ·00003 mm. in length, enters a little retinal staff, then it will pass undisturbed through the disks of other dimensions than ·00003 mm., but after having once penetrated this one, it will be repeatedly reflected. Thus special nervous fibers are excited, and the definition of natural philosophers, that color is nothing but the sensation of ether waves of a specific length is accounted for. Here the light wave ends; it does not die however, but is transmitted to the ether-zones enveloping the molecules of the optic nerve. Usually this transmission is called absorption of light.

Natural science has of late discovered a law of the greatest fundamental importance, the law of preservation and correlation of forces. This law shows that force can neither be created nor destroyed, it can only be transferred, and manifest itself under other phenomena. Light can be converted into electricity, and the nervous current is very much akin to the electric current. It moves the magnetic needle, and has many properties in common with the electric currents. They are, however, not identical, since the velocity of the nervous current, as Helmholtz was the first to show, is only 61 mt. in a second, while that of the electric current is not far from 300,000 miles in the same time.

Thus far we are able to accompany the light wave: it has united with the nervous fluid, and will thereby be transmitted to the central organ of the nervous system, the brain, where it is ultimately converted into thought.

But here, science in its present state, stands on the confines of an apparently unfathomable mystery, to penetrate which another mirror must be invented. I have, however, faith in the power of science, and am convinced that nothing is impenetrable to the eye of the human mind.

The history of civilization shows a slow work, and frequent disturbances by political convulsions. Europe, especially Germany, where scientific investigation is so generally appreciated and liberally encouraged, may be crushed with the downfall of the untenable forms of personal government; but this country, although still betraying many deficiencies of youth, is the bright star that will usher in an epoch of higher culture.

In regard to the last problem of our subject, the formation of thought out of visual impressions, centuries may pass, before a brain mirror will be invented. But so sure as science is ever progressive, so sure it is that another Helmholtz will will come to invent this mirror, and as the course of civilization and human progress is westward, let us hope that he will be—an American.

MAMMALIAN FOSSILS.---A FACETIOUS REVIEWER.

Mr. J. P. Lesley contributes to *Old and New*, a review of the recent work of Dr. Leidy on "Mammalian Fossils of North America," which is worth reading for its humor as well as the scientific information it contains. It is so seldom that scientific discourse is relieved by wit, that it is refreshing to meet occasionally with an essay which happily blends learning with fun.

Mr. Lesley says:

The long expected and truly magnificent work of Dr. Leidy, on the mammalian remains in the rocks of Nebraska and Dakotah, with a synopsis of all the mammalian fossils as yet discovered in North America, has at length appeared. It forms an entire volume of the quarto "Journal of the Academy of Natural Sciences" of Philadelphia, and is illustrated with plates excellently well done. These plates show the teeth, jaws, heads, and limb-bones of the American fossil mammals, either life size, or on a reduced scale. Dr. Hayden prefixes to the book a geological description of that remarkable part of the United States, where the greatest treasures of this sort have been preserved for our astonishment and study. Creatures lived there, strange enough to test the credulity of the most superstitious—hogs that chewed the cud, deer that had solid hoofs like horses, or horses with cloven hoofs like deer; tropical pachyderms feeding at the swampy margins of vast fresh-water lakes, from the shores of which arose ranges of the Rocky Mountains in 45° north latitude.

North America in pre-human times was provided with every kind of mammal excepting man—horse, deer, cow, sheep, elephant, rhinoceros; and the smaller kinds were not forgotten—except the hippopotamus. That would have been a little too absurd. The red Indian and the mastodon together?—that is all right. But the corn-planter and the river-horse of the Nile and Niger!—not if you please.

Such at least were our reflections, until a Friday night, a few weeks since, we were destined to hear Professor Cope inform the members of the American Philosophical Society, that he had just discovered an unmistakable hippopotamus' molar tooth in a bed of Miocene Tertiary marl in New Jersey, and that a learned friend of his had collected other teeth, from a similar position in the series of rocks in Maryland, which he identified generically with hippopotamus. But the two species were different: that of the New Jersey locality having been no larger than the common hog, and distinguished by certain tuberculous processes studding the crown of the tooth, from which feature Mr. Cope should construct its specific name.

We ask, what does all this raree show of Palæontology mean? Who gets up those strange and varied forms? Was there no trick of humor in these shapes? Are we to call them tentative inventions, of a busy, ever busy mind, never satisfied with the result, but ever changing the combination, ever reaching toward a higher pitch of success? Or do we see a slow eternal growth—form expanding into form—form budding out of form—as in some vast circumplanetal coral reef, filled by one family of life, fed by one gulf stream of vital force, energetic, but half conscious, and as improphetic for itself of its own culmination in man, as the British savage was of the appearance of his children, the Newton and the Faraday?

The books say that no mammal has ever been found in rocks older than the Tertiary. Some years ago—a good many years ago, in fact, for it was in those early days of the Philadelphia Academy, made brilliant with the presence of Wilson, and Nuttall, and Say, and McClure, and Bartram, and Ord, and the Abbé Da Serra, and the wild Rafinesque, and the enthusiastic Vanuxem—Dr. Bartram found in the cretaceous green sand marl of New Jersey, a vertebra, which he so labeled (libeled is the proper word here), and placed it in the Academy's museum. Some time afterward, Dr. Leidy pronouncing it the vertebra of some extinct whale, and the European palæontologists being startled at the thought of a cretaceous whale, Sir Charles Lyell wrote over to Mr. Conrad, to look up the spot and verify the rock. He did. The marl was not cretaceous—but Middle Tertiary. Europe fell back in its easy-chair and lit another cigar, with "Infernal American pretension," *sotto voce.*

But the cigar was hardly lighted, when it was flung again into the grate. Dr. Emmons had found a mammal in the— Europe sprang to its feet with a thundering "What?"—in the Trias of North Carolina. This was rather too bad. In the Old World—that land of precedent and vested privileges—they could find no precedent for suckling babies which went back or down, lower than the Tertiary. The American cretaceous pretense had been squelched. No one thought of the Oolite. It was folly to suggest Lias. Madness alone could dream of babies at the breast in the age of the Muschelkalk, Keuper, or Rodte-todt-liegende. Their very names were against it. One might as well go recklessly two steps deeper—Permian—Carboniferous, and dig extinct sucking-pigs out with anthracite coal.

But how vain are the assaults of prejudice against the gates of Truth! A fact envelops us like a nightmare—or the cool night air—however we may rage or rhyme. Emmons found two perfect little one-side jaw-bones, about an inch and a quarter long, and so smooth and perfect that a lens could detect no fracture anywhere, and he found them in that iron-ore bed which lies between the two layers or benches of the Deep River coal-bed, at Egypt, in North Carolina. This stratum of iron ore is only two feet thick; and each layer of coal, above it and below it, is about two feet thick. But the ore contains millions of teeth of reptiles and fishes belonging to extinct genera and types of Triassic age.

Dr. Leidy examined both the specimens found by Dr. Emmons, and received one as a gift for the Academy's museum. They were alike. They belonged to a little mammal no bigger than a field-mouse, but with elongated jaws; for it fed on the numerous insects of that period! Dr. Leidy has now explained to the Academy the most remarkable deduction to be drawn from these little waifs of a by-gone world. Until their discovery it was taken for granted that all jaws of mammals were provided with knuckles, knobs, or condyles, at the upper hinder end, articulating into a socket in some form of temporal bone, attached to the other bones of the skull. All other known mammal jaw-bones were single bones, armed with a condyle. Shall we say that this poor little old-fashioned Triassic mouse's jaw-bone wasn't worth a condyle? Or, more probably that condyles hadn't been invented then? Its little jaw ends, backward, in a broad, smooth, nearly straight edge, chisel-shaped. How it was attached thus to its poor little head, or whether it had an auxiliary bone with a condyle on that, to articulate into the head, are questions, like many others, waiting fortunate discoveries to be answered. Reptile jaws, instead of being simple, are made up of several pieces; first, the long bone for the insertion of the teeth, a splint bone laid along its base inside, a triangular bone at its back end, a large bone on top of that, and an articulating bone (in lieu of a condyle) capping that again. We see in our poor little mouse, a praiseworthy attempt to free itself from this horrid reptilian style of getting up (resembling the feminine coiffure of the day), without attaining to the dignity of wearing a condyle.

Probably the mouse was in the intellectual posture of that member of the London Royal Society, who, in 1776, when Paine patented the crank for the steam-engine, wrote a memoir to show that the crank was inapplicable to the steam-engine; and another and more distinguished British engineer followed his brother member's assertions, with a conclusive mathematical demonstration, to the same effect. It is soothing to believe that in Triassic, Liassic, and perhaps through Cretaceous ages, the dislocation of the jaw was a casualty unknown to mammals. All jaws as yet were many-hinged, ligamentous, and capaciously flexible. The bird-like kangaroos of the Connecticut River Valley—the enormous Hadrosaurs of New Jersey—could worry down gentry of half their own size. They had the cheek to do it.

[For the Scientific American.]

THE COCOA PALM.

BY J. CANTINI.

A brief sketch of one of the principal palm trees may be of interest to many of our readers, especially at this particular season of the year, when the leaves form such an important article of commerce, and an object of general adoration in the Christian world. In some places, especially in Catholic countries, the palm leaves are largely imported from the southern coast, and an extensive business is carried on, though only for a short time.

The inhabitant of the North, who has never visited the tropical countries, has but a faint idea of the actual beauty and grandeur of these plants, which, even in the South, amidst eternal verdure, are ever an object of admiration. From our earliest childhood we hear the word "palm" in connection with every thing that is beautiful and poetical. We speak of the "palmy days," when we think of times of happiness; and we say, "he has carried off the palm," when we allude to glory. It would be difficult to say how long the palm has been associated with religion and sentiment, as the word "palm" itself is an expression of comparatively modern times. The Romans called a tree which grows on the shores of the Mediterranean the "Fan Palm," probably on account of the resemblance of its leaves to the palm of the human hand (*palma*).

One of the loftiest of the palms is the cocoanut tree (*Cocoa nucifera*), which grows to a hight of from sixty to a hundred feet. According to some naturalists, it is a littoral plant, but Humboldt and Bonpland assert that they met with it inland (in Mexico), though of a growth somewhat inferior to those of the sea shore. The tree prefers a sandy, arid soil, and it is rare that much vegitation is found growing around it. The cocoa-palms adorn the otherwise desolate beach or the low islands. Gliding along the shore in a boat, the attention of the traveler is aroused by the doleful, wailing sound which the wind causes in waving to and fro the long leaves. There is something solemn and almost ghost-like in the appearance of an avenue of cocoanut trees, when seen by the peculiar moonlight of the tropics, especially when there is a strong breeze blowing. The leaf-crowned summit forms, everywhere, an object of truly intertropical scenery, and the palms well deserve the name given to them by Linnæus, "Kings of Vegetation."

Various, nay, "hundredfold," as the natives express themselves, are the uses of this plant, and its propagation may be considered as a never-failing source of progressive national prosperity, for it will furnish, with but little trouble, clothing, food, and habitation.

Almost every particle of this tropical production can be used. The trunk serves to build the huts; the rind or husk, which is fibrous, is used, everywhere, for matting, brushes, etc. The leaves, which measure some twenty feet in length, are, also, of great utility. The finest roofs are made of the plaited cocoanut leaves. Screens, baskets, hats, and many other domestic articles are made of them. The heart or young leaves, called "cabbage," is an excellent vegetable, which can be prepared in many different ways. The dried leaves are sometimes used as torches in dark nights, while the washer-women often burn the foliage for the sake of its alkaline ashes. In the East Indies, the leaves of the cocoa palm, like those of the Palmyra, serve the natives in lieu of paper, upon which they write with a stylus. It is not unusual that letters, written upon these leaves, neatly rolled up, and sealed with a little gum lac, pass through a postoffice.

The most important part of the tree is the nut, which grows in bunches of twelve or more in number. In some parts, the fruit can be gathered four and five times a year. The liquid or water, or, as it is generally and improperly termed, the "milk," is, in the young nuts, a most delicious draft, as it is always cool, more particularly early in the morning. It is slightly effervescent, and, if mixed with Madeira wine or brandy, it makes an excellent beverage, though many consider it unhealthy. The natives ascribe many inestimable properties to this liquid; amongst others, they pretend that, if used as a wash, "it clears the face of wrinkles and imparts to it the rosy tints of youth."

The milk is made of the kernel itself by grating it and pouring warm water over it, after which it is pressed, yielding a whitish liquid. This milk is almost indispensable in the tropics, and fully takes the place of animal milk. Bread and pastry, prepared with it, are most delicious, and retain an almost imperceptible taste of cocoanut. The albumen of the young nut is quite soft, and can be removed with a spoon, and might appropriately be termed "a vegetable blanc mange."

Another valuable and important article of commerce, obtained from this nut, is the oil. The natives all understand how to extract it from the kernel by a most simple process. They remove the kernel from the shell and boil it in water, after which they pound it in a mortar and then press it. The milk or liquid is then put over a slow fire. The oil or fat will soon float on the top and can easily be skimmed off. Two quarts of oil are usually obtained from fourteen fresh nuts. This oil, when fresh, is excellent for cooking purposes, and for frying fish and plantains; but, not being rectified, it soon turns rancid, thus giving a most disagreeable taste to the food prepared with it. The natives everywhere lavish it upon their persons, as a preventive against the sting of insects, or to give to their skin a glossy appearance. In cool weather, or even over night, it becomes quite hard, and requires melting before it can be used for burning. Cocoanut oil is, with the exception of the Cohune oil, the only article in use among the Indians of America to burn in lamps and torches.

The much-relished "toddy" is also obtained from the cocoa palm by tapping the trunk. This beverage is slightly stimulating, and, when fermentation has set in, it is intoxicating. During the state of fermentation, this liquid can be used as yeast, and the bread made with it is remarkably light and spongy.

These are the general uses which are made of this valuable plant; but the inhabitant of the tropics will discover many more, which are, however, of value only to those who live there and are able to make use of the numerous medicinal and other properties attributed to this tree.

HOW TO CLEAN PAINT.— There is a very simple method to clean paint that has become dirty, and, if our housewives should adopt it, it would save them a great deal of trouble Provide a plate with some of the best whiting to be had, and have ready some clean warm water and a piece of flannel, which dip into the water and squeeze nearly dry; then take as much whiting as will adhere to it, apply it to the painted surface, when a little rubbing will instantly remove any dirt or grease. After which wash the part well with clean water, rubbing it dry with a soft chamois. Paint thus cleaned looks as well as when first laid on, without any injury to the most delicate colors. It is far better than using soap, and does not require more than half the time and labor.