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SCIENTIFIC AMERICAN SUPPLEMENT

No. 957.

For the Week Ending May 5, 1894.

Price 10 cents. For sale by all newsdealers.

A NEW THEORY OF LIGHT SENSATION.

Two recent numbers of *Mind* contain articles upon the new theory of light sensation devised by Mrs. Christine Ladd Franklin, a graduate of Vassar College and the first alumna of that institution to receive the degree of Ph.D. from her alma mater. *Nature* thus compares this theory with those known as the Young-Helmholtz and the Hering theories.

The former of these supposes that the judgment picks out of a mixture of colors all the even red-green-blue sensations, and deceives itself into thinking them to be a new sensation called white. The new theory assumes an independent retinal process as ground for the latter sensation, therein agreeing with Hering's theory.

But while Hering supposes that some parts of the spectrum produce construction and others destruction of the tissue of the retina, Mrs. Franklin considers that the sensations of the black-gray-white series must be regarded as the fundamental ones, and attributed to the dissociation of certain molecules, which she provisionally calls the gray molecules. The atoms thus dissociated have different periods of vibration, and in the more highly developed visual organs—those capable of color sensations—these color atoms differ in behavior according to the wave length of the light beating upon them. Thus some atoms would only be torn off by red light, and would give rise to the sensation of red. The prevalence of such color molecules would coincide with the predominance of the structures known as "cones" in the fovea of the retina, while the "rods" are endowed chiefly with gray molecules. This is simply translating into the language of the theory the well known fact that the color sense is chiefly confined to the center of vision, as anybody may prove by looking at a colored object through the corner of the eye. This distribution, says Mrs. Franklin, offers a perfect analogy with the organs of hearing. In the ear we have a very simple apparatus for hearing noise only, and also a highly differentiated structure for the discrimination of notes of various pitch.

ITALIAN COLONIZATION IN AFRICA.

As the European nations divide Africa among them, Italy is taking her share and has established a protectorate over Abyssinia. The eastern portion of this country, bordering on the Red Sea, is called Eritrea. This is ruled by a civil and a military governor and three councilors appointed by King Humbert, and here an Italian colony has been started in the hope of bettering the condition of the country and of lessening the tide of emigration to America. *L'Illustrazione Italiana*, of Milan, publishes an account of the arrival of the first detachment of peasants taken to Eritrea, at Asmara, a small town near the Red Sea. It is written by some one already resident there and familiar with the country and the colonization scheme. We have taken from the articles some of the most important details respecting the colonists and their future home.

The company consisted of nine families, fifty-seven persons in all, twenty four of them strong laboring men. They are from Lombardy, Milan, and Sicily, and were under the leadership of Baron Franchetti, who was authorized by the Minister of Foreign Affairs to take command of the expedition. The baron has worked with untiring zeal in behalf of this agrarian colonization project, and his face shone with delight when his little company were safely landed last November.

The peasants themselves were pleased with the country from the first. Much had been said to intimidate them before they left their homes. They had been told that "on the Red Sea fire would rain upon them from heaven;" but they saw no fire and felt no more heat than that of an Italian June day.

Their steamer landed at Massaua, the largest town of Eritrea, on an island of the same name near the coast. Those who wished to deter the colonists from starting had told them that they would "die of suffocation at Massaua;" but they were actually very little affected by the tropical temperature. They remained there only long enough to get their luggage transferred to the train at Abd-el-Kader. From there they went up to Asmara on the plateau where their new home was to be. The women and children were greatly interested in the natives, the men felt of the soil, shelled the grain still in the fields, examined the native implements and began to be hopeful of the future. At Asmara, the men grouped themselves around the carts in which their wives and children were to be carried to their final destination, the colonial farm near Circolo, and sang the Italian national hymn. The Asmarians pressed around them and in their way gave the strangers a welcome.

The officials who received them at Circolo were very kind; wine was offered to the adults and cakes to the children. The men were melted to tears, and the women said, "It is too good to be true!"

When they saw the fine grain which was being harvested at the colonial farm and the variety of products raised, their last fears vanished and they agreed that the success of the undertaking was sure.

The fact is that the Eritrean plateau is very similar to Italy in fertility and climate. The various altitudes will admit of their raising tobacco, coffee and cotton, besides grain. The country is so large that there is plenty of room for the emigrants without encroaching upon the rights of the natives. And they have been so much disturbed by the invasion of hostile tribes from the Soudan that they welcome the protection of a civilized government.

The best promise of success for the colony is in the selection of the emigrants. They are honest people, and they understand that they must not expect help except so far as it is necessary in the first months; their own labor is to give them the ownership of the land.

Baron Franchetti's form of contract, approved by the foreign minister, is based upon the two following fundamental articles:

1. Gratuitous grant in perpetual ownership of a farm of twenty *ettari* (equal to sixty acres) for a family is subject to the condition of residence and labor on the same for a period not longer than five years.

2. Money advanced for seed for the first planting, food for the first year, farming tools and a house, is all to be returned at an annual rate in the form of labor, produce, cattle or money, with interest at three per cent.

Baron Franchetti has overcome great difficulties and much opposition in the furtherance of this scheme. If this nucleus of a colony is contented and successful, so that large numbers of families join it, the social problem which is at present so seriously disturbing Italy will find a most happy solution.

Was There a Flood?

One of the largest meetings ever held by the Victoria Institute, of London, England, took place in the third week of March, to hear that well-known "Nestor among Geologists," Professor Prestwich, F.R.S., read a paper on "A Possible Cause for the Origin of the Tradition of the Flood," in which he treated the subject "from a purely scientific standpoint." In it the author described at considerable length the various phenomena which had come under his observation during long years of geological research in Europe and the coasts of the Mediterranean. Among these he specially referred to having found the flints of the drift to be of two classes, one with bones of animals, carved, and interspersed with the remains of man, and the other, which he termed the rubbledrift, containing bones of animals of all ages and kinds in vast heaps. He cited the confirmatory opinions on this point of Professor Geikie, F.R.S., a member of the Institute, and drew special attention to the geological surroundings of these strange deposits, and the manner in which the bones were found. He then referred to phenomena in regard to raised sea beaches, and the constant occurrence of "head," the large masses of transported rock, loam and loess, covering the high plains in Hungary and Southern Russia, and the ossiferous breccias in various localities. From the circumstances attending these and their surroundings he said he had been forced to the conclusion that all their phenomena were "only explicable upon the hypothesis of a widespread and short submergence, followed by early re-elevation, and this hypothesis satisfied all the important conditions of the problem," which forced one to recognize that there had been a submergence of continental dimensions. The Age of Man was held to be divided into Palæolithic and Neolithic, and he considered rightly so. He concluded by suggesting that thus there seemed cause for the origin of a tradition of a flood.—*Bulletin of the Victoria Institute.*

The Yellow Calla Lily.

The white calla lily of our gardens is well known, it still retaining the original name of *Calla*, although botanists have in modern times removed it to another genus, which is called *Richardia*. Calla will, however, long be its common name. It has been frequently hinted that there are species with other colors, which would soon come into cultivation; but, so far, these have been mere rumors. It is now definitely known, says *Meehan's Monthly*, which is good authority, that there is a bright yellow species, which has been named by botanists *Calla Elliottiana*. The one in cultivation, known as *Richardia maculata*, has a slightly yellowish tint sometimes. The new one is said to be a clear yellow, and has leaves spotted with white, similar to our common *maculata*. Only one original plant was introduced, and it is said there are only a few propagated from it in cultivation. Ten plants were recently sold at auction in London, and bought by enterprising florists for $2,000, which is considered the largest figures ever obtained for auction plants. Another yellow one has been introduced under the name of *Calla Pentlandi*, which is said to differ in having larger foliage and richer colored spathes, but which has not yet been offered to the trade.

Cost of an Electric Light Plant.

An article by Mr. J. H. Talbot, in the *Engineering Magazine*, condensed in the *Street Railway and Electrical News*, contains valuable information for city taxpayers or investors interested in the establishment of small electric light stations. If the facts in this article had been given to the public several years ago, without doubt a large waste of capital would have been prevented, and a great many enterprises of this kind now struggling under financial burdens might be in a prosperous and flourishing condition. Mr. Talbot points out how very difficult it has been for persons desiring to establish an electric light station to obtain in advance accurate and definite information regarding its cost of construction and expense of operation, and it is his purpose in the present article to furnish such information.

Mr. Talbot estimates as follows the cost of construction of a plant suitable for a town of from 5,000 to 10,000 inhabitants—one requiring from fifty to sixty arc lights for public use, and about 1,200 incandescent lamps for commercial purposes:

Steam plant of 150 horse power, including foundations, stack, piping, belting, etc.	$5,000
Electrical apparatus in station, including arc lamps, instruments, switchboards, etc.	7,000
Arc circuit, complete, to include poles, wire, hanging of lamps, etc., on the basis of say 8 miles of wire and 5 miles of pole line	2,000
Incandescent circuit, primary, utilizing arc light poles	1,000
Converters for 500-light capacity, leaving balance to be purchased as needed	625
Wiring up, with plain wiring—500 lights—to include lamps and sockets	1,250
Total, excluding real estate and buildings	$16,875

It is thus found that for a plant of the size suggested, the promoters would have to reckon on an expenditure of capital, paid in cash payments, amounting to about $17,000, excluding real estate and buildings.

Mr. Talbot next considers the cost of operating such a plant as compared with total earnings. He believes that the following figures may be taken as approximately correct: $4,250 may be reasonably counted upon as revenue from fifty arc lamps lighted each night from dark until midnight, under contract with the city at $85 per lamp per year, and $7,300 as revenue from incandescent lighting; or a total revenue of $11,550. The expense of operating the plant would be, for labor, engineers, firemen and lamp trimmers, $2,160; fuel, estimated at 750 tons of coal at $2.75 a ton, $2,062; for arc lamps and carbons, incandescent lamp renewals, $1,100; tax and insurance, $600; collections, bookkeeping and stationery, $500; repairs, contingencies and sundries, $560; allowance for depreciation, 7½ per cent on $12,000, $900; or a total cost of operating plant of $7,882. Deducting the operating expense from the revenue, it is found that there is an apparent profit of $3,668. The cost of real estate, of building and of steam power plant depend largely upon local conditions, and no estimates of the items are given by Mr. Talbot.

Natural History Notes.

The Flight of Bees.—According to Prof. Marey's graphic method, bees make 190 wing-beats per second. His method consists in fastening a bee in such a way that its wings are free to move, one of them lightly touching a rotating cylinder covered with a smooth and lightly blackened paper. Prof. Landois, who has studied the sound apparatus of many animals, thinks, from the pitch of the sounds made by the vibrating wings, that they move to and fro at the rate of 400 vibrations per second—more than double those claimed by Marey.

According to Prof. Marey's figures, 190 wing-beats per second would carry the bee over a distance of one mile per minute. If Prof. Landois is right, the distance would be two miles. According to these estimates, it will not be far from the truth to say that bees fly about thirty miles an hour, and that, during an absence of twenty minutes from the hive, they fly about ten to twelve miles. Most observers, however, are inclined to think that bees do not fly more than from eighteen to twenty miles an hour, because the wing-beats of a bee in freedom and under the observer's instrument are not the same.

Every one has observed the comparatively slow flight of the bee when returning home loaded with honey and pollen. Practical examination shows that experiments of this kind are not entirely reliable. Better results are obtained by observing bees in districts where bees were never before found, or by introducing yellow bees were only gray or brown ones are known, or *vice versa*. In such cases it has been seen that the bee never went more than from four to five miles away at the most. The usual distance was two miles. One instance is known in which a beekeeper, on an island seven miles from the coast of Texas, found that his bees went to the mainland for honey and pollen. A practical beekeeper does not expect any great results from flower fields three miles away. They should be no more than two miles distant in a straight line.

The Production of Sound among the Ants.—That ants have some means of communicating with each other is well established. The experiments of Landois and those of Lubbock suggest that this communication is carried on by means of sounds produced and heard by these small creatures, but which the human ear is incapable of appreciating. The observations of Mr. C. Janet, published in *Ann. Entomol. de France* (vol. lxii., p. 159), show that certain species of the Formicidæ, notably *Myrmica rubra*, L., and *Tetramorium cæspitum*, L., are in the habit of making a stridulating noise, probably by reciprocally rubbing superficial parts of the body. A demonstration of this fact is very simple. On a small pane of glass put a ring of soft putty, and after carefully dropping in the middle of the ring, by means of a funnel, a mass of ants freed from bits of earth or vegetable matter, quickly cover them with a second pane of glass and press it down until there is just barely room between the two pieces of glass for the ants to move. If provision has been made for renewal of air, the imprisoned ants will live for several days. On holding this little box of ants to the ear and listening attentively, a murmur is heard very similar to that made by a liquid boiling gently in a closed vessel, and before long distinct stridulations can be heard in the midst of the murmuring. These sounds are heard only when the ants are disturbed.

Mr. Janet concludes that the numerous rugose surfaces which are found on the body of ants in such places that two of them can be rubbed together are probably the organs which produce the stridulating sounds of the Formicidæ. These rugosities have other uses. For instance, those about the articulations serve to hold the body stiff at will at that particular point—an advantage to the animal in pushing or carrying heavy weights up steep slopes—*Revue Scientifique.*

Courtship among the Flies.—Mr. J. M. Aldrich has made some observations upon this subject, which he records in the January number of the *American Naturalist.* The dipterous family, Dolichopodidæ, perhaps surpasses all other families of animals in the variety and complexity of the sexual adornments of the males. Probably three-fourths of the species offer well marked peculiarities which distinguish the male at a glance. A new species found at Moscow, Idaho, has the fore tarsi in the male exceedingly elongated and slender, with the last joint in the shape of a comparatively large, oval, black disk. The tarsi of the female are of the ordinary simple structure. The maneuvers of the male in courting the female were observed by the author. The fly places himself in front of the female within half an inch, rapidly vibrates his wings, gives his forefeet an up and down motion, raising them simultaneously above his head, and brings them down with a slight force, this movement recurring in about half a second, during some ten seconds. The female hastily moves away a few inches, when the male has to repeat the movements described. The author was much impressed by the perfect coincidence of these observations with Darwin's theory of sexual selection. The reluctance of the females and the corresponding ardor and persistence of the males being carried to an almost incredible limit.

The Number of Plants of the World.—In a paper by Prof. P. A. Saccardo (in *Atti Cong. Bot. Internaz.*), translated by Mr. R. Pound for the *American Naturalist*, the author estimates the true number of species of plants known up to the present time as 173,706; that is, 105,231 phanerogams and 68,475 cryptogams, thus distributed:

Phanerogams	105,231
Ferns	2,819
Equis., Marsil., Lycopod	565
Mosses	4,609
Liverworts	3,041
Lichens	5,600
Fungi	39,603
Algæ	12,178
Total	173,706

As regards the entire number of species that inhabit the globe, "I think," says the author, "we shall not go far astray in estimating that the flora of the world, when it is completely enough known, will consist of at least 385,000 species of plants (that is 250,000 fungi and 135,000 species of other plants). If one wish only to reduce to 15,000 the species that will appear in these other groups (not fungi), the sum total of plants would ascend to 400,000 species at least." In conclusion, Prof. Saccardo, judging from the rate of progress made up to the present time, thinks 150 more years of research ought to run before we reach a problematical number of 400,000.

The Thorns and Prickles of Plants.—We distinguish in plants two kinds of prickles, those provided with conducting bundles and those that have none. The first have a central cylinder which connects them with the organ that carries them. They are transformed branches or folier organs, and are commonly designated as thorns and spines. The second are of purely cortical, or even epidermic, origin, and are called prickles. Mr. A. Lothelier has undertaken an anatomical study of these two kinds of very distinct organs in considering successively, among thorns or spines, those that possess the morphological signification of branches and those which, being of folier origin, represent leaves, or merely the teeth of leaves, or stipules.

Mr. Lothelier has thus not only ascertained the exact structure of organs as yet incompletely examined in their entirety, but has established the exact origin of a certain number whose true morphological nature was unknown or doubtful.

For example, it is now established that the prickles of *Xanthoxylum planispinum* and *fraxineum*, as well as those of *Capparis spinosa*, are prickles, properly so called; that the spines of the stalk of *Xanthium spinosum* have the value of floral peduncles concrescent with stipules; and that the prickles of the burs of *Castanea vulgaris*, like those with which a large number of fruits are provided (*Datura stramonium*, *Æsculus hippocastanum*, *Ricinus communis*, etc.) represent the teeth of leaves.

In all these, and in many other cases, the anatomy alone permitted of drawing precise conclusions. It was impossible, through external characters, to legitimately prejudge the value of the organ simply from its position upon the plant.

In a general way, the results of Mr. Lothelier's work may be stated as follows:

The spine, when it is due to the transformation of a branch, owes its power of resistance and its hardness especially to the great development of the central cylinder and to the energetic sclerification of the pith, which increases more and more from the apex. It is only quite rarely that the pericycle presents a marked sclerosis at the same time. On the contrary, in the spine that is derived from the leaf, the supporting tissue is in most cases principally formed of the sclerous sheath of the pericycle. The central parenchyma undergoes but a relatively slight sclerification. The stereoma is here found in a zone intermediate between the center and the epidermis.

In prickles, which exhibit a great uniformity of structure, the stereoma is, with rare exceptions, completely relegated to the exterior. As for the origin of these prickles upon the bark, it is, according to the species, of greater or less depth. While superficial in the roses, the mother cells may, in the *Rubi*, for example, be contiguous to the endodermis. In this latter case, we may, if we desire, see a transition between prickles and spines.

Oil from Leather Waste.

A French contemporary of *Industries* contains a paper on the oily matter extractable from leather. The composition of such leather is given as follows:

	I.	II.
	Parts per 100.	Parts per 100.
Water	12	12
Hide	37	33
Tannin	29	28
Fat	18	18
Soluble in water	3·17	5·09
	0·22	0·23
Ash	0·61	0·68

The crude leather is boiled with water, and squeezed until dry under hydraulic presses. The greasy liquor is then treated with sulphuric acid and the purified grease floats on the surface, whence it is decanted off hot and run into barrels to cool. The yield in practice is about 12 per cent. It can, if necessary, be still further purified by washing with dilute sodium carbonate solution. Thus obtained the fat is yellow, melts at 27° C., and has a powerful odor of hide. It has a strong tendency to granulate and separate itself from a reddish brown liquid, similar to goose fat oil. Its odor prevents its being used in soap making, unless it be very thoroughly saponified. Its composition is as follows:

Olein	38	Resinous matter	8
Margarine	18	Water and impurities	2
Stearine	19		—
Fatty acids	15		100

When distilled it is converted into almost colorless fatty acids.

The Corinth Ship Canal.

According to a recent report of the British acting-consul at Patras, the Corinth ship canal is up to the present but little used. Between the opening of the canal in November and the end of February, the only vessels passing through have been a few ships of war, some yachts, and about 200 small Greek sailing craft, a though the canal is open to vessels of all nationalities not over 65 feet 7½ inches wide and drawing not more than 23 feet 8¾ inches of water. The tolls charged are as follows: Mail and passenger steamers, either going to or coming from the Adriatic Sea, pay 15 cents per register ton and 20 cents for each passenger carried, both in gold.

The dimensions of the canal are: Length, 3 miles 7⅓ fur ongs; breadth at surface, 80 feet 8½ inches; breadth at bottom, 68 feet 11 inches; depth, 24 feet 3 inches. The usual strength of the current in the canal is about one knot, occasionally rising to from two to three knots an hour, when great care in the navigation is required to prevent vessels from bumping against the steep sides of the canal. Although some additional lights have been placed in the Gulf of Corinth, steamship companies require still better lighting before deciding finally to adopt the canal route.