mum of the year on or about October 22, and hence it is that the guide books say the Nile is at its highest in the end of October.

"A gauge of 16½ cubits at Aswan while the basins are being filled does not give more than 21 cubits at Rodah (Cairo), but as the basins with a 16½ gauge will fill by the 10th of September, it follows that a 16½ to 16 cubit gauge at Aswan will not give a constant Cairo gauge, as the great mass of water passes by the basins and reaches Cairo. Hence we have frequently the paradox of a steady or falling gauge at Aswan showing a steady rise at Cairo.

"If the gauge at Aswan keeps above 16 cubits to near the end of September, the basin emptying is much retarded, as the emptying at each successive basin fills the Nile above the 16 cubit level; hence the lower halves of the chains of basins do not flow off, and thus when the great Middle Egypt basins are discharged, they do not raise the Nile so much as they do when the last half of September Nile is below 16 at Aswan.

"In years like 1887 and 1892, which differ from each other only in date of maximum gauge at Aswan, the river, having filled the basins in 15 to 20 days instead of in 25 to 30 days, comes down to Cairo in so largely increased a volume that a really dangerous gauge of 25 cubits at Cairo is maintained for over a fortnight (the average October gauge in Cairo is about 23 cubits), and from September 10 to October 25 the river remains from 24 cubits to 25½ cubits, and the Middle Egypt basins discharge so slowly that the opening day is hardly traceable on the Cairo gauge.

"In the 1878 flood, which was the most disastrous flood possible, the river rose in the most abnormal fashion, and on October 3 attained 18 cubits at Aswan. This breached the Delta and, in addition, so delayed the Upper Egypt basins emptying from the reason before given, that the wheat was sown too late and got badly scorched by the hot winds of March and April."*
—Nature.

THE MISAPPLICATIONS OF THE TERM COCOA.

THE CORRECT USAGES FOR CACAO, COCA, COCO, AND COCOA.

By Dr. EUGENE MURRAY AARON.

NOT long since, while present in a recitation room in one of the higher grade schools in one of our leading cities, I had an opportunity to listen to the recitations of a class in physical geography, a class made up of children ranging in age from fourteen to seventeen. A reply made to a question from the teacher convinced me that the scholar making it was unaware of the difference existing between the trees producing the chocolate and the cocoanut of commerce. With the teacher's permission I put a question to the class which resulted in my discovering that not one among them was aware of the difference existing. My surprise was much heightened by discovering that the teacher was also in the dark on this matter, and to have the principal of the school, who entered just as I had finished a short talk to the scholars, when his assistant explained to him the subject of what I had been saying, reply: "Oh! yes; one is the nut of the palm tree and the other is a product from the sap."

It seemed beyond belief at first that such ignorance concerning two most prominent products of the nearby tropics could thus be confused; but I have since discovered that this was by no means an isolated case, rather being typical of the confused ideas that are common on the subject. Recently, on picking up that entertaining little work of Judge Bell in which he gives us the benefit of his observations in the West Indies, I came across these appropriate words: "Ideas at home [in England] on cocoa are generally very mixed, as most writers on the subject use various terms, such as cocoa, cacao, cocoa nut, cocoa palm, etc. The cocoa [sic] or chocolate is also often confused with the cocoanut palm."† I say appropriate words, because they are such inasmuch as they testify to the equally mixed impressions holding in England, and furthermore show that even the judge, who attempted thus to set his fellows right, still further mixes them up by applying the term cocoa to both the nut-bearing palm and the pod-bearing smaller tree.

Another illustration of this confusion of ideas is to be found in the last report of our own agricultural department, where in one place this accurate statement is to be found: "The chocolate plant, *Theobroma Cacao*, is highly valued for the produce of its seed.

In this case *cacao* is the proper term to use when describing the plant or its products,† and where on another page, under the subject of adulterants, these products are invariably alluded to as "cocoa preparations," and the "cocoa bean."§ Our government is a prime offender in this respect, both the publications under the charge of the Smithsonian Institution and the Bureau of American Republics (State Department) being very careless in their use of these terms. It is a fact that throughout these bureaus, in the Government Printing Office, and in nearly every newspaper office in the land there is need that some primary instruction on this subject should be given to the proof-readers.

At a meeting of the London chamber of commerce in July last, Mr. J. Ferguson, while reading a paper on tropical agriculture in Ceylon, attempted to set this matter right by suggesting that the product of the chocolate-yielding tree should be known as *cocoa*, as it now is among uninformed people, and that that of the palm should drop the final *a* and be spelled *coco*. Unfortunately, Mr. Ferguson appears to have been unaware of the fact that this term is, by the claims of priority, the property of the tubers of *Caladium esculentum*, *Colocasia antiquorum*, and other allied species, that furnish an important starch-laden food in many tropical countries. Even the Century Dictionary, that monument of the industry of many industrious men, after setting those who consult it right by giving *cacao* as the correct spelling, uses the terms *cocoa*, *cocoa shells*,

and *cocoa butter*, simply because they are the generally accepted inaccuracies.

There are four very distinct products that are mixed under the one term *cocoa*, and which in the minds of very many are all the products of the *cocoa* palm. These are:

Cacao [kah-ków] *Theobroma Cacao*; the chocolate berry tree.

Coca [ko-kah'] *Erythroxylon Coca*; the coca leaf bush.

Coco [ko-ko] *Caladium esculentum*, et al.; the coco roots.

Cocoa [kó-kwah] *Cocos nucifera*; the cocoanut palm.

Of these four, the first and last are best known in northern latitudes, both being very important articles of export from the tropical lands where they are grown; but of all of them there are certain interesting phases that are worthy of mention here.

Cacao, well placed in the genus *Theobroma* (food for the gods), derives its specific name from the Portuguese *Cacau*, which, according to Senor Jesus Sanches, is derived from the Mexican word *cacauatl*, a pure Nahuatl word. It belongs to the natural order *Sterculiaceae*, is a small evergreen tree, like our apple, growing from 15 to 45 ft., is a native of tropical America, but has been introduced into Africa, where it has escaped from cultivation in some localities and may now be found growing wild. It bears a somewhat egg-shaped pointed pod, furrowed into 10 ridges, from 5 to 12 in. long, with a number of seeds buried in a sweet pulp. It is from the seeds that is derived the nutritive fat, about 50 per cent. of the whole, which is used as a food both in the fresh and dried state. Roasted and divested of their husks, they are known as "cacao nibs;" ground into a paste and sweetened and flavored, they yield "chocolate," the most important product of the tree; the nibs alone, either ground, unground, or in a crude paste, yield "cacao," erroneously called in English countries *cocoa*; with the oil thoroughly extracted, the dried powder yields "broma;" the husks alone furnish an article known as "cacao shells;" while the oil from the seeds is known as "cacao butter," which, with a chocolate-like taste and odor, is solid at ordinary temperatures, and is used for soaps, pomatums, suppositories, and like purposes.

The *cacao* tree, like the nutmeg and a number of other tropical growths, produces a curious impression, from the fact that the flowers and pods grow directly out of the bark of the trunk and branches, seemingly without any stalks, and not at the ends of the smaller stems. From Bulletin No. 7, Bureau of the American Republics, I extract the following:

"About 250 plants are ordinarily planted to the acre. The cultivation is very simple, consisting, after planting of the trees, in keeping down the weeds. During the first years banana plants are grown between the rows to shade the young plants and the soil. The first crop is taken in the fourth year from planting. The trees will produce, on an average, 200 fruits with from 30 to 50 nuts each, and a plantation of 50,000 trees would yield 550 tons of nuts. This, at 12½ cents per pound, would give an annual income of \$137,500. From this would be deducted:

"Preparation of 200 acres, purchase of seeds, care of seed beds, etc.....	\$14,000
Planting 12,500 banana plants to shelter plants.....	400
Pay of labor for care of plantation for four years	20,000
Total.....	\$34,400

"The gathering and preparation of the nuts is estimated at about 1 cent per pound, and adding to this the cost of packing, transportation, and interest on capital, a net income of about \$60,000 would result.

"A plantation of *cocoa* [sic] trees is an inheritance for the children of a family, as it produces from 50 to 80 years, and after the first few years needs little attention."*

An average temperature ranging near 80° F., a moist soil and a humid atmosphere are prime requisites for the successful cultivation of *cacao*. The belt along the Caribbean coast of Venezuela produces that prime article the "Caracas *cacao*," which is generally recognized as the best known to commerce, and is of that grade which all other countries are trying to copy. Speaking of the cultivation of *cacao* in that region, Bulletin No. 34, of the series already quoted, gives this much more moderate estimate of the results of the *cacao* plantation:

"One acre will accommodate about 100 trees, and like coffee, they must be protected from the sun by umbrageous trees, the banana, for instance, until they have acquired normal size. . . . Five years after planting the trees begin to bear two crops per year, ripening in June and December. The average age of the tree is about forty years, during which time the crop will yield from 500 to 600 pounds per acre. . . . The *cacao* crop pays for its cost with usury. It does not incur the risks that imperil the tobacco crop; it is safer, less expensive, and more profitable than stock raising or sugar growing, and is much more easily and cheaply gathered and manipulated than coffee."†

In Mexico, Jamaica, most of the Central American republics, and in the Windward Islands this crop is growing to be a prime favorite with those who are willing to wait a few years for a great return and who are not intoxicated by the almost immediate yield of the soil-exhausting banana.

Judge Bell, already quoted, has given on page 118 of his interesting little work this graphic description of a *cacao* plantation: "The *cacao* trees are planted in rows 15 ft. apart, and when full grown form a beautiful clean cultivation; the branches of each row interlacing with the next, form endless cool shady avenues, and carpet the ground with fallen leaves. The fruit grows in large red, yellow and green pods, ribbed somewhat like a melon (cantaloupe) and sprouting from the trunk and branches of the tree. When ripe, these pods are picked, cut open, and the beans found inside thrown into boxes and allowed to 'sweat' or ferment for five or six days; the beans are then taken out and spread out in drawers and mats, and after six or seven

days' drying in the sun, are bagged and shipped to Europe."*

What I have written or quoted here of the present or very profitable productivity of the *cacao* crop has not been for the purpose of inducing northerners to try their hands at *cacao* cultivation in the tropics, as I am much of the opinion of Bell that "it is very much to be feared that in a few years the supply will exceed the demand, and these colonies, which persist in putting all their eggs in one basket, will at no distant date find themselves in the same predicament as they were in fifty years ago, with sugar." However, it is likely that for years to come it will remain an important factor in the earnings of many tropical belts, passing current in the place of money in some places, as it has long done on the upper Amazons.

Under the head of *cacao* the "cacao cuadrado," a wild species of the United States of Colombia, *Herzania pulcherrima*, and the "Guarana *cacao*" or "Guarana bread," as it is sometimes called, *Paullinia sorbilis*, are both to be borne in mind. The latter is a wild species of climbing, sapindaceous shrub, the pounded seeds of which contain *caffein*, and are made into rolls and cakes, used as food or as medicine, and in the preparation of a very refreshing drink.

From the last report of the Division of Chemistry, U. S. Agricultural Department, I extract the following on the subject of *cacao* adulteration:

"Perhaps no food material offers conditions so favorable for profitable adulteration and so well utilized by its manufacturers as do *cocoa* [sic] preparations. There is probably no more misleading or more abused term in the English language than 'soluble *cocoa*.' No *cocoa* in the market contains more than 10 per cent. to 30 per cent. of matter soluble in water, unless the material so dissolved is foreign soluble material that has been added during the process of preparation.

. . . This purpose may be accomplished in two ways; the material may be so finely divided that a very long time will be required for its deposition, or foreign substances (as starch or sugar) may be added to render the liquid of so high specific gravity or so pasty that the insoluble matter will not deposit. The first method is decidedly to be preferred; it accomplishes the object in view and puts the preparation in better condition for the action of the digestive juices, and all this without the addition of a cheap diluent that is always at hand in every kitchen should its use be desired."‡

Coca, the second of our four very distinct growths, is a product of the Andean chain from the United States of Colombia to Chile, though it is found in greatest luxuriance in the Peruvian Andes. This shrub is famed for the extraordinary stimulating properties of its leaves, which are known as "spacic" as well as "coca." They contain two alkaloids, cocaine and hygrin, as well as a peculiar tannic acid. The Peruvians mix the leaves with the ordinary forage plants to increase the muscular energy and the endurance of their mules and llamas. There are many species of the germs *Erythroxylon*, but whether others of these contain the same valuable properties does not appear to have been ascertained. We in the United States are best acquainted with the product of the *coca* leaves at our soda water counters, where, as "wine of *coca*," "moxie," and as one of the ingredients of "coca kola," it is abused quite as much as used. In the latter case it is mixed with the wine of the kola nut, *Sterculia acuminata*, an African growth, the nutritive and revivifying qualities of which have already been sufficiently exploited by the surgeons of the German and British armies. Cocaine, another product of these leaves, is also a prominent factor in surgery. According to Baron von Mueller, more than \$3,000,000 worth of *coca* leaves were exported from Peru as early as 1880. † This is a crop that might be introduced in the higher mountain areas of New Mexico, Arizona, and Utah, with profitable results.

The stimulating qualities of *coca* have not been generally overstated, remarkable as have been many of the claims made for it. I have made trips through tropical mountain ranges at a speed that was quite equal to that maintained by the most stalwart guides and which was only possible through these qualities of the leaf of the *coca* bush. A few leaves carried in the pocket make any other food supply unnecessary for a day's exhausting tramp; and I have seen a fagged pack mule so rejuvenated by having a few leaves put with his noontide feed that he was rather more frisky and unmanageable at 2 p. m. than he had been at 6 in the morning.

Coco, as already stated, is a name only to be properly applied to the roots of *Caladium esculentum*, *Colocasia antiquorum*, and allied plants. It is also applied to the yam-like roots of *Sechium edule*, more properly known as "chocho" or "chayota," a West Indian climbing plant, which, used as a culinary plant, yields a monster tuber capable of much the same treatment as our sweet potato, and the good sized fruits of which are also edible. The latter often germinate before they drop to the ground, and over 100 may be found on one plant in a year. None of these growths are of exportable worth at present, and are, therefore, of but little interest to northern readers.

The last of our quartette, *Cocos nucifera*, the cocoanut palm, is so well known as a growth, from Florida to Chile, and its hand-shelled nuts, their desiccated interior pulp, and the many uses to which the fibers of the tree are put, make it so familiar to all that any description here would be but to reproduce what has already frequently been well done.

If what has here been said shall contribute to the clearing away of the very misty ideas of the great mass of readers regarding the use of the word *cocoa* and its allied terms, I shall feel that something has been gained; for at present the muddle into which careless writers and equally careless proofreaders have got these terms in a source of mortification to the English student, as it is a cause for surprise, and more, on the part of the German and Frenchman, who long ago learned to avoid these pitfalls and always follow the botanical distinctions.

* Bell, *l. c.*, p. 118.

† Rep. of the Secy. of Agriculture, 1891; Washin ton, 1892, p. 189.

‡ I wish here to acknowledge the debt under which I, in common with all who are interested in tropical vegetation, am constantly put by the unrivaled work of Baron von Mueller, *Select Extra-Tropical Plants*, Calcutta, 1892, without which there would be a serious gap in botanical literature.

* Brazil: Bulletin No. 7; Washin ton, June, 1891, p. 65.

† Venezuela: Bulletin No. 34, Washington, February, 1892.

* The modern Egyptians still hold to the old months for irrigation. 7 Tuba = January 15 is commencement of wheat irrigation; 30 Misra is the last safe date for sowing maize in the Delta; 1st Tut is the date of re-ulating the bridges = September 8 in Upper Egypt.

† Bell, H. J.; *Obeah: Witchcraft in the West India*. London, 1889, p. 118.

‡ Rep. of the Secy. of Agriculture; 1891. Washin ton, 1892, p. 465.

§ *Ibid.*, p. 189.