# SCIENCE:

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Attention is called to the "Wants" column. All are invited to use it in soliciting information or seeking new positions. The name and address of applicants should be given in full, so that answers will go direct to them. The "Exchange" column is likewise open.


## TECHNICAL EDUCATION AT ST. ETIENNE.

FOR the past twenty years the French Government has devoted a great deal of attention to the education of the people. National schools, says the United States consul at St. Etienne, have been opened in almost every village, and the instruction given is of a very useful order. Besides the primary schools, there are superior schools where diplomas for "great merit" may be obtained. These latter, however, are only attained by pupils belonging for the most part to the middle classes, who intend to become teachers or governesses in public or private institutions, or by those who have no other purpose in view than of being considered fairly well educated. As the working classes, on the other hand, cannot afford for their children the expenditure of time and money which a course of these higher schools involves, they are obliged to withdraw them when they have received the certificate of elementary education which is generally given to children between the ages of twelve and thirteen. It is for this poorer class that towns of importance throughout France have established well-equipped schools where various trades are taught gratuitously, both practically and theoretically. St. Etienne being one of these important cities, with 113,000 inhabitants, possesses a model, well organized, and successful technical school.

The technical institution of St. Etienne was built in 1885 at a cost of $115,000. The school has three hundred students, and the trades taught are weaving, dyeing, sculpture, iron founding, cabinet making, etc. The apprenticeship is four years in duration, and the institution is free. At the end of four years, a certificate of aptitude is given, which enables the pupil to obtain a situation in the line of industrial labor which he had chosen. The work of the school begins each day at seven in the morning, and ends at seven in the evening. The school is composed of two buildings. The first is reserved for general education, and the second contains the different workshops, occupying 1,400 square metres of surface. The fitting up of these workshops is very complete, and comprises vices, lathes, boring, planing, and other machines, forges, anvils, steam-hammers, carpenters' benches, circular saws, weaving machines of every variety, and all the accessories of the dyeing industry, as well as important collections of chemical and physical apparatus. The whole building is lighted by electricity.

The lectures are of two kinds. The first are common to all students of the same year, and embrace general subjects, while the second are exclusively technical, and are special to each section. In the first year, the students pass through all the workshops to be initiated into the proper handling of the different tools, whether of iron or wood. After this period, the boys are classed according to their tastes, desires, and aptitudes. They work at manual labor three hours daily during the second year, four hours in the third, and five in the fourth and last year for the first six months, and seven hours during the last six months, in order to accustom them to the burden of a day's work. During this period, also, great attention is paid to the teaching of the theory of the different trades, that is to say, the fitters are taught to trace and cut out cog-wheels, and the carpenters to design and execute a certain number of apparatus, such as stairs of different variety, shutters, balconies, etc., on a reduced scale. The weavers, besides being taught thoroughly all the details of the loom and its working, receive special lessons in book-keeping, legislation, commercial geography, and are taught one of the modern languages. Very careful attention is paid to design. The apprentices at all the trades are obliged to follow the instruction given on this subject, which is rightly considered of the greatest importance in the school. Designs of various kinds are executed by the more advanced sections, and every year an exhibition of the work of the boys is held.

Consul Loomis says that the results of this school have been most excellent, and he has been informed that, as a rule, its graduates become self-supporting members of society in a very short time.

## THE PRODUCTION OF BUTTER.

BULLETIN No. 17 of the Pennsylvania State College Agricultural Experiment Station, by Professor Thomas F. Hunt, details some carefully conducted experiments with twelve milch cows to determine the value of cotton-seed-meal as compared with bran for the production of butter. The main inquiry was with reference to the relative effect of cotton-seed meal and bran upon the quality of the butter. The quantity of food required to produce a given quantity of butter, the effect of the food upon the health of the animals, and the effect of the food upon the completeness with which the butter fat was recovered from the milk were also subjects of research.

There were three feeding periods of four, four, and two weeks, respectively. The cows were divided into two lots of six cows each, care being taken to have the two lots as nearly comparable as may be.

Beginning with a small quantity of cotton-seed-meal, six cows were fed an increasing quantity of cotton-seed-meal until six pounds were given daily per animal. This heavy feeding of cotton-seed-meal, fed during April and May, did not affect the health of cows averaging 900 pounds each. Calves were fed one pound of cotton seed-meal daily, in skim-milk, with apparently disastrous results.

The six check cows were fed bran in place of cotton-seed-meal, while all the other food offered was the same in each lot. The yield of milk was increased about one-fifth when

cows were fed cotton-seed-meal instead of bran, the cotton-seed-meal constituting about three-fifths of the grain ration, and about one-fourth the total food eaten. This conclusion is reached by two comparisons which substantially check. First, the yield of milk from the cows fed cotton seed-meal was compared with that of those fed bran; and, second, the yield of milk from the cows fed cotton-seed-meal was compared with that from the same cows fed bran. This is shown in the following table, which gives the milk produced daily per animal by four cows of each lot:

| | Period I. | Period II. | Period III. |
|---|---|---|---|
| | pounds. | pounds. | pounds. |
| Lot I. | 19.4 | 19.5 | 19.0 |
| Lot II. | 23.4 | 23.9 | 19.6 |

Lot I. during all these periods and Lot II. during period III. were fed a ration containing bran, while Lot II. during periods I. and. II. was fed a ration containing cotton seed-meal. We have not noticed this double method of comparing results being used in a feeding experiment heretofore. As the per cent of fat was not materially changed the quantity of butter fat was appreciably increased by feeding cotton-seed-meal in place of bran.

Butter was made both with the extractor and with the churn and deep cold-setting system, — twelve churnings with the extractor and four with the ordinary churn. With the extractor, the per cent of fat recovered was practically the same whether bran or cotton-seed-meal was fed. The per cent of fat recovered varied in ten "runs" with the extractor from 80.3 to 90.6 per cent, — averaging about 86 per cent. With the deep cold-setting system slightly more fat was left in the skim-milk and in the butter-milk when bran was fed.

Samples of butter made from eight lots of milk in which the grain ration was corn-meal and bran, and samples of butter made from the same number of lots of milk in which the bran was more or less completely displaced by cotton-seed-meal were rated by one or more commission merchants. A's score, who rated all the samples, is given in detail. He decided that the bran butter was 18 per cent better in body, 12 per cent better in smelling flavor, 9 per cent better in tasting flavor, 9 per cent better in salt, and 2.5 per cent better in color than the cotton-seed-meal butter. While there was considerable variation in opinion among the several judges, there was a general agreement that feeding cotton-seed meal reduced the quality of the butter.

The conditions of manufacture of the two kinds of butter were alike, but it is shown that cotton-seed-meal butter requires to be salted heavier than bran butter, and it is suggested that if more salt had been used in making the former as compared with the latter, the two kinds of butter might have been nearer equal in quality.

The average melting-point of eight samples of bran butter was 93° F., while that of eight samples of cotton-seed-meal butter was 99° F. The average per cent of fat was practically identical in both kinds of butter, being about 78 per cent.

## SAVAGE RELIGION.

AT a meeting of the Anthropological Institute of Great Britain and Ireland, the president, Dr. Edward B. Taylor, read a paper on "The Limits of Savage Religion."

Dr. Taylor pointed out that, in defining the religious systems of the lower races so as to place them correctly in the history of culture, careful examination was necessary to separate the genuine developments of native theology from the effects of intercourse with civilized foreigners. This borrowing in some degree from the religious ideas inculcated by foreigners was generally admitted; but he said that he would show that it had taken place to a much greater extent than had been supposed. Especially through missionary influence since 1500, ideas of dualistic and monotheistic deities and of the moral government of the world had been implanted on native polytheism in various parts of the globe.

The mistaken attribution to barbaric races of theological beliefs really belonging to the cultured world, as well as the actual development among these races of new religious formations under cultured influence, had been due to three principal causes: (1) Direct adoption from foreign teachers; (2) the exaggeration of genuine native deities of a lower order into a supreme god or devil; (3) the conversion of native words denoting a whole class of minor spiritual beings, such as ghosts or demons, into individual names alleged to be those of a supreme good deity or a rival evil deity. Conspicuous among the cases of borrowing from the beliefs of a higher culture was the famous belief in the "Great Spirit" of the North American Indians. Philosophers had long been wont, on the strength of this belief, to point to the "poor Indian, whose untutored mind sees God in clouds, and hears him in the wind;" but that the "Great Spirit" belief was really the product of the tutored mind of the Jesuit missionaries in Canada was proved by their own records. In South America, among the tribes of the regions of the Orinoco, missionaries and travellers had recorded the names of great divine beings, good and evil, which, could they be received as native to these rude people, would prove that the religion of the lower culture involved a conception of a supreme creative being. Yet, when the names of these recorded deities were translated, the result threw light on their probable origin outside any native development of religion. They might variously be interpreted as "The Highest," "Lord of All," "Creator," and "Our Great Father;" and these were obviously to be attributed to the missionary teaching which had been going on for three centuries.

The Maipuri tribe explained to Father Gilij, who had written such valuable accounts of the Orinoco tribes, how their spirit Purrunaminari ("Lord of All") created man, and formed woman afterwards by extracting a rib from man during his sleep; and, further, how, again in accordance with Genesis, light was created before the sun. They had an account also reproducing the very details of the divine birth according to Christian dogma; and all this Father Gilij accepted as proof of sacred tradition having been preserved since the beginning of the human race, regardless of the fact that there had been intercourse with Europeans since 1535. These tribes had stories of a universal deluge, told as native traditions, with details plainly borrowed from European teaching, such, for instance, as the story of the great waters being sent by the "Creator," from which only one man escaped, and he in a canoe, whence he sent out a rat to see whether the water had fallen, the rat returning with an ear of Indian corn. Australia afforded much material for the illustration of the question in hand.

Since the period of European colonization, a crowd of alleged native names for the Supreme Deity and a great evil deity had been recorded. Bishop Salvado of the Benedictine Mission in West Australia gave an account of the savages' belief in an omnipotent creator called "Montogon" (believed to be a wise old man of their own race), and also in a malignant spirit, extremely feared, called "Chenga." This region