pound. Ylang-ylang oil has been held almost as an exclusive monopoly by France and Germany; but a steady cultivation of the trees in Porto Rico should lead to a change. The oil is extracted by simple processes, and without the use of chemicals, and from seventy-five pounds of the flowers a pound of oil is usually produced. In Europe the oil of ylang-ylang is used as the basic essence of the best perfumes as much as the famous attar of roses.

GEORGE E. WALSH.

THE INFLUENCE OF MILKING UPON THE QUANTITY AND QUALITY OF MILK.

M. Lepoutre, agricultural engineer and assistant to M. Roquet, professor of zootechny and animal physiology at the Agricultural Institute of Belgium, has just made a series of interesting and careful experiments at the laboratory of zootechny and hygiene of the said institute for the purpose of determining the influence exerted by milking upon the quantity of milk, upon its composition, and particulary upon the proportion of its fatty materials.

Although our knowledge as to the influence exerted by the nervous system upon the physiological tissues is very meager, the experimenter started from the innervation (nervous stimulation) of the glands in general (to the greater or less excitation of which corresponds a more or less abundant secretion), in order to try to bring about an artificial excitation of the mammary innervation for the purpose of improving the lacteal secretion.

Broadly considered, the operation of milking is a rational massage that has the effect of drawing from the udder a quantity of milk much greater than that which is contained at the outset. It is admitted that the udder of a good cow may, before the operation, contain 3 quarts of milk already formed, while, if the animal is well treated, the udder may yield from 10 to 15 parts. It follows, besides, from the experiments of M. Lepoutre, that milking exerts a great influence upon the proportion of the fatty materials contained in the fluid. This influence is due, according to the experimenter, to the peripheric excitation of the nerves of secretion, which in their turn, by reflex action, bring about a greater excitation of the glandular cells. If we consider the general case of milking from two teats at once, as usual, we find that the effect produced is not the same during the entire period of the milking. The milk extracted from the first two teats is generally richer in fat than that of the two milked in the last place, and this richness will be greater if we simultaneously milk the two teats of one side, than if we simultaneously milk one teat of one side and one of the other, and then the two remaining ones—in other words, if we do the milking diagonally instead of laterally. The phenomenon is singular, if not obscure. It seems, however, explainable by the fact that in diagonal milking the excitation extends to all of the nerves of the gland, while in lateral milking it extends only to the side on which the operation is performed, and is consequently stronger. At all events, the influence of milking upon the proportion of fat is shown by the following experiment of M. Lepoutre. The same cow was milked several times and simultaneously by two different persons, who at each operation changed sides. The milk of each side was collected separately. One of the persons performed the operation by exerting a simple alternating pressure upon the teat, while the other performed a downward massage at the same time. The milk collected by the latter person was always markedly richer in fatty matter than that collected by the former. The difference was considerable, since in the first case there was 55 per cent of the total yield, and in the second 45 per cent. The method of milking has therefore a great influence upon the quality of the milk, and this influence is not explainable unless we grant that it bears some relation to the excitation produced.

On the other hand, the milk obtained at the beginning of the operation is not so rich as that obtained at the end. Up to the present, this fact has been explained by the statement that a prolonged operation ends by detaching from the lactiferous vessels the particles of butter adhering to the walls. M. Lepoutre is not of this opinion, and remarks that the operation is performed more vigorously at the end than at the beginning. The excitation must therefore be stronger, and the reflex action be greater upon the mammalary tissues, thus causing a lactiferous secretion richer in fat.

The experiments of Prof. Roquet's assistant tend to condemn all milking machines, especially those based upon the use of a centrifugal pump. Up to the present it has been thought that the superiority of hand milking is shown only by the quantity of milk obtained; but now it is necessary to add the superiority from the viewpoint of richness in fatty matters.

Although these facts would show machines to be useless which, it was thought, would some day solve the problem of mechanical milking, it is probable that more highly improved ones will eventually take their place. The principles upon which these new apparatus will be based will be those of the mechanical and intensive production of nervous excitation at present effected, unconsciously as it were, by manual treatment. It is not unlikely even, and it is the logical consequence of what has just been said, that the milking machine of the future, based upon such principles, will be able to perform the operation of milking better and obtain a greater quantity of milk, richer in fatty matters, in a more uniform and more scientific manner.

PHOSPHORESCENT CRYSTALLIZATION OF ARSENIOUS ACID.

BY A. C. MAURY.

In the crystallization of arsenious acid there is frequently displayed one of the most beautiful and interesting phenomena of physics, the emission of light by a crystal at the moment of its formation. The experiment is one of the most impressive in laboratory or lecture room, yet it is rarely attempted, owing to uncertainty of success. It was accordingly proposed in a previous article of the SCIENTIFIC AMERICAN, entitled "Light in Crystals," that a brief description should be given of the writer's method of preparing the phosphorescent solution.

Fresh samples of arsenious acid were dissolved in hydrochloric acid, the lumps being first ground to powder, and then boiled with the hydrochloric acid in a test-tube or small flask. Success is dependent mainly on the solution's being of the right strength, and the best results are obtained when 3.81 grammes of arsenious acid are dissolved in 4 cubic centimeters of hydrochloric acid at 18 per cent to 18.5 per cent. The liquid must be boiled till clear and free from undissolved material, but solution should be effected as rapidly as possible, since long boiling alters the strength of the hydrochloric acid. The most highly phosphorescent solutions are those made in five minutes. This point is found to be of less importance when a return-flow condenser is used, though even then solutions made rapidly are the most successful. The condenser is convenient, but the open tube or flask serves equally well, if the exact amount of arsenious acid is placed in it and quickly dissolved. A favorable condition is indicated by the bubbles' breaking tardily, as though the fluid were slightly viscous. A drop taken out on a glass rod and placed on a cold glass surface should at once form a white ring round the edge, and in a few seconds should turn all to white crystals. If the whole drop turns instantly to a white mass, the solution is too highly supersaturated, and the crystals will be thrown down before cooling and without apparent phosphorescence.

When ready, the solution is placed in a hot sand bath, and set aside in a perfectly dark closet, where it may cool slowly without being jarred by passing footsteps.

When still warm but no longer hot, it begins to show occasional sparks, which resemble the soft flashes of the phosphorescent light seen sometimes in the wake of a vessel on summer evenings. Frequently two or three crystals form at once, and their light is then prettily reflected against the glass. When the flask is shaken hard the illumination is very beautiful, resembling a fine display of the light at sea. The phosphorescence is visible on repeated shaking, the solution being allowed intervals of rest; or if the flask be left undisturbed, the tiny crystals form spontaneously, and sparks continue until or even after the liquid is quite cold. Crystals which dry on the sides of the flask are phosphorescent when scratched with a glass rod.

The slight sound said by some observers to be emitted by the crystals in forming has not been noticed.

Bandrowski in his experiments (American Journal of Science, January, 1896, p. 51) found the most favorable strength of the hydrochloric acid to be 16.5 per cent to 18 per cent, which is somewhat lower than that given above. In the experiments made by the writer, solutions at 18 per cent and 18.6 per cent were alone successful; those at 17.4 per cent, 19 per cent, and 19.7 per cent showed only a few faint sparks on hard shaking.

The difference in Bandrowski's results is doubtless due to the fact that with the lower percentage of hydrochloric acid he used a smaller amount of arsenious acid, viz., 15 grammes in 150 cubic centimeters of the dilute acid, for altering the strength of the hydrochloric acid alters the solubility of the arsenious acid; and as phosphorescence in all probability depends on the readiness of the crystals to separate from the fluid, it is likely that various corresponding proportions may meet the required conditions.

It is likewise owing to alteration in solubility that long boiling impairs the liquid. Loss by boiling alters the strength of the hydrochloric acid, and increases the solubility of the arsenious acid. Thus when the return-flow condenser is used, it is not found possible to dissolve more than 4 grammes of arsenious acid in 4 cubic centimeters of hydrochloric acid at 18 to 18.5 per cent; but when the liquid is allowed to boil away in the open tube while being kept replenished with fresh hydrochloric acid, as much as 6 grammes of arsenious acid are dissolved. In the latter case nearly half the liquid boils away and must be renewed. That boiling had no immediate effect on phosphorescence is shown by the fact that the first successful experiment is made by boiling a solution of unknown strength for a number of hours, when a beautiful display is seen.

In the above experiments the transparent or vitreous form of arsenious acid was used, some very fine samples from their laboratories in Germany having been kindly presented to the writer by Messrs. Merck & Co. It will be remembered that arsenious acid assumes this form when it has been freshly sublimed at a high temperature, after which it passes slowly into the white, opaque, crystalline form, in which it is commonly found. Becquerel, in La Lumière, stated that the transparent form alone gives phosphorescent crystals; but Bandrowski later found both varieties to be phosphorescent. Trials were made in the present experiments, selecting the opaque portions of the specimens, and phosphorescence was obtained, though the transparent portions gave perhaps the finer results. The fact that both kinds phosphoresce is of interest, because the theory was formerly advanced that phosphorescence is due to the change from the transparent form, which is amorphous, to the opaque, which is crystalline. The explanation must therefore be sought elsewhere, in connection with similar phenomena shown in other cases of simple crystallization.

SCIENCE NOTES.

The Carnegie Institution at Washington has received from Prof. Pumpelly a preliminary report of the investigations which he is making under the auspices of the Institution on the ancient site of Anau, near Aschabad, in Russian Turkestan. He reports gratifying success, the expedition having explored over 136 feet of successive culture strata, containing at least four almost uninterrupted culture stages, extending apparently for thousands of years through the neolithic and bronze into the beginning of the iron age, and having correlated the stages of culture with important events in the physiographic history and with the introduction of irrigation.—N. Y. Evening Post.

A series of interesting experiments with a new war kite for utilization with a newly-discovered system of wireless telegraphy were recently carried out with great secrecy before Kaiser Wilhelm. The inventor is a German-American professor, at present residing at Havre. The operations were carried out about a mile from the shore. No spectators whatever, beyond the naval officials and the Emperor and his suite, were allowed to witness the experiments. Seven kites were flown on copper wires to a height of from 10,000 to 12,000 feet. The experiments were partly made from the Kaiser's dispatch boat "Sleipner," traveling at the rate of thirty knots an hour, and several languages were employed. The feature of the invention is the possibility of transmission over the greatest distances without affecting any other wireless telegraphy station. The form of the kites used is that of two cubes side by side, similar to the Cody box kites.

From the bark of trees and shrubs the Japanese make scores of papers, which are far ahead of ours. The walls of the Japanese houses are wooden frames covered with thin paper, which keeps out the wind but lets in the light, and when one compares these paper-walled "doll houses" with the gloomy bamboo cabins of the inhabitants of the island of Java or the small-windowed huts of our forefathers, one realizes that, without glass and in a rainy climate, these ingenious people have solved in a remarkable way the problem of lighting their dwellings and, at least in a measure, of keeping out the cold. Their oiled papers are astonishingly cheap and durable. As a cover for his load of tea when a rainstorm overtakes him, the Japanese farmer spreads over it a tough, pliable cover of oiled paper, which is almost as impervious as tarpaulin and as light as gossamer. He has doubtless carried this cover for years, neatly packed away somewhere about his cart. The "rikisha" coolies in the large cities wear rain mantles of this oiled paper, which cost less than 18 cents and last for a year or more with constant use. An oiled tissue paper, which is as tough as writing paper, can be had at the stationer's for wrapping up delicate articles. Grain and meal sacks are almost always made of bark paper in Japan, for it is not easily penetrated by weevils and other insects. But perhaps the most remarkable of all the papers which find a common use in the Japanese household are the leather papers of which the tobacco pouches and pipe cases are made. They are almost as tough as French kid, so translucent that one can nearly see through them, and as pliable and soft as calfskin. The material of which they are made is as thick as cardboard, but as flexible as kid.—David G. Fairchild in the National Geographic Magazine.