no doubt that these are the indications of a system that is founded in reason and results in efficiency. The setting-up drill, therefore, should be sedulously cultivated as a gymnastic method of physical improvement; but care should always be observed not to carry the exercise of swinging the extended arms in circles to excess. This seems simple, but is very fatiguing, especially when the heart is irritable, and leads to faintness in recruits.

There is a vicious habit in the British army, not common in our own but mentioned here as a warning, where the drill-sergeant seeks, not only to expand the chest, but to keep it expanded. The recruit is required to stand bolt upright, with the head well back and the chest inflated by the fullest inspiration. This artificial dilatation is sought to be maintained without giving place to a corresponding expiration. The expiration being held in abeyance obstructs the circulation and impedes the cardiac action. With the imperfect respiration the aëration of the blood is likewise imperfect, the abdominal muscles are weakened by overstrain, and their action is impeded by the forced depression of the diaphragm, while the increased measurement of the recruit's chest is secured only at the expense of its mobility, and at the risk of vesicular emphysema. In this distended chest the heart is displaced downward, the area of the impulse is increased, the beat becomes jerky and too powerful, and in frequency it may reach 110, with irregular force and time. This is persevered in from day to day, training men into picturesque soldiers, but soldiers whose vital organs are weakened by the strain. For the foregoing analysis credit is due Major F. Arthur Davy, a medical officer of the British service. Our officers should be watchful to prevent its introduction here.

Gymnastics.—Everything leading to increased physical vigor, and mental alertness on the part of men and officers is to be encouraged. In peace, the ordinary garrisons are so small, and the work required of them is so various, that there is little lack of physical exercise in the sense of mere muscular exertion. In war, or in the field, there is neither apparatus nor time to develop the skilled gymnast. But, when circumstances allow, the systematic training in feats of agility and endurance amply repays the trouble taken. In large garrisons with proper buildings this can be done in all weathers, with confidence that the chest capacity and the muscle measurement will surely increase. The modern target

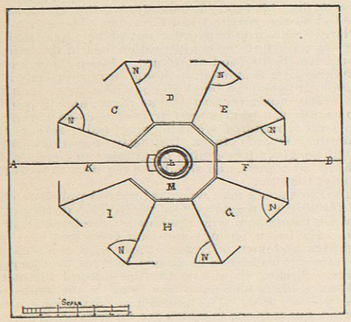

Fig. 3353.—Bathing Cells.

practice is a particularly valuable form for the co-ordination of the eye and hand, where each experiment checks on the spot its immediate result. To this add bayonet and sabre exercise; scaling drill, such as the firemen of large cities practise; field trials, as "hare and hounds"; the various equestrian exploits for cavalry; and, the locality permitting, swimming drill as well as swimming for amusement. A carefully prepared scheme of formal gymnastics as preparatory exercises for recruits should be developed later into the practical studies hinted above, midway between pastime and instruction. Much more attention is now paid to gymnastics than formerly, but they do not yet appear to have the practical recognition they deserve.

Bathing.—Cleanliness of the soldier's person as well as of his habitation demands a vigilance by the officer not always exercised. For, besides providing him with

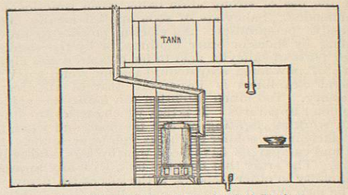

Fig. 3354.—Bathing Cells; Vertical Section.

food, clothing, and shelter, and regulating his daily occupation, the military authorities must exercise a paternal supervision over the man himself. It is not sufficient to see that the arms are bright, the uniform spotless, and the bedding neatly rolled. Dirt that is hurtful is not the mud of the highway or field, or the dust of the parade caught on the shoes or on the outside of the clothing; it is the cutaneous débris, mingled with dust and dissolved in perspiration, soaked into the underclothing; organic dirt that offends the nose as well as the eye, that depresses the subject and may poison his comrade. The oppressive odor of personal filth peculiar to human crowds can be avoided among soldiers in barracks only by inspections that expose the shirt, the stockings, and the skin under them. Men's necks, breasts, feet, and legs should be frequently and critically inspected, their hair must be kept short, and their whole persons be washed as often as necessary. That opportunity for ablution may be had with the most scanty water-supply, and the most limited appropriation, these cuts (Figs. 3353 and 3354) illustrate. By such an arrangement of warm shower-baths seven men can wash their entire persons simultaneously and in privacy with a minimum of waste. (Fig. 3353 shows the plan, and Fig. 3354 a vertical section on the line *A*, *B*. *K*, opening to stove; *L*, stove in central apartment, *M*, to heat the room and water in the tank; *N*, shelves in corner of bathing cells *C*, *D*, *E*, *F*, *G*, *H*, *I*. *M* is 5 feet in diameter, and the bathing-cells are 4½ feet deep and 5 feet 3 inches across the widest end. About the central apartment should be eight posts to support the tank, and between these slat-work, to allow the warmth from the stove to enter the bathing cells. Doorways to be 2 feet wide and 6 feet 6 inches high; cells to be 8 feet high in the clear, and the jets to be 5 feet 6 inches from the floor; the cell floors to slope downward and inward one inch to a common point, and a drain pipe should carry off the waste water. Very little water is used by this method, and the stove heats both the tank and the little rooms. Such baths are used at Rouen, and this plan was proposed to the army by Dr. Billings in 1875, but does not appear to have been acted upon. Dirt fosters discontent and diminishes efficiency.

As a military exercise, apart from its hygienic advantages, all soldiers should be taught swimming. In swimming, men should be cautioned against swimming under water, on account of danger to the hearing. If men *swim*, not merely paddle in the water, and bathe, there is no harm going in the water while perspiring moderately.

Colds are caught by attempting to cool off before plunging in.

General Considerations.—Military hygiene must take account of the new environment of the recruits, and of the occupation, as well as of the clothing, food, and shelter of soldiers. In peace the United States army is recruited chiefly from the ranks of unskilled labor, with a fair sprinkling of clerks and mechanics. The enlistment is for three years, and, contrary to the popular belief, the most of the men are native-born. As a rule, these soldiers are men of brawn, not of brain, who enlist at first from no special love of the profession, but merely to secure a present support. Those who develop an aptitude for arms enlist again. For war, volunteers of all classes come forward, from patriotism or love of adventure. The regular troops are picked men, physically; the volunteers are apt to be not so well selected in that respect. Over both classes officers must exercise constant and real supervision and control. The intelligent selection of men to be soldiers is indispensable for an effective army. It is perfectly useless to attempt making a fighting force from immature or imperfect men. Military hygiene can do nothing, in the creative sense, with men not physically sound at first.

This general rule should always be remembered: Troops from the rural districts break down more readily than those from cities. The agricultural recruit will be better nourished, and at first may appear the more vigorous. That is due to his previous life of moderate exercise in the open air, of stated and sufficient meals, and of uninterrupted nightly sleep. His mind and body work slowly, and generally best in accustomed grooves. To him the plainer and more scanty food, the garrison exercise which is less or the marches which are more fatiguing, the prompt obedience without discussion and the sharp movements without voluntary rest, the excitement of active service, the lack of comfortable surroundings when the day's work is over, and especially the exposure at night, marching or on guard, in all weathers, with broken and insufficient rest—all these are conditions that disturb and lower his physical estate until he becomes inured to them. On the other hand, the young man from the city has been accustomed to all grades of mental and physical excitement, he has probably eaten spare, irregular, and perhaps poorly cooked meals, and has lived in crowded and ill-ventilated rooms; he may have been insufficiently clothed; he certainly has been used to late and irregular hours, and to spasmodic physical exertion. Both mind and body are more active, and, although he may appear less stalwart, he represents the survivors in a struggle for existence that has not beset his comrade from the country. Discipline is distasteful, but its methods and its aims are more readily grasped. To him the military life is physical promotion, in that it substitutes regularity, system, and sufficiency for irregularity and inadequacy in meals, exercise, clothing, hours and amount of rest, and atmospheric purity. The new conditions disturb both classes, but to the city men infinitely less inconvenience follows. This is distinctly tested where city and country regiments lie side by side, or, as I have seen, where a city company has been incorporated in a country regiment. After elimination by length of service the country regiments rival those from the city in endurance, and generally excel them in familiarity with the implements and ways of outdoor life. An important factor in estimating the efficiency of newly raised troops is their comparative liability to certain contagious diseases. As a rule, urban residents have all the children's diseases in early life, but many country people escape them then. It follows, practically, that mumps and measles, serious diseases to treat in camp, have a favorable field, and upon the exposure of one individual are sure to invade, as epidemics, troops from the country, while those from the city escape lightly. Measles, with a high rate of mortality, kept large sections of both armies unserviceable during the earlier months of their enlistment in the civil war. New troops never escape such troubles, and all officers must be prepared for their occurrence, both as reducing the available strength and as magnifying the sick-list, and this may be foreshadowed as to degree by a knowledge of their civil residence.

As the consequence of efficient military hygiene, which involves moral as well as physical training, the average recruit at the completion of his enlistment is a better man in mind and body, if his company has any discipline worthy the name. He has learned obedience, responsibility, promptness, order, the value of co-operation, and attention to his own duty as moral qualities, and the importance of cleanliness, of regular habits, and of stated and sufficient bodily exercise as physical ones. The slouchy, dirty, careless, and perhaps insubordinate rough becomes the erect, neat, and disciplined man-at-arms, distinctly charged with the preservation of the peace. His body and mind are both in better tone. The bucolic youth has his wits sharpened and his limbs suppled, his mental and moral horizons are widened, and he becomes alert and self-reliant in mind, and more elastic in physique. To this development all officers must co-operate, and the process is distinctly the embodiment of military hygiene.

After the novelty of his new scenes has worn off, and his interest in attaining his military education has been dulled by acquisition, the soldier in garrison suffers from want of occupation. All officers serving with troops know, and many have proclaimed, that *ennui* is the bane of military life, and is at the bottom of half of the physical and nine-tenths of the moral evils that annoy both officers and men. An officer worthy of his commission has internal resources that will pleasantly occupy him, if he will but use them; but for the soldier employment must be found. Idleness, discontent, and sickness are a military trinity, interdependent. It is notorious that in the field a marching column is a healthy body, and that the sick-list increases in direct proportion to the age of the camp. The excitement of the march keeps the men well. In camp and garrison similar employment must be found. Marches into the surrounding country, temporary camps from garrisoned posts, occasional bivouacs, athletic games, the erection of field-works with practical illustration of their defence and attack—all are physical methods of improving the general and individual efficiency of the men; and dramatic and variety entertainments, reading-rooms, lectures by officers on practical subjects, and, above all, music, are valuable moral aids. I have little faith in so-called literary and debating societies for soldiers. Their tendency is to introduce the town-meeting element, which has no proper place in military life. Nor is it ever reasonable to expect the rank and file to be really interested or to excel in intellectual pursuits. It is especially in the enforced monotony of winter camps that systematic effort is required to amuse and to interest the men. The narrow quarters, the imperfect means for ablution, the inconvenient alternations of heat within and cold without their huts, the long dark evenings and late chilly dawns, the prolonged sexual abstinence, and the treadmill round of minor and annoying drudgery—all tend to disturb the nervous balance, and lead to attempted relief through cards, tobacco, alcohol when it can be had, excessive sleep, and sometimes vicious gratification of natural passion. The physical evil of cards is due to constrained positions long sustained in impure air, and the nervous mischief is the gambling excitement. Although a common vice, gambling should always be discouraged in the army as tending to foster a race of sharpers who fleece their comrades and beget bad feeling directly to the prejudice of discipline. It is very necessary to break up the weary tedium of winter camps by varied amusements officially encouraged, and useful hints may be taken from the systematic provision to that end that Arctic explorers make in anticipation of their inevitable and more serious blockades. Under all circumstances music, especially martial music, dispels melancholy and stimulates and enlivens all whom it reaches. The most unmusical of men feel its emotional influence and respond to its appeals. It is not economy, it is parsimony, to dispense with bands on ac-

count of their cost, whether in the field or in garrison. This is particularly true of unseasoned troops, but I believe it holds good for all. The suppression of music for military reasons at the siege of Yorktown, I am confident, injured the troops by the gloomy silence that resulted. On the other hand, the use Heintzelman made of martial music at the battle of Williamsburg shows its value as a moral stimulant.

No sketch of military hygiene, however meagre, should omit a tribute to the late Dr. E. A. Parkes, of the British service, whose copious experience and clearly expressed knowledge have done so much to improve the well-being of enlisted men the world over. Parkes' "Hygiene" is the general reservoir from which for many years the military student must draw his theoretical information.

The officer, whether medical or line, who would properly care for the troops must keep an ever-vigilant watch over their interests. But concern should not degenerate into friction and worry. Perpetual nagging, too curious supervision, is almost as bad as contemptuous neglect. He must love his duty, must love soldiers and a soldier's life, and, while commanding with impartiality, must under all circumstances lead and protect his men.

Alfred A. Woodhull.

MILIUM.—Grutum, Strophulus albus, Acne albida, Tubercula miliaria, Tubercula sebacea. It consists of small, round, or pointed bodies which contain sebaceous matter and epithelial cells, and are situated immediately beneath the epidermis. Their size varies from that of a pinhead to that of a small pea; they are white or yellowish in color, rather hard in consistence, especially so when calcified, in this instance being termed cutaneous calculi.

They are most commonly situated on those parts of the skin which are well supplied with sebaceous glands; therefore they will be found generally about and upon the eyelids, on the cheeks, and in the neighborhood of the lips. Another favorite locality for this affection is on the genital organs of both sexes: in the male, on the scrotum and penis; in the female, on the labia minora.

The affection seems to occur more frequently in women, at about middle life, being the cause of real suffering from the attendant disfigurement. In men I have seen it attack the genital organs more frequently than any other part of the body. The disease is far from uncommon, but it is so trivial in its nature that people seldom seek treatment for it, and our advice is sought only when the number of milia is large, or when they are large in size, or, finally, when they occasion distress on account of their prominent position on the face. Fortunately, these little tumors do not grow continuously unless injured; otherwise, after attaining a certain size they remain permanently quiescent.

These little tumors consist of accumulated sebaceous matter and of epithelial cells within a sebaceous gland and its obliterated duct. In the centre there is a core of sebum and, arranged concentrically about it, layer upon layer of epithelial cells. This symmetrical arrangement of the layers Kaposi happily compares to the structure of an onion. The milia are situated directly under the epidermis. Kaposi claims that they also have over them a very thin layer of corium.

Virchow and Rindfleisch believe that the seat of the disease is in different portions of the hair follicles, but the fact that these little tumors occur in localities totally devoid of hair or lanugo, as the glans penis, would not support this idea. No cause has ever been discovered for this disease; it would seem that there must be another cause for it besides the mere mechanical occlusion of the ducts, but thus far it has escaped us.

Diagnosis.—With the exercise of some care there is little chance of confounding milium with anything else. The disease most apt to be mistaken for it is comedo, but the following points ought to differentiate them: In milium the color is white or yellowish-white, it is covered by epidermis; it cannot be pressed out unless the epidermal layer is incised, and as a rule it is the sole lesion present, although cases do occur in which several affections coexist (as acne with milium, or comedo with milium, etc.).

Prognosis.—The disease is obstinate. It remains in the same condition for years, or the little tumors become calcified, forming the so-called cutaneous calculi.

Treatment.—This should be incision of the thin layer of epidermis over each individual little tumor and the extrusion of the mass as a whole by pressure. This little operation is almost bloodless and leaves no scar.

N. J. Ponce de Léon.

MILK.—There is no one article of food more important to the human race than milk. In health it is in universal use; in pathological conditions it serves as the basis of dietetic treatment; and in the feeding of infants, both by natural and by artificial means, it is the one essential source of nourishment. A knowledge of the physiological and chemical properties of milk is therefore of far-reaching importance to physicians, and deserves more attention and study than are generally accorded it.

It is the milk of cows which has been most extensively investigated, the knowledge of which must underlie our consideration of the subject in general.

Secretion of Milk.—In the mammary gland of mammals, nature has provided a mechanism of extreme delicacy for the elaboration of milk. It is a storehouse for its product in a limited degree only, its principal function being the secretion of milk, in accordance with demands made upon it by the nursing offspring, or, in case of the domesticated cow, by the artificial conditions which surround it. It draws its material from the various parts of the animal economy by means of the blood, recombining them and building them up into the constituents of milk—the fats, sugar, proteids, mineral matter, and water.

The specific secretory action of the mammary gland, as opposed to simple filtration and excretion, is shown by the chemical analysis of milk. We do not find, for instance, the milk-sugar or lactose, one of its principal constituents, in the blood. The lactalbumin also differs in certain respects from serum albumin; and the mineral matter is found in different proportions from those which exist in the blood. Filtration and excretion, therefore, are only parts of the general process, while the synthetic property of the mammary gland depends, probably, upon the activity of the epithelial cells lining the ducts of the gland. The gland is of the compound racemose variety, and thus presents a large surface for the exercise of its function.

The proportion of solids secreted in milk is not constant. It varies with the variety of mammal and with the variety of species, that is, according to the breed of the animal. It is also influenced in an individual animal by such factors as changes in the atmosphere, *i.e.*, the seasons, by changes in food, by the hygienic surroundings, by emotions, fatigue, sickness, and at different stages of the milking period, being more watery in the early periods, and more concentrated in the late periods. In nursing women the catamenia and pregnancy are also conditions which influence the composition of the milk.

The *quantity* of milk secreted, especially in human breasts, in the natural state, is adapted to the age and gastric capacity of the infant, but this function is modified greatly by artificial conditions.

That the mammary gland has also the function of excretion is shown in its power of eliminating certain drugs ingested by the mother. The most important of these are morphine, opium, atropine and belladonna, iodine, arsenic, bismuth, antimony, zinc, lead, mercury, and iron. It is interesting to note, however, that other substances, such as bile acids and bile pigments, are not excreted by the mammary gland.[16] Toxins, on the other hand, may be eliminated and secondarily react upon the nursing infant. The majority of drugs, however, are not excreted in the milk.

Certain classes of foods contain substances which may be excreted and modify the taste of milk, notably turnips, onions, garlic, mouldy hay and grain, etc. The

taste of milk may also be influenced by exposure of milk to volatile substances. This property of absorption of odors is very great. The odors of strong disinfectants, kerosene oil, and similar articles, if brought in close contact with milk, are readily taken up and impart their properties to the absorbing medium.

Origin of Fat in Milk.—Microscopically, the fat globules may be seen in the epithelial cells of the mammary gland. They are discharged into the milk ducts either by a breaking up of the cells themselves or by a contractile extension similar to that which occurs when the amœba ejects its food.[5] The question of how much fat is produced by the secretory mechanism of the milk glands, and of how much is obtained from other organs and tissues and eliminated from the blood by the milk glands, has not been determined. Winternitz[14] has proved by experiments with iodized fats that fat may be extracted directly from the blood by the mammary glands and be eliminated with its secretions. Similar observations have been made by Spampani and Daddi with sesame oil.[15] It is also now conceded that fat may be formed from carbohydrates in the animal organism, and it is possible that the milk glands may produce fats from the carbohydrates brought to them by the blood.[16]

Origin of Milk Proteids.—The epithelial cells are rich in proteids and nucleo-proteids, which are probably the sources of the casein or its mother substance, the caseinogen.[16] Basch has attempted to show that the casein is formed in the mammary gland by the nucleic acid of the nucleus set free, uniting the intra-alveolar with the transudated serum, thereby forming a nucleo-albumin, called caseinogen. The origin of the proteids is, however, far from being settled.

Origin of Milk Sugar.—The origin of milk sugar or lactose is not definitely known. Among the nucleoproteids just mentioned is one which yields a reducing substance when boiled with dilute acids, but the relation of this substance to the formation of lactose has not been thoroughly investigated.[16] Muntz believes that milk sugar may be formed in herbivora by syntheses from dextrose and galactose, but this theory does not hold in the case of carnivora which may produce milk sugar even when fed exclusively on a diet of lean meat.[16]

Composition of Cow's Milk.—Milk consists of an emulsion of fat in minute subdivision suspended in the milk plasma which consists of milk sugar, or lactose, proteids, extractives, mineral matter, and water. It is therefore apparent that we have represented all the great subdivisions of foodstuffs, that is, fats, carbohydrates, proteids, mineral matter, and water. The proportion in which these substances occur in the milk varies in different animals and also in the same animal at different times.

The average of a large number of analyses made in this country showed the following result:[17]

Fat	4.00 per cent.
Sugar	4.95 "
Proteids	3.30 "
Mineral matter	.75 "
Total solids	13.00 "
Water	87.00 "
	100.00 "

Droop-Richmond[19] gives the composition of cow's milk in England based on the analyses of two hundred thousand specimens as:

Fat	3.90 per cent.
Lactose	4.75 "
Casein	3.00 "
Albumin	.40 "
Mineral matter	.75 "
Water	87.10 "

The analyses of milk by French and German chemists, as well as by many English and American investigators, show varying results, which serve to emphasize the fact, which cannot be too strongly impressed upon the reader, that the composition of milk of large herds of cows, as well as of individual cows, varies sometimes within wide limits of any average that one may attempt to establish. These variations depend upon the breed of cow, the methods of feeding, the health of the animal, the season of the year, and other conditions.

The variation according to the breed is shown in the following table, compiled from average analyses, by Mr. Gordon of the Walker-Gordon Laboratory:

	Durham or Shorthorn.	Devon.	Ayrshire.	Holstein-Friesian.
Fats	4.04	4.09	3.89	2.88
Sugar	4.34	4.32	4.41	4.33
Proteids	4.17	4.04	4.01	3.99
Mineral matter	.73	.76	.73	.74
Total solids	13.28	13.21	13.04	11.94
Water	86.72	86.79	86.96	88.06
Daily quantity	large	moderate	large	very large

	Brown Swiss.	Jersey.	Common native.	American grade.
Fats	4.00	5.21	3.69	4.01
Sugar	4.30	4.52	4.35	4.36
Proteids	4.00	3.99	4.09	4.06
Mineral matter	.76	.71	.73	.74
Total solids	13.06	14.43	12.86	13.17
Water	86.94	85.57	84.14	86.83
Daily quantity	moderate	large	moderate	moderate

Analyses of milk from Guernsey cows closely approach those of the Jersey cow, but with slightly lower percentages of fat.

As it is of much importance to have some average upon which to base our calculations, we may accept the figures of Holt, Adriance, and others, as fairly representative of the average of American milk, bearing in mind, however, that there is a wide variation possible in any individual case.

Fats[20]	4.00 per cent.
Lactose	4.50 "
Proteids	3.50 "
Mineral matter	.75 "

As an illustration of the variations in the percentage composition of milk during the three periods of a milking, we may quote the following analysis by Harrington.[5]

	Fat.	Total solids.	Water.	Mineral matter.
"Fore milk"	3.88	13.34	86.66	0.85
"Middle milk"	6.74	15.40	84.60	.31
"Strippings"	8.12	17.13	82.87	.82

Seasonal and monthly variations in the composition of cow's milk are quite distinct as shown in the following table by Droop-Richmond[19] prepared from analyses covering a period of sixteen years:

Month.	Specific gravity.	Total solids. Per cent.	Fat. Per cent.	Solids not fat. Per cent.
January	1.0322	12.88	4.02	8.86
February	1.0322	12.78	3.93	8.85
March	1.0322	12.71	3.88	8.83
April	1.0323	12.66	3.84	8.82
May	1.0323	12.66	3.82	8.84
June	1.0322	12.59	3.79	8.80
July	1.0317	12.66	3.93	8.73
August	1.0316	12.73	4.02	8.71
September	1.0319	12.92	4.12	8.80
October	1.0322	13.13	4.21	8.92
November	1.0322	13.19	4.30	8.89
December	1.0322	13.04	4.16	8.88