in saying that practically all the fats in milk are products of digestion, and none of them results of simple translation through the digestive organs of fats already present in food. On the other hand, we have undoubted evidence of the translation of other substances directly from the food of the cow to the butter-fat, as is shown in the presence of the aldehyde in cotton-oil, which reduces silver, in the butter of cows fed on these substances. Among other studies on the influence of the food on the composition of butter, I might cite the paper of Ladd, already noted; and also one by C. J. von Lookeren, published in the *Milch Zeitung* (No. 3, 1889, p. 47); and the paper of Mayer, published in *Die Landwirtschaftlichen Versuchs Stationen* (vol. xxxv. p. 261). These studies are of such practical interest, that it is my intention to continue them during the coming year on an extended series of feeding experiments, in which I hope to interest experimenters in different parts of the country.

THE STING OF THE JELLY-FISH.

DR. B. W. RICHARDSON writes on the above subject in the last number of the *Asclepiad*, giving a personal experience of his own. He says, —

"In my case I was caught by the shoulders and chest in the tentacles of a large medusa, and had really for a minute or two a difficulty in freeing myself. The surface of the skin touched by the tentacles began to smart at once, and, by the time I was out of the water and partly dressed, the skin was covered, over the surface attacked, with a bright erythema, accompanied with a sense of extreme heat and irritation. The sensation was much the same as that brought on by the application of a mustard poultice, except that it was not so uniformly diffused, but was rather in the form of wheals in slightly raised lines, with a considerable number of points at which the tingling and heat were most severe. Unfortunately, I had no clinical thermometer by me with which to take the local temperature, but, judging by the touch of the hand, the local temperature was raised at least two or three degrees. The redness and irritation lasted seven hours, and did not absolutely subside until after a night's rest; but, during the time it was on in the acute form, it was soothed considerably by the application of water, rendered alkaline by common washing soda in the proportion of an ounce of the soda to about two quarts of water.

"A friend of the writer suffered far more severely. He was bathing where a number of jelly-fish were present, and got so entangled amongst them, that, as he said, he was 'stung over almost all the surface of his body.' He suffered from an acute erythematous eruption, which lasted over sixteen hours, attended with two degrees of general fever, and followed by malaise that lasted three days.

"A still more important case happened in a very singular manner to another friend and patient. I had gone down to a bathing-place in the summer of 1872, not knowing that my friend was there. I had not been on the spot two hours, when a messenger came to me, asking if I would go at once to Mr. G., the friend in question, because he had been 'stung in the throat by a jelly-fish, and they were afraid he would not live.' On reaching my friend, who had accidentally heard I was near to him, I learned that about two hours before, while he had been floating on his back in the sea, with his mouth open, the tentacles of a jelly-fish swept into his mouth, and stung him severely in the back of the throat. There could be no doubt about the mischief, for the throat over the whole of the pharynx was intensely red, and the surface was rough and raised. With this condition there were considerable heat and irritation, amounting to acute pain, and attended with inability to swallow any thing except fluids cooled with iced water. The idea of extreme danger was present in the mind of the sufferer, and I believe my firm assurance that he would take no harm contributed as much to the recovery that succeeded as the simple alkaline remedies which formed the chief part of the medical treatment. In this case also there was a rise of two degrees of temperature, and during convalescence there was marked depression of both mind and body for a period of two or three days.

"In describing these phenomena," he adds, "I have used the ordinary word 'sting' for the want of one more accurate. Really, I do not know whether it is a sting, like that of a wasp or a nettle, that is inflicted, or whether a secretion, acrid in kind, is thrown upon the surface, and acts directly as an irritant fluid. On the whole, I suspect it is a fluid, or organic acid, which is the cause of the irritation. For the resultant erythema, local alkaline treatment is particularly effective. In the throat case, bicarbonate of soda with *mel boracis* proved very grateful and useful."

MENTAL SCIENCE.

The Energy and Rapidity of Voluntary Movements.[1]

M. FÉRÉ, whose volume upon the relations of sensation and movement, upon the phases of hypnotism and kindred topics, has given him a deserved reputation, has recently investigated the relation between the energy or physical power at the disposal of the individual and the rapidity of his re-actions to simple physical processes. His main thesis is, that great energy and great quickness of movements are concomitant, and vary in the same way under similar circumstances. He has studied this relation among the hysterical and epileptic (as typical instances of abnormal sensori-motor organisms) as well as in normal individuals.

M. Féré had shown that in hysteria the influence of certain emotions, pleasant in their nature, was to increase the maximum power of exertion, as tested by the "squeezing" of a dynamometer, which action he terms "sthenic;" while opposite emotions decrease such power, and are "asthenic."[2] He now studies the variations in the re-action times to an electrical shock under the same influences, and the concomitant variation in dynamometric power. In five subjects re-acting from the forehead and the back of the hand, both on the right side and on the left, the average re-action times were, T .61, M .61, V .42, R .28, and B .27 of a second, when the dynamometer registered respectively, T, 24; M, 24; V, 28; R, 28; and B, 29. Furthermore, the side of the body from which the re-action is quickest (the subjects are affected with partial anæsthesia) also claims the hand with greatest dynamometric force.

If these subjects are put into the somnambulic stage of hypnotism, the effect upon the re-action time may be either to shorten it or lengthen it, or leave it unaltered; but in every case the power of the maximum contraction is affected in the same way. The re-action times are, for T .61, for V .61, for R .35, for B .25, for M .20, of a second; and the strength of squeeze respectively, 24, 25, 30, 36, 40. Under the influence of an "asthenic" or strength-depriving unpleasant emotion, such as fear, B's re-action time increased from the normal of .29 to .44 of a second, and his muscular force decreased from 29 to 20; M's re-action time of .61 becomes .65 of a second, and his dynamometric record of 24 becomes 25. Similar changes for V are from .42 to .51 of a second, and from 28 to 24; for R, from .28 to .45 of a second, and from 28 to 16; for T, from .61 to .62 of a second, and from 24 to 30. We notice the individual variations, but in general the law is maintained. Under the influence of a "sthenic" or strength-giving emotion, the re-action times decreased and the squeeze increases as follows: for B, .13 of a second and 40; for M, .16 of a second and 46; for V, .28 of a second and 37; for R, .14 of a second and 42; for T, .19 of a second and 38. Essentially similar results are shown for two hysterical patients re-acting to sound instead of to touch impressions. M. Féré records the form of the contraction of the hand, and finds, that, when the effort is powerful and the re-action quick, the curve of contraction rises suddenly, while in the opposite case it rises slowly. He notes, too, many other mainly physiological conditions into which we cannot here enter, but all of which go to show that the speed of re-action times depends upon the rate at which the nutritive processes of circulation, etc., proceed. Essentially similar results were obtained in epileptics. In one case the re-action time to a touch impression was .34 of a second; to a sound impression, .28 in the normal condition; one hour after an

[1] Revue Philosophique, No. 7, 1889.

[2] It is interesting to compare this action with the re-enforcement of the patellar-tendon reflex or knee-jerk by similar means. Any impressive sensation will cause an increase in the response to a simple blow below the knee. Both may be regarded as very sensitive and quickly registering indices of the effect of stimuli upon the nervous system, and have the extreme value that the great rarity of such indications gives them (see Lombard, in Vol. I. No. 1. of the American Journal of Psychology).

epileptic seizure it was .50 of a second for touch, and .37 for sound. In another patient the re-action times were .35 of a second for touch and .30 for hearing three hours after an attack, as against .21 of a second and .16 normally. A third patient, whose normal re-action times were .28 of a second (touch) and .34 of a second (sound), two hours after a seizure, re-acted in .40 of a second to touch and .37 of a second to a sound. The same patient, seventy-two hours after the last of fifteen successive attacks, required 1.11 seconds to re-act to touch, and 1.25 seconds to re-act to a sound. In an independent research, M. Féré had shown that in the average of twenty cases the dynamometric power was reduced to 45 per cent of its normal value immediately after a seizure, to 33 per cent after one-quarter of an hour, to 25 per cent after an interval of one half-hour, and to 17 per cent after an interval of three-quarters of an hour. Apart from special relations of the nature of the seizure to the diminution in muscular power, the general thesis of M. Féré is well borne out by these facts.

In normal individuals the same relations can be demonstrated, though the contrasts are not as sharp. Fatigue diminishes muscular force, and increases the times of re-action. Intelligent persons, speaking generally, have a short re-action time and a high dynamometric pressure. In order to study in closer detail the relation of re action time and motor power in special motor groups, M. Féré had constructed a dynamometer in which the pressure of each finger was recorded separately. With this apparatus M. Féré was able to establish that the movements of flexion were from three to ten times as powerful as those of extension; that the power of different fingers varies with different individuals, and stands in relation to the profession of the individual, the third and fourth fingers being especially strong in piano-players; and that intellectual persons have an especially strong thumb, an essentially human movement.

	Flexion.		Extension.	
	Dynamometer.	Re-action Time. Seconds.	Dynamometer.	Re-action Time. Seconds.
Thumb	4.2	.163	1 2	.190
Forefinger.....	4.0	.191	1.0	.261
Middle finger...	3 5	.193	.9	.280
Third finger....	2.0	.201	.6	.299
Little finger ..	1.9	.203	.4	.310
Thumb.....	2.7	.230	1.0	.335
Forefinger.....	3.3	.160	1.1	.260
Middle finger...	2.2	.180	.4	.277
Third finger...	2.0	.195	.35	296
Little finger ..	1 8	.246	.3	.309
Thumb	4.1	.170	1.1	.220
Forefinger.....	3.0	.191	.6	.210
Middle finger ..	3.2	.182	.7	.190
Third finger ...	2.2	.181	.7	.183
Little finger..	5.1	.171	.5	.142
Thumb..... ...	2.8	.282	.6	.340
Forefinger.....	2 6	.359	.4	.516
Middle finger..	2.5	.346	.3	.515
Third finger ...	1.7	.436	.1	.639
Little finger....	1.4	.515	.2	.517

The first three records were obtained from officials of the hospital, and exhibited very fairly the points in discussion, while the third subject is also a pianist, and shows a remarkable power of flexion of the little finger as well as a quick re-action time for both flexion and extension of this finger. The fourth record is of an intelligent epileptic patient. We see, that, while the dynamometer shows movements of flexion far superior to those of extension, the re-action times show only a slight superiority, and that exercise seems to increase not only the power of flexion, but the speed of extension. If we make separate observations on the right and left hands, we will find that the preferred hand presses more strongly and re-acts more quickly than the other hand.

The same method can be applied to the movement of other organs. The energy of extension of the tongue has been measured, and varies in normal subjects from 500 to 850 grams. In deaf-mutes and patients afflicted with aphasia it may be as low as 100 grams. That the energy of this movement is related to the re-action time is shown in the following results: F (a normal subject) moves the tongue with a force of 850 grams, and performs this motion in .13 of a second; L (also normal), 400 grams and .15 of a second; J (partially aphasic), 300 grams and .30 of a second; F (a stammerer), 200 grams and .33 of a second.

That nutritive processes play an important part in these movements is more than likely. Cold retards and heat accelerates the re-action times. The following table shows the effect of warming upon the re-action time in movements of flexion and extension of the five fingers: —

	Flexion.		Extension.		
	Before Warming.	After Warming.	Before Warming.	After Warming.	
Thumb	.346	.233	.362	.194	The movements of extension, and especially those ordinarily the slowest, seem to be most benefited by this additional warmth.
Forefinger..... ..	.269	.234	.270	.186	
Middle finger..... .	.266	.261	.280	.201	
Third finger.....	.255	.239	.320	.250	
Little finger.....	.283	.237	.312	220	

This research, though incomplete, and founded upon rather few experiments with each subject, yet admirably suggests the close relations that exist between the motor, sensory, and nutritive functions of the psycho-physical organism. As our knowledge of this relation becomes more and more exact, the possibilities of utilizing such knowledge for making the elementary processes of knowledge and action easier and quicker, become more and more real.

RAPIDITY OF MOVEMENTS. — A pianist, in playing a presto of Mendelssohn, played 5,595 notes in four minutes and three seconds. The striking of each of these notes, it has been estimated, involved two movements of the finger, and possibly more. Again, the movements of the wrists, elbows, and arms can scarcely be less than one movement for each note. As twenty-four notes were played each second, and each involves three movements, we would have seventy-two voluntary movements per second. Again, the place, the force, the time, and the duration of each of these movements, was controlled. All these motor re-actions were conditioned upon a knowledge of the position of each finger of each hand before it was moved, while moving it, as well as of the auditory effect in force and pitch, all of which involves at least equally rapid sensory transmissions. If we add to this the work of the memory in placing the notes in their proper position, as well as the fact that the performer at the same time participates in the emotions the selection describes, and feels the strength and weaknesses of the performance, we arrive at a truly bewildering network of afferent and efferent impulses, coursing along at inconceivably rapid rates. Such estimates show, too, that we are capable of doing many things at once. The mind is not a unit, but is composed of higher and lower centres, the available fund of attention being distributable among them.

BOOK-REVIEWS.

A Treatise on Linear Differential Equations. By THOMAS CRAIG. New York, Wiley. 8°.

THE theory of differential equations has undergone within the last thirty years a most fundamental change. The object of the older theory was to integrate a given differential equation "in finite