Experimental researches on the physiological and therapeutic action of phosphate of lime / by L. Dusart.

EXPERIMENTAL RESEARCHES

ON THE

PHYSIOLOGICAL AND THERAPEUTIC ACTION

OF

PHOSPHATE OF LIME.

EXPERIMENTAL RESEARCHES

ON THE

PHYSIOLOGICAL AND THERAPEUTIC ACTION

OF

PHOSPHATE OF LIME.

BY

L. DUSART,

EX-INTERNE DES HOPITAUX.

LONDON:
BAILLIÈRE, TINDALL, AND COX,
20, KING WILLIAM STREET, STRAND.
1885.

IMPORTANT NOTICE.

SINCE the publication of these Researches, of which we offer the third edition, we have been fortunate enough to see that the principal properties we have attributed to phosphate of lime have been confirmed by the best authorities. In all cases where, under the influence of acute or chronic affections, denutrition tended to produce cachexia or adynamia, or whenever it is necessary to produce a reconstituent effect of a durable character, it will be found that phosphate of lime acts in a heroic manner, having at the same time this advantage, that, being a physiological substance, it produces its effect by fixing itself in the economy. Hence our idea in offering it more as an aliment than as a medicamentous substance.

The confirmation of several years' experience has induced us to introduce into therapeutics the preparations which bear our name, *Dusart's Syrup and Wine*, which occupy the important position they deserve.

But, as often happens, the success of these preparations has excited the cupidity of other chemists who think more of speculating on the work of others than of tending by their own efforts to the progress of their art. We have thus seen a certain number of products of the phosphate of lime prepared without the most elementary notions of physiology, and extolled as sovereign without having received the slightest sanction of experience.

As the preparation of our products presents certain difficulties which study and experience alone can overcome, it has been found more convenient by our imitators to offer to the Profession substances easy to obtain, of no commercial value, without any consideration as to their effects on the system, and which, in fact, in no way resemble the really active medicamentous matter which we employed in our experiments.

It is thus that we have seen presented under different names the product of the action of mineral acids, such as sulphuric and hydrochloric acids, on bones, which are administered in the most reckless manner, and which not being burnt in the system, are eliminated only after having impoverished the blood by saturating the alkalies contained in this liquid.

By these rough manipulations they succeed in producing the bi-phosphate of lime, or the acid phosphate, commonly known in agriculture under the name of super-phosphate ; but these bodies, of which

the composition is not to be compared with that of the physiological phosphate, have lost two-thirds of their calcareous substance, and cannot replace the phosphatic salt. On the other hand, the lime being of great importance, greater even than that of phosphoric acid, these preparations, in being deprived of the former, have lost two-thirds of their medicinal power, and are moreover badly supported by the stomach; we may add that free phosphoric acid is eliminated only after having altered the composition of the blood, and the long-continued use of these substances will infallibly produce anemia.

Some chemists, without any proper reason, mix the salts of soda with the acid phosphate, which are physiologically antagonistic to each other; others, with assurance only equal to their ignorance, represent the concentrated product of the artificial digestion of the phosphate by lactic acid as being deprived of acidity, and offer to the patients homœopathic doses of the phosphate; finally, and this is the crowning of all, we have analysed one of these preparations, and found it to contain only that quantity of calcareous salt which is natural to the water employed for dissolving the sugar.

From these facts, it will be seen that great confusion is produced, which is much to be regretted as being detrimental to the interests of the sick, and as being able to throw discredit on a preparation destined to render great service in the art of healing.

It is therefore necessary to recall the fact that in prescribing our phosphatic preparations, known under the name of *Dusart's Syrup and Wine*, the physician will always be sure of having at his disposal an active medicament, whose dosage has been founded on clinical indications by physicians of undoubted authority, and the preparation of which is based upon physiological researches which it is the object of this volume to show.

Our name will then be a guarantee for the physician when he wishes to utilize the therapeutic effects of the phosphate of lime.

We shall take advantage of this third edition to announce the early publication of a work which will be devoted exclusively to clinical researches on Rickets, Phthisis, Adynamic Fevers, Dyspepsia, and the medical treatment of Wounds and Fractures, and bearing the title of "MINERAL INANITION IN DISEASES."

EXPERIMENTAL RESEARCHES

ON THE

PHYSIOLOGICAL AND THERAPEUTIC ACTION

OF

PHOSPHATE OF LIME.

I.

IN consequence of researches on the assimilation of the phosphate of lime, which were prosecuted in common with Dr. Blache, we have been led to propose the therapeutic employment of this substance under a new and completely assimilable form to which we have given the name of *lacto-phosphate of lime*, more to express its composition than to represent a definite chemical species that does not exist. During the researches referred to above, we proved by experiments on animals that this product is easily absorbed, and we were enabled to measure with scales the rapidity and quantity of this absorption. We have equally seen that in pathological cases, when the phosphate of lime was indicated, for example in rickets, its action was most marked. Lastly, we have noticed the action of this preparation in dyspepsia, and the remarkable development of the appetite which is produced in persons submitted to this treatment.

Since this time, having had occasion to follow a great number of observations, we have been struck with two facts: the action on nutrition, and the development of muscular activity.

We therefore thought that these manifestations, of a purely physiological order, were the expression of a property not yet mentioned of the phosphate of lime, and, supposing that these facts were not isolated but ought, on the contrary, to be connected with a general law which regulates the growth of living beings, we have set ourselves to collect systematically all the facts which appeared to us fit to throw some light on the question.

We do not disguise the imperfection of this work and our incapacity on a subject of this nature; we shall therefore consider ourselves sufficiently compensated if we succeed in drawing the attention of competent men to facts whose better knowledge would contribute much to the art of cure.

For the greater number of physiologists, the phosphate of lime has no other function than to contribute, with the carbonate of the same basis, to the formation of the mineral substance of the skeleton of animals. According to this order of ideas, the phosphate thus assimilated fixes itself for a time in the meshes of the bones, accompanies them in their evolution, and is finally rejected as an excrementitious product.

During this migration in the organism it would only exist as a plastic agent of the osseous matter, and exercise no particular action on the substance of the tissues it passes through.

This manner of interpreting the part played by the phosphate of lime in the animal economy is the only

one that reigns in therapeutics. It is, therefore, not to be wondered at that so little importance has been attached to this substance in the treatment of diseases which relate to the lymphatic system, in rickets and in scrofula.

Studied for more than thirty years by men who are justly considered authorities in science, such as Bouvier, J. Guérin, Broca, Trousseau, etc., these affections have been attributed to a deviation from normal alimentation, without however indicating the exact nature of the element whose absence or insufficiency constituted the primary cause or origin of the diseases referred to.

The disappearance of the phosphate of lime in rickets had nevertheless struck all observers, and several physicians made extensive use of this salt. Mouries, in a remarkable work, supported by theoretic considerations drawn from Chossat's experiments, attributed to phosphate of lime a certain action in the phenomena of assimilation and disassimilation of organic elements, and regarded it as an agent destined to maintain the irritability of the tissues.

But it should be said, that owing to the imperfect study of the physiological conditions of the assimilation of the phosphate of lime, the therapeutical properties of this body had never been defined; so that, in 1858, Dr. Bouvier in his "Clinical Lessons," page 320, could still say that "we do not possess, in the present state of science, a medicament capable of hardening the bones of rickety patients."

In fact, as absorption is always under the immediate dependence of the digestive powers, the quantity absorbed, even in the most favourable conditions,

was too limited to produce the physiological effects required.

Our former researches having, on the contrary, put us in possession of a reactive which may be introduced into the economy in nearly unlimited doses, we have been enabled to produce effects altogether new, and often of such intensity as to attract notice.

We hope to be able to show that the phosphate of lime is not, as is generally believed, an inert substance in the economy ; but that, on the contrary, it plays an active part in the accomplishment of certain phenomena which contribute to the maintenance of life and to the development of organized beings.

Observation and experience point out to us that we ought, henceforth, to allow the freest scope to the action of this substance, for it presents itself to us as an agent of *nutritive irritability* or formation, in attributing to this term the sense which Haller in the last century, and Virchow in our own time, attached to it, namely, the property which the tissues in general, and the cell in particular, possess of reacting on themselves and on the surrounding parts for the accomplishment of the physical or chemical phenomena which preside over life.

Before studying the part which the phosphate of lime plays in the animal kingdom, and its mode of distribution, it will not be uninteresting to examine what takes place in the vegetable kingdom, and the conclusions that have been arrived at by the authors who have studied the question.

We know that vegetables are chemically composed of two sorts of principles entirely different in their nature : an azotised substance of the same composi-

tion as that found in animals, and the ligneous one which forms the principal mass of the vegetable. It is this last substance which, properly speaking, constitutes the skeleton of the plant, and which gives it its exterior form.

These immediate principles differ not only in their composition, but also in their chemical properties; therefore it is possible to isolate them one from the other. And indeed, one can extract from any given part of a vegetable all the azotised substance, only preserving the ligneous part, and with it the original form of the plant. In treating vegetables by alkalies, M. Payen succeeded in dissolving all the azotised matter without in any way altering their structure, and has thus proved that the existence of this substance is independent of that of the tissues; time produces upon vegetables an effect analogous to that of reactives, and everyone has been able to observe in forests that the leaves left to slow putrefaction have been anatomized with an infinite richness of detail.

If now, after having separated the elements of vegetables in two parts by the reactives, we try to ascertain in which of the two substances (ligneous or azotised) are found the phosphates, incineration and the analysis of the ashes will enlighten us: we then find that the ligneous matter, slightly loaded with mineral substances, contains only traces of phosphate; while the azotised matter contains, on the contrary, nearly the whole of the ashes of the vegetable, and with them nearly all the phosphate existing in the plant.

A chemist, Corenwinder, who occupied himself a great deal about the distribution of phosphates in

vegetables, had already brought this fact to notice in 1856 in the following terms: "In removing by a reactive the azotised matter of plants, we remove at the same time all the phosphates which have an existence independent of the organs, and circulate to contribute to the development of phenomena of a higher order."

But the vegetables do not contain in all their parts, or at all periods of their existence, the same quantity of ligneous and azotised substances; during the entire duration of their evolution, the azotised matter and the phosphate displace themselves continually; after having presided over the formation of new tissues, they follow an ascending march, to arrive, in concentrating themselves in it, at the grain, object and ultimate end of vegetation.

"The leaf of a tree," says De Saussure, "always contains ashes more loaded with earthy phosphates in leaving the bud, than at any subsequent period."

More recently, Garreau notices the same fact in terms nearly identical: "The ashes of the axes and of the young leaves of the buds are rich in phosphates; the herbaceous stalks, on the contrary, after the maturation of the grain, furnish ashes which contain but feeble proportions of them."

Thus it will be clearly seen from the above observations that wherever there is an organ in process of formation or of development, analysis has found in it an accumulation of phosphates and of azotised matter.

We have said that the movement of these substances in the vegetables is an ascending movement, that they successively leave the organs once formed to concentrate themselves definitely in the parts whose

function is of a higher order. It is more particularly in the grain that this accumulation becomes striking by its constancy and by the quantity of products thus condensed.

In the bean, the solid matter amounts, according to Braconnot, to as much as 25 per cent.; in the pea and the horse-bean the quantity may reach 20 per cent.

The comparative analysis made by M. Boussingault of the grain and straw of wheat and of oats clearly demonstrates this law of decrease.

In 1000 parts are found:

	Phosphoric Acid.	Nitrogen.
Wheat - - - -	9·64	19·70
Wheat straw - - -	1·61	3·80
Oats - - - -	4·73	19·00
Oat straw - - -	1·07	3·00

There exists, as is seen from the above, a close connection between azotised matter and phosphoric acid in the organic world.

These relations had long ago been brought to notice by M. Boussingault:

"Generally the alimentary substances the most azotized are also the richest in phosphates, which would appear to indicate that in the products of vegetable organization the phosphates belong to the azotised principles, and that they follow them in the organization of animals."—"Économie rurale," tome ii., p. 353.

A few years later, M. Mayer formulated as follows the results of his researches on the same subject:

"There exists a remarkable relation between the albuminoid substances and the phosphoric acid con-

tained in grain. To an increase of phosphoric acid corresponds an increase of the proportion of albuminoid substances. It may, therefore, be admitted that the *formation of albuminoid substances is subordinated to the existence of the phosphates.*"

What, according to us, adds considerable importance to the simultaneous presence of these two substances, is the numerical relation which appears to preside over their co-existence, a relation whose oscillations are comprised in sufficiently narrow limits to exclude all idea of accidental combination : thus, in the fourteen alimentary substances of vegetable origin contained in M. Boussingault's table of analyses ("Économie rurale," tome ii., p. 353), it is found that the phosphoric acid being represented by 1, the quantity of nitrogen varies from 3 to 4, wheat alone forming an exception to this rule, and offering the relation of 1 to 2.

Finally, direct experiments have lately brought to light the capital importance of the phosphates in vegetation, importance which the writings and works of Liebig and Boussingault had vulgarized. M. G. Ville showed that a plant—wheat, for instance—can germinate and develop itself in a soil completely deprived of phosphates, but that it cannot produce grain; the seed confided to this soil germinates, and the young plant grows in height ; but soon this vegetation ceases when all the phosphate furnished by the grain is expended for the benefit of the new organs.

If now we observe that the plant does not receive ready formed, like animals, the material of its tissues, but that, on the contrary, these are formed entirely with the simplest agents which the soil and

the atmosphere place at their disposal ; that, moreover, the organic materials thus produced with the elements do not contain phosphates as an integrant part of their molecule, we arrive at the conclusion, from the absolute necessity of these substances for the development of the tissues, that the phosphate is a *mechanical agent* which presides over their formation. It is even beyond doubt that if it were possible to deprive a grain of its phosphate without altering its organized structure, this grain, confided to the earth, would undergo putrid fermentation, without any appearance of germination.

The facts previously mentioned may therefore be summed up in the following propositions :

1. There exists a close solidarity between the phosphates and albuminoid substances : the presence in the plant of one of these two substances, implies necessarily that of a proportional quantity of the other.

2. The phosphate which enters into the composition of vegetables does not form part of their skeleton ; it accompanies, on the contrary, the azotised substance whose existence is anatomically independent of that of the tissues.

3. This salt does not remain stationary in the organs where analysis detects its presence ; it shows itself in greater quantity in the parts in process of formation, and follows an ascending movement, to attain, in the grain, its maximum of concentration.

4. A grain deposited in a soil deprived of phosphate, but containing all the other elements necessary to its life, will produce but a sum of vegetation proportional to the quantity of phosphate it brings with it : the increase is stopped when this reserve is used up.

II.

We have just pointed out the large part which the phosphates take in the phenomena of vegetation ; the plants, in virtue of a special elective affinity, analyze, so to say, the soil where they develop themselves, and extract from a considerable quantity of other elements the phosphate which they assimilate.

This aptitude, common to all organized beings, we find to a high degree in the animal kingdom. The phosphate of lime not only forms almost the entire skeleton of vertebrated animals, but impregnates all their tissues, and even undergoes there a partial decomposition, thus participating in the movement of transformation of the organs.

The phosphate of lime, comparatively so rare in nature, is then found taken up in the first instance from the soil by the vegetable, then condensed in the animal organism. It is difficult, when one sees with what constancy the phenomenon is produced, only to assign to this substance an office purely physical : namely, to form the mineral element of the osseous frame. It is in fact known that this last function is, with the carbonate of lime, common to it, and that the presence of the latter, already remarkable in superior animals, becomes predominant in inferior beings, where the phosphate intervenes only for a mere fraction.

Even the most superficial examination shows that the distribution of the phosphate of lime is very unequal in the animal kingdom ; that abundant in the vertebrates, we see its quantity diminishing as the

beings are lower in the animal scale, until it reaches its minimum in the mollusks and zoophytes.

If, on the other hand, we take into account the mode of existence of these animals in their different classes, this unequal distribution of the mineral element leads us to conclude that the quantity of phosphate in animals is more considerable in proportion to their instincts of preservation which multiply their relations with the exterior world, which proposition may be thus formulated: "The quantity of phosphate of lime contained in living beings is proportional to their activity."

If this proposition is true, it ought to be verifiable by the comparative examination of the osseous matter in two classes of animals perfectly comparable, birds and mammalia, which present, either by their relative temperature or by their mode of existence, marked differences.

The following are some of the results of analyses prosecuted for this end:

	Quantity of Osseous Matter for 100 parts of Living Weight.
Common swallow - - -	3·88
Ditto (very fat) - -	3·20
Lark - - - - - -	4·00
Titmouse - - - - -	3·70
Yellow-hammer - - - -	3·83
Sparrow - - - - -	3·56
Goose - - - - -	3·99
Ditto - - - - - -	3·53
Duck - - - - - -	3·34
Ditto - - - - - -	3·70
Mean - - -	3·67

	Osseous Matter for 100 parts of Living Weight.
White rat - - - - -	2·30
Pig - - - - - -	2·55
Ditto - - - - - -	2·61
Rabbit, lean - - - -	2·94
Sheep - - - - -	2·56
Rabbit - - - - -	2·48
Mean - - -	2·57

Thus, in living birds, 100 parts of living weight contain on average 3·67 of osseous matter, and in mammalia 2·57 : the difference being, therefore, 30 per cent. in favour of the bird.

This result was far from being foreseen ; the prevailing idea in science being that to facilitate the flight of a bird, its osseous system ought to weigh less than that of the other vertebrated animals.

M. Boussingault, whose excellent works we will have on more than one occasion to quote, had fixed for mammalia 2·90 as the mean figure, which approaches a good deal that which we have found.—(“*Économie rurale*,” tome ii., p. 634.)

A direct experiment by the same author has led to a result nearly identical. We shall give it in substance, as it is, for more than one reason, very instructive. A calf six months old, weighing 168 kilogrammes, receives in 48 hours 8 kilogrammes 666 grammes of fodder, which contain 34 grammes of phosphoric acid and 134 grammes of lime, combined with different acids, organic and mineral. In deducting the phosphoric acid and the lime ejected with the excrements and the urine, it is found that the animal has fixed in

its organism, in 48 hours, 28·60 grammes of the phosphate of lime of the bones. On the other hand, it is found that the gain in weight is 630 grammes in 24 hours, which contain 14·30 grammes of phosphate; and, consequently, when 100 parts of living weight have developed themselves, 2·25 of the tribasic phosphate of lime are fixed, and if the carbonate which enters normally into the composition of bones be added, we attain nearly 3 per cent of osseous matter —an amount very close to that which was given above.

This experiment, moreover, proves that during the period of growth, the assimilation of organic and inorganic elements go together while preserving the same relations.

The following analyses place in evidence the variation of the quantity of phosphate of lime, according to the class of animal in which it is observed :

	Phosphate of Lime for 100 parts of Living Weight.
Common fly - - - -	2·02
Bee - - - - - -	1·44
Pike - - - - - -	1·48
Eel - - - - - -	0·61
Mackerel - - - - -	0·92
Crayfish and its shell - - -	1·21
Leech - - - - -	0·15

The systematic search for phosphate of lime in the animal kingdom leads us to the confirmation of a great generality : the relation between the heat and the activity of an animal and the quantity of phosphate of lime it contains. Is the comparison of these two facts the result of a simple coincidence

without any direct link, or does the phosphate of lime really play an active physiological part in the manifestation of vital phenomena? Therefore, is not the skeleton of superior animals itself while a point of attachment for the living levers, also a reservoir of a dynamic substance whose action is felt when thrown into the circulation?

We have previously shown with what constancy the phosphate of lime and the azotised matter are found in those parts of vegetables in process of formation; is the same thing observed in the animal kingdom, and do the tissues of animals in process of organization require to group their elements together in the form of cells, produced by phosphate of lime?

"Among the mechanical agents," says Lehman,* "the phosphate of lime holds the first rank."

"In general, there exists no tissue of animal nature which does not contain more or less of phosphate of lime. Up to this we have not determined with precision what influence is exercised by this salt on the physical properties of the tissues, according as the quantity is more or less great. This salt exists there under the form of a particular combination, and *it is more than probable that its presence is the determinant cause of certain metamorphoses which the albuminoid substances undergo during life.*"

"*Many other facts show that this salt is absolutely indispensable to the formation of the cells.* Thus it has been observed that in the inferior animals, in whose organism the carbonate of lime is nevertheless the mineral substance in greatest abundance, *the phosphate*

* "Physiologie animale," p. 100.

of lime accumulates in the parts where the new cells are in process of formation."

"The plastic properties of exsudations are commonly attributed * to the presence of fibrine; nevertheless, as this substance is found in notable quantity in certain transudations, notably in that of acute dropsy, without manifesting the least plasticity, it must be admitted that this latter does not depend on the presence of fibrine alone. Its cause was therefore sought in the phosphates; this opinion was confirmed by the fact that:

"*The presence of phosphates in appreciable quantity has been noticed wherever fibres and cells originate*, even in the inferior animals, who nevertheless contain but little phosphate. Let us add to this, that *the blood which escapes from those organs in which vitality is most energetic*—for example, that which escapes from muscles in which the metamorphoses of the tissues are very active—*always contains less phosphate than the venous blood which leaves the capillaries belonging to organs whose vital activity is less energetic.* Lastly, a certain number of careful analyses have shown that the phosphates are always more abundant in the plastic secretions of wounds deprived of globules than in the serum of the organism. *It is therefore nearly certain that the phosphates are indispensable to the formation of the cells and the tissues*, since they are always met with there."

To the facts enunciated by the German physiologist can be added many of our own observations taken from patients affected with fractures, in whom the administration of the phosphate of lime rendered soluble has given rise, principally in the part in

* "Lehman," p. 286.

process of reparation, to phenomena of a special nature ; and particularly its action on the economy of young children submitted to the same treatment, by which the average of growth is considerably increased—increase coinciding with an abnormal development of the appetite.

If the animal tissues require the assistance of the phosphates for their development, they ought, like the vegetable tissues, always to contain phosphates in their normal state, and yield ashes rich in principles of this nature to the analysis.

The following analyses executed by De Bibra, on the muscles of numerous animal species, show that the ashes are almost entirely composed of phosphates :

Muscles dried at 100° C.	Percentage of Ashes in Muscles.	Alkaline Phosphates	Phosphate of Lime.	Sea Salt.	Sulphate of Soda.
Squirrel -	5·40	85·54	11·42	3·04	...
Hare - -	4·48	79·80	15·10	4·20	0·90
Roebuck -	4·68	72·00	20·60	1·00	...
Ox - -	7·71	76·80	16·40	6·50	...
Calf - -	...	89·80	10·20	...	...
Cat - -	5·36	74·13	20·70	3·17	...
Fox - -	3·85	74·08	22·40	1·02	2·50
Raven - -	5·06	70·07	28·20	1·73	...
Hawk - -	4·73	90·40	8·45	1·15	...
Owl - -	4·40	76·40	23·60	...	...
Fowl - -	5·51	84·72	13·89	1·39	...
Wild Duck	4·48	84·00	14·80	1·20	...
Frog - -	4·96	64·00	25·00	11·00	...
Perch - -	7·08	54·39	44·34	1·27	...
Carp - -	6·10	44·19	42·20	1·31	12·30
Average -	5·27	74·68	21·15		

Opposite to these figures, it is not without interest to place those furnished by wheat on the one hand, and on the other the blood of animals nourished exclusively with this substance.

ANALYSIS OF WHEAT.

PERCENTAGE OF ASHES.

Alkaline phosphates	69·32
Phosphate of lime -	5·59
„ magnesia „ oxide of iron	23·80
Phosphate of silica -	1·40

ANALYSIS OF THE BLOOD OF YOUNG COCKS NOURISHED WITH WHEAT.

PERCENTAGE OF ASHES.

Alkaline phosphates	52·34
Phosphate of lime -	11·79
„ magnesia	3·00
„ iron -	3·00
Silicate of potash -	3·53
Chloride of sodium Traces of the sulphate	20·89

Thus when the average representing the total of phosphates amounts, in the ashes of dry muscle, to 95·83, it is only 75·58 for the ashes of blood, and 74·91 for those of wheat.

But the difference between the results furnished by the blood and by the wheat is really greater than it appears, for whilst 100 parts of dried blood yield 4·4 gr. of ashes, the wheat furnishes only from 1·50 gr. to 2·4 per cent. of them. The absolute amount of phosphates in the wheat is, therefore, more than half less than in the muscles and in the blood.

But the leading fact which ought to be noticed is the increasing proportion of the phosphate of lime, which increases while condensing itself from the aliment whose ashes contain 5·59, the blood 11·79, to the muscle which contains 21·15 per cent.

This accumulation of the phosphate of lime is still more remarkable in examining the result of the

analysis made of the muscles of the stomach by De Bibra.

Ashes of the Stomach of the	Percentage of Ashes of Dry Matter.	Alkaline Phosphates.	Phosphate of Lime.
Cat—muscles - -	2·66	46·36	46·70
Cat—mucous membrane	2·26	23·30	75·00
Hawk—muscles - -	2·82	57·90	42·18
Hawk—mucous membrane	3·09	58·40	41·60
Owl—muscles - -	4·05	49·00	46·60
Average - - -		46·99	50·44

Here, indeed, the quantity of phosphate of lime, which in the ashes of the muscles amounts to 21·15, rises to 50·44 per cent. It is impossible not to be struck with this fact, and it may be asked if this condensation of phosphate does not correspond with a special physiological function of the stomach.

We will here recall to mind about this subject that M. Blondlot had, a long time since, in analyzing gastric juice, detected the presence of the biphosphate of lime, and attributed to it an active intervention in the chemical phenomena of the digestion. We may also assure ourselves that pepsine, prepared in expressing the alimentary bolus of animals killed at the slaughter-house, furnishes ashes strongly charged with phosphate of lime.

We cannot, on the other hand, do otherwise than compare this fact with the well-established property of the phosphate of lime to develop the appetite and behave as a strong digestive agent.

The preceding analyses, in indicating the quantity of phosphate of lime existing physiologically in the muscles, do not give an idea of the relatively rapid

movement by which it is absorbed into the organism, and of the quantity which fixes itself there during the period of growth and of gestation.

For a long time it has been remarked that the urine of children, and especially that of pregnant women, is so poor in calcareous phosphate that it is often impossible to detect its presence by reagents. In this last case will be seen a most interesting fact, and which, up till now, has not been sufficiently explained.

The interpretation which we would put on the part played by the phosphate of lime allows us to class this fact among the most natural physiological phenomena; for instance, Ducrest had a long time since remarked that in pregnant women the bone of the skull thickened to a remarkable degree, and that even the other parts of the skeleton also participated in this increase.

Follin had equally seen the formation of concretions on the surface of the pelvis, which he named osteophytes, composed entirely of phosphate of lime.

They wished to consider these facts as accidental, by ascribing them to a deviation of nutrition; we believe them to be essentially physiological.

It must, indeed, be remarked that the disappearance of phosphate of lime in the urine begins soon after the fecundation, and that the assimilation of this salt continues with intensity during the first seven months, or nearly so, of pregnancy. Near the eighth and ninth months a contrary reaction manifests itself; the urine gets cloudy and precipates a great quantity of phosphate. As the full term of pregnancy approaches, the thickness of the bones returns to its normal condition and the osteophytes disappear.

Now we know that in the physiological state there is daily an expenditure of phosphate of lime necessitated by the wants of the economy; after the fecundation, the phosphate, instead of being eliminated by the natural channels, is re-absorbed, and, fixing itself in all the parts of the skeleton, constitutes thus a reserve for ulterior use.

Thence its absence or diminution in the urine, and doubtless also in the excrements.

From the beginning of the eighth to the end of the ninth month of the gestation, produces in the fœtus a growth relatively considerable; the cartilages fill with phosphate, and the muscular masses form themselves in great quantity. It is at the second period that there is a greater expenditure of phosphate of lime; one portion retained by the skeleton of the infant becomes definitely fixed; another portion, after having contributed to the formation of the new tissues, is rejected, and gives to the urine that particular character mentioned above.

This forethought of nature which keeps in reserve the materials for an utilization often distant, is not, as is known, an isolated fact. We see nature, in fact, accumulating for the accomplishment of a different physiological function, fatty matter and sugar in the liver, lungs and tissues of the fœtus, to furnish a respiratory aliment during the first hours of life in anticipation of the entry in function of the digestive organs.

We must equally connect with the part played by the phosphate of lime during pregnancy, those cases of cachexia, osteomalacia, and even those ill-defined and deep pains of the limbs which are often observed

in certain pregnant women of a feeble and lymphatic temperament, whose insufficient alimentation is unable to produce that natural reserve of phosphate; the mother then furnishes it, by borrowing from her own skeleton the osseous matter necessary for the development of the infant.

There is, in fact, at this period a very great activity of assimilation. Thus M. Boussingault has demonstrated that the young animals subjected to his experimentation had absorbed a more considerable quantity of calcareous salts than that existing in their aliments, and that they must have drawn from the water they drank the complement of mineral elements necessary to their growth.

The same chemist, whose works cannot be too often quoted, has measured in the animals of a farm the quantity of phosphate of lime absorbed in the twenty-four hours by a calf, on the one hand, and, on the other hand, by a cow, of the weight of 660 kilog., two months and a half pregnant. He has thus found that the calf fixed in its organism, during twenty-four hours, 14·30 gr. of phosphate of lime, and the cow, during the same time, 34·6 gr. of the same salt; a quantity really considerable, and which corresponds, as we have already pointed out, with 3 per cent. of living weight developed during the same space of time.

We have previously established by varied weighings that this weight of 3 grammes per cent. of living weight is constantly maintained in mammalia; the knowledge of this fact may be an important guide to the physician called upon to regulate the alimentation suited to infancy.

MM. Blache and Odier have determined by weighing new-born infants the normal average of growth for a period of twenty-four hours ; it is allowable to affirm that for this sum of growth a proportional quantity of phosphate of lime fixes itself, and that it is indispensable that the milk and the other aliments ingested by the infant represent a quantity of calcareous salts still more considerable, for the whole mineral substance detected by the analysis is by no means entirely assimilable.

The composition of the milk and of different aliments is now sufficiently known for it to be possible to fix in a positive manner the minimum doses which the infant ought to ingest in a given time, in order that its growth should remain within physiological limits.

Nevertheless, these experiments show us with what rapidity the phosphate of lime is absorbed and definitively fixed to contribute to the development of the individual. "In the adult animal," says M. Boussingault, "it was to be presumed that this final fixation of inorganic principles did not take place or that it was far less considerable, and that all the phosphoric acid and all the lime which were introduced with the aliments ought to be found in the dejections and secretions. This is confirmed by the experiment made on a horse, and in which the mineral substances rendered have balanced the mineral substances received. However, from the fact that these mineral substances expelled daily from the organism are nearly equal in quantity, and resemble in their nature those of aliments consumed, it must not be concluded that an adult individual could content himself with a

nutriment devoid of them. As the organic matter, a part of the inorganic matter of the plants assimilates itself in the first instance in the organism, and enters for a certain time in the constitution of a living being before being rejected. No doubt that an animal whose alimentary regimen did not possess, for instance, a sufficient quantity of lime and of phosphoric acid would experience bad symptoms which would evidently terminate in death, if a similar diet were continued. This is what is proved by some very interesting experiments, in which Chossat has nourished some granivorous animals with an aliment rich in azotised and feculent principles, in phosphoric acid, but not containing a suitable dose of lime.

On the other hand, experiments by Flourens have shown that penetration into the bones by madder takes a long time to produce itself completely in the adult animal, and that this colouration persists, so to say, indefinitely, whence it must be concluded that in an animal placed in proper physiological conditions, the movement of the phosphates is extremely slow, and that which is contained in the aliments suffices to maintain the irritability of the tissues which it goes through. We can scarcely affirm that the lac formed by the madder, and the organic matter of the bones persists without reabsorbing itself, and without participating in the movement of the mineral matter. In this hypothesis, the phosphate of bones being eliminated would be replaced by the new phosphate furnished by the aliments, the organic coloured mesh remaining the same, and then the fact of the non-decoloration of the bones could not be quoted as an example of the permanency of the phosphate of lime.

Independently of the solution of these questions, the necessity of the phosphate of lime in a definite quantity in the aliments of the adult animal, and the importance of the part it plays for the preservation of life are placed beyond doubt by the experiment of Chossat, in which an adult pigeon, nourished exclusively on wheat, a substance very poor in calcareous phosphate, expends for the sustenance of its tissues three quarters of the substance of its skeleton in a time three times less than that required for the physiological renewal of its bones. The bird having exhausted its reserve of phosphate, soon succumbs, although it has at its disposal an abundance of starch and gluten in its aliment—that is to say, the plastic and respiratory elements necessary for the maintenance of life.

Thus the nutrition of bones by the phosphate of lime, far from being a function of the first order, here appears to us as a secondary consideration; for the animal not only does not retain the calcareous phosphate contained in its aliments, but, on the contrary, expends that of its skeleton which constitutes its reserve in the same way as when, in presence of an insufficient alimentation, the animal borrows at first from the fat, and after even from the substance of its organs, the complement of materials indispensable to the accomplishment of the phenomena which ensure its preservation.

We have always attributed to phosphate of lime the phenomena which Chossat ascribed to the insufficiency of calcareous salts, without concerning himself about the nature of the acid, struck as he was with the imperious necessity which pushes the grani-

vorous animals to add carbonate of lime to their aliments. It is certain, and M. Boussingault has shown it with the greatest clearness, that animals in the period of growth fix in their tissues a considerable quantity of lime, and far more than that necessitated by the development of their bones.

But the fixation alone of lime in the economy could not explain how an aliment like wheat would become complete, and would suffice the wants of the animal, when we see him lose each day, and constantly, a notable quantity of phosphate of lime which does not exist in its aliments.

If we take into account the composition of the ashes of wheat, it is easy to show that the carbonate of lime absorbed and digested by granivorous animals with their aliments intervenes as an active agent of production of calcareous phosphate. We know, in fact, that wheat, very poor in phosphate of lime, is nevertheless very rich in phosphate of potash and of soda. These bodies, which cannot by themselves contribute to the direct nutrition of tissues and of the osseous system, once introduced into the circulation, meet the salts which the carbonate of lime has formed, either the lactic acid or other organic acids, and reacting by double decomposition give birth to phosphate of lime.

This instinctive habit, which induces granivorous animals to add to their ordinary alimentation a certain quantity of calcareous salts, is not, moreover, peculiar to these animals. We find it to the same degree in the human species, particularly in certain tribes of India known under the generic name of geophagi, and whose little varied alimentation nearly consists entirely of maiz.

The notions which precede authorize us to regard as natural the cause which induces the inhabitants of those countries to continue a practice which has been looked on as a depravation of taste, but which we can now consider as the expression of a physiological necessity of the first order. It is sufficient, in fact, to recall to mind that the maiz, which constitutes the basis of the nutriment of those tribes, is as poor in phosphate of lime as wheat, and that, like the latter, it contains a relatively considerable quantity of alkaline phosphates, which can intervene as a continued cause of production of calcareous phosphate.

"This habit of eating earth," says M. Boussingault, "we find among the Indian tribes, not always, as was asserted, to assuage the feeling of hunger in times of dearth, but from a particular taste which the missionaries term a depraved taste, and which, since I have known the composition of the ashes of maiz, does not seem to me so much to deserve this epithet. In several boroughs I have seen children punished who had been surprised eating earth."

The following experiment, which is the modified reproduction of that of Chossat, has enabled us to establish the chemical statics of the mineral elements in an animal whose alimentation is disturbed by the want of balance between the azotised matter and the phosphate of lime.

It shows with what rapidity and constancy the skeleton of an animal can be brought into play, and at the same time the facility with which, in the physiological state, that reparation is effected.

Lastly, we find the experimental demonstration of the part played by the phosphate of lime and alkaline phosphates in the alimentation of granivorous

animals, and in general of animals nourished for the greater part with maiz and wheat: we see in it at the same time the confirmation of this remarkable property of the phosphate of lime to be an energetic agent of nutrition.

An adult pigeon was nourished exclusively with wheat and distilled water: and in order to take into account the exact amount of phosphate of lime afforded by the skeleton with that furnished by the aliments, we have carefully determined the tenor in phosphate of lime of the aliment employed as well as the quantity daily consumed by the bird. In fact, the following are the details of the experiment:

On the 16th of June, 1869, we confined an adult pigeon weighing 347 gr. in a sufficiently spacious cage, arranged in such a manner that the excrements might be collected without loss. It received from that day for its sole nourishment some wheat carefully sifted, and distilled water.

In order to allow the contents of the intestines time to renew themselves, and to have to submit to the analysis products only which would be the exact expression of the new alimentation, we only commenced the experiment on the 20th. In the interval of these four days of preparation, the pigeon laid an egg weighing 19 grammes.

The wheat employed leaves by incineration a residue 1·30 gramme per cent.

The ashes contain:

Phosphate of lime - -	0·20 per cent.
Alkaline phosphates - -	0·60 „

The experiment, begun on the 20th of June, has been continued to the 11th September.

The following table shows week by week the results obtained :

	Dates.	Wheat consumed.	Ashes in the excrements.	Phosphate of Lime.	Alkaline Phosphates.	Observations.
		gr.				
June - -	From 20th to 26th	168	2·10	0·85	0·75	On the 4th July the bird weighed 290 grammes.
July - -	From 27th to 3rd	125	1·83	0·60	0·65	
	From 4th to 10th	118	1·80	0·64	0·65	
	From 11th to 17th	132	1·75	0·60	0·65	On the 11th July it weighs 286 grammes.
	From 18th to 24th	138	1·55	0·61	0·60	
	From 25th to 31st	130	1·67	0·61	0·70	
August -	From 1st to 7th -	133	1·63	0·63	0·72	
	From 8th to 14th -	147	1·83	0·69	0·63	On the 12th August it weighs 290 grammes.
	From 15th to 21st	134	1·84	0·70	0·72	
	From 22nd to 28th	128	1·78	0·65	0·68	
September	From 29th to 6th -	170	2·15	0·83	0·75	On the 17th September it weighs 289 grammes.
	From 7th to 11th -	120	1·80	0·77	0·60	
	83 days . .	1·643		8·18	8·30	

The pigeon has therefore eaten in eighty-three days 1 kilogr. 643 gr. of wheat (that is 19·70 per diem); containing—

Phosphate of lime - - - -	3·28
Alkaline phosphates - - - -	9·85

It has rejected in its excrements :

Phosphate of lime - - - -	8·18
Alkaline phosphates - - - -	8·10

So that in the space of eighty-three days the bird had borrowed from its skeleton 4·90 gr. of phosphate of lime, and that receiving each day in its aliment 0·039 of phosphate, it rejected 0·098, or a daily weight of 0·059 more than that furnished by the wheat.

We also see that all the alkaline phosphates contained in the aliment were rejected under the same form in the excrements, except a difference of 1·75 gr. loss no doubt resulting from the partial destruction which they had undergone in the economy and from their transformation into salt of magnesia.

If we refer to the figure given at page 20, explaining the average quantity of osseous matter existing in birds, that is to say, 3·67 per cent. of living weight, we find that the pigeon, weighing 347 grammes at the commencement of the experiment, had a skeleton weighing 12·74 gr., and that after eighty-three days of insufficient mineral alimentation this weight fell to 7·84 gr.

We know what is the fatal termination of this experiment continued during several months; the animal dies, and its bones, reduced to 2 or 3 grammes,

are so thin that they break under the least pressure.

The colouring of the bones by madder allowing one to follow their evolution, Flourens has seen, at the end of eighteen months, this colouration still persisting in the pigeon. It appears, therefore, probable that it requires at least two years for a complete renewal of its bones. In the preceding experiment, on the contrary, the economy obeying a law superior to that which rules the nutrition of the skeleton, expends the phosphate of lime to apply it to a function of a higher order ; and this expenditure is so active, that it would bring on the death of the bird in seven or eight months.

Instead of pushing the experiment to this extremity, we have transformed the alimentation in giving, instead of distilled water, common water, and mixing with the wheat carbonate of lime in powder.

The following table resumes the results obtained under these conditions :

	Dates.	Wheat consumed.	Ashes.	Phosphate of Lime.	Alkaline Phosphates.	Observations.
September -	From 12th to 18th	143	2·50	1·70	...	The animal shakes itself in its cage and flaps its wings.
	From 19th to 25th	172	2·51	1·22	0·25	
October - -	From 26th to 2nd	170	2·38	1·07	0·28	Ditto.
	From 3rd to 9th	180	3·07	1·90	...	
	From 10th to 16th	162	2·75	1·75	...	It weighs 520.
	From 17th to 23rd	185	3·26	2·03	...	It weighs 330.

We place in view of this table an analysis made on the excrements of pigeons nourished at liberty, and collected in a pigeon-house water-tight :

Ashes - - - - -	3·12
Phosphate of lime - - -	0·44
Alkaline phosphates - - -	0·00

The action of the carbonate of lime is therefore very evident, whether produced on birds in captivity or feeding at liberty.

We see in this experiment nearly the entire amount of alkaline phosphate transformed into phosphate of lime, and, what is remarkable, the contents of the intestine itself, which, at the commencement of the experiment, still represented the residue of the alimentation without the carbonate, and contained the seventh part of alkaline phosphates found in the analysis of a week—this residue, we say, has undergone itself the decomposing influence of the carbonate of lime, doubtless after the absorption of the intestinal liquids, for the analysis does not show the least trace of alkaline phosphates in the ashes.

Notwithstanding large quantity of phosphate of lime produced all at once in the economy, there was none assimilated during the first week, for the quantity collected in the excrements—that is to say, 1·144, plus 0·556 coming from the skeleton, in all 1·70—represents the totality of phosphates existing in the aliments. We find in favour of the absorption a difference of 0·036; but it may, strictly speaking, be attributed to errors inherent to this sort of experimentation.

But from the second week a complete change takes

place; the aliment,* by the intervention of the carbonate of lime, has furnished 1·55 of phosphate of lime and 0·25 of alkaline phosphate, and the bird rendered 1·22 of phosphate of lime and 0·25 of alkaline phosphates undecomposed. There has, therefore, disappeared 0·33 of phosphate of lime, corresponding to an equal assimilation. From this time, the expenditure of the skeleton is arrested, and to this impoverishment succeeds, on the contrary, a very energetic movement of assimilation.

On the third week, the work of reparation is more accentuated still, the phosphate of lime furnished by the aliment being 1·50, taking always into account the action exercised by the carbonate, the alkaline phosphate 0·28, we find in the excrements 1·07 of phosphate of lime and 0·28 of alkaline phosphates undecomposed. The bird has, therefore, still fixed in its skeleton a weight of 0·43 of phosphate of lime.

On the fourth week the appetite is still more developed. The quantity of aliments consumed has amounted to 180 grammes. The weight of the animal has risen from 289 grammes to 320.

We find in the excrements 1·90 of phosphate of lime, and not the slightest trace of alkaline phosphates.

In calculating the quantity of phosphate of lime existing in wheat and that produced by the transformation of the alkaline phosphates by the carbonate of lime, we find 1·893, a figure which sufficiently approaches that found in the excrements to be identified

* Analysis of corn employed per cent. :

Phosphate of lime - - - -	0·175
Alkaline phosphates - - - -	0·877

with it. Lastly, fifteen days later, the pigeon weighs 330 gr., and resumed its initial weight of 347 gr., if we take into account the weight of the egg (19 gr.), which it gave at the beginning of the experiment.

Thus, we see once more, under the influence of a more active movement of nutrition coinciding with an increase of weight and the formation of new tissues, the reparation of the skeleton remains stationary, although the loss sustained during the period of mineral inanition amounts still to more than 4 gr.

It is evident that the work of reconstruction of the skeleton takes place, but in a manner more gradual than the work of disassimilation.

This fact itself, in the order of ideas which we are trying to demonstrate, far from being considered as abnormal, corroborates, on the contrary, our views. The moment, in fact, that the nutrition of the osseous system is not considered as the predominant and necessary element, we can understand that the first desire of the economy is to create, by means of the phosphate of lime placed at its disposal, a new vitality to the tissues: thus, from the first week, we see nearly the total amount of phosphate of lime rejected from the circulation after having gone through the organs, and the absorption reduced to so small a figure that it might be neglected.

From the second week, on the contrary, this first want once satisfied, assimilation begins and goes on increasing on the following days.

Far more—and this is a new proof that it is in this sense that we must interpret the phenomena which the analysis reveals to us—at the same time that we see the phosphate of lime take rise in the tissues and

increase under the influence of the carbonate, we notice in the bird a greater activity, a considerable development of appetite.

In fact, in referring to the first table, we find that the quantity of wheat consumed in a period of eighty-three days amounts to an average of 137·90 gr., or 19·70 gr. daily. The first week of that second experiment the quantity of wheat amounted to 143 gr., and passes immediately afterwards to 172, 170, 180 on the following weeks, or 24·57 gr. per day, which represents, in fact, an increase of 20 per cent.

We have had occasion to observe in man phenomena of the same order. We have seen in fact, to our great surprise, in lymphatic children, who did not walk, deprived of appetite, and in whom the osseous system was incompletely developed, the administration of the lacto-phosphate of lime did not produce for several weeks any of these phenomena which we are accustomed to observe ; then, as by a sort of sudden explosion, we have seen them appear with remarkable intensity.

III.

We were compelled, in the preceding pages, to group all the facts which could place in evidence the physiological part played by the phosphate of lime; it remains for us to present different observations, having for object to corroborate the propositions produced in this work, and tending to affirm the part of the lacto-phosphate of lime as an agent of nutrition.

We would especially call the attention of physiologists to a particular phenomenon produced in cases of

fracture—phenomenon which we have made appear and disappear at wish by the administration or suppression of the medicaments.

We also produce various observations having reference to pathological cases in which the use of the phosphate of lime was indicated, and finally others which show the part that can play, in the treatment of dyspepsia, an agent which is an energetic stimulant of nutrition, and whose first action has, for effect, to exalt or awaken the chemical phenomena of digestion.

Struck with these variable effects, often null, obtained by the administration of the ordinary phosphate of lime, we have made researches with Dr. R. Blache to ascertain to what cause we must attribute the so frequent inactivity of this substance. Experiments made on a dog, afflicted with a gastric fistula, have led us to formulate the following conclusions :

" The phosphate of lime undergoes, under the influence of the gastric juice, a partial transformation which renders it apt to assimilation.

" The different phosphates of lime employed up to this—very variable in their composition and properties—offer an unequal resistance to the action of the gastric juice.

" Their employment in therapeutics does not offer sufficient security, and it is more rational to substitute for them the substance which we designate under the name of lacto-phosphate of lime, which represents the product of the action of the gastric juice on the phosphate of lime."

This new product, obtained by the action of lactic acid on the phosphate of lime, is soluble in all proportions in water and gastric fluids ; injected into the

stomach of a dog afflicted with a fistula, and in the full act of digestion, it is not precipitated by the aliments in part chymified, and is found again in totality in the filtered liquids. This property was then a sure guarantee of its absorption by the veins of the stomach, and we possessed thus a medicament which was no longer submitted to the necessity of a previous digestion to pass into the circulation. It is, moreover, needful to add that this digestion of ordinary phosphate, limited to a few centigrammes, even with regard, as in our experiments, to a strong dog of large size, is often without effect in children or adults whose digestive powers of the stomach are already weakened by disease.

Thanks to this new form, it was possible for us to cause considerable quantities of the phosphate of lime to be absorbed in a very short time, and thus to determine the appearance of new phenomena, which it was impossible before to observe with the ordinary product.

The following experiments, borrowed from our first labours with Dr. Blache, have had for object to show the action of the lacto-phosphate of lime in cases of fracture.

Our experiments were exclusively practised on the guinea-pig. This animal bearing, without appearing to suffer much, the operations to which it was subjected, offered us the advantage of multiplying our experiments in operating comparatively on animals of the same litter ; moreover, on account of the small size of its bones, it gave us the means of controlling by scales of precision the march of the ossification.

During the whole of the period of experimentation,

the animals were weighed every three days, and those which presented an arrest in their growth were carefully eliminated.

The lacto-phosphate of lime, previously mixed with starch, was sprinkled in fine powder over carrots, cut fine, and given to the animal every morning, fasting.

Those which were not submitted to the lacto-phosphate regimen received the same dose of aliments; after this first meal, all were put together in ordinary condition and lived in common.

The care that we had taken to eliminate those animals in which the fracture interfered with the growth, caused us to reject from experimentation the half at least of the animals operated on. The number of those which were left us, although limited, was sufficient, nevertheless, to show, in an evident manner, the part played by the lacto-phosphate of lime.

From the 22nd September to 12th October.

Animal submitted to the Lacto-Phosphate of Lime Regimen.	gr.	Animal submitted to the Ordinary Regimen.	gr.
Weight of the animal	812·00	- - - -	611·00
Healthy fore-leg -	0·72	- - - -	0·55
Fractured fore-leg -	01·01	- - - -	0·67
Gross difference -	0·29	- - - -	0·12

Weight of the Bone compared with the Weight of Animal = 100.

	gr.		gr.
Healthy fore-leg -	0·0886	- - - -	0·0916
Fractured fore-leg -	0·1245	- - - -	0·1096
Difference - -	0·0357	- - - -	0·0180
Consolidation.		Mobility sufficiently great.	

From 1st October to 1st November.

No. 1. Animal submitted to the Lacto-Phosphate of Lime Regimen.	gr.	No. 2. Animal submitted to the Ordinary Regimen.	gr.
Weight of the animal	325·00	- - - -	424·000
Healthy fore-leg -	0·54	- - - -	0·475
Fractured fore-leg -	0·70	- - - -	0·625
Gross difference -	0·24	- - - -	0·150

Weight of the Bone compared with the Weight of Animal = 100.

	gr.		gr.
Healthy fore-leg -	0·166	- - - -	0·112
Fractured fore-leg -	0·218	- - - -	0·147
Difference - -	0·052	- - - -	0·035
Consolidation.		A little mobility.	

From 10th December to 11th January.

No. 1. Animal submitted to the Lacto-Phosphate of Lime Regimen.	gr.	No. 2. Lacto-Phosphate of Lime.	gr.	No. 3. Animal submitted to the Ordinary Regimen.	gr.
Weight of animal -	472·00	- -	395·000	- -	590·00
Healthy fore-leg -	0·47	- -	0·435	- -	0·53
Fractured fore-leg -	0·67	- -	0·620	- -	0·70
Gross difference -	0·20	- -	0·185	- -	0·17

Weight of the Bone compared with the Weight of Animal = 100.

	gr.		gr.		gr.
Healthy fore-leg -	0·099	- -	0·110	- -	0·089
Fractured fore-leg -	0·142	- -	0·156	- -	0·118
Difference - -	0·044	- -	0·046	- -	0·029

	Animals submitted to the Lacto-Phosphate of Lime Regimen.			Animal Submitted to the Ordinary Regimen.
	gr.	gr.	gr.	gr.
Weight of animal	350·00	275·000	680·00	- 545·00
Healthy fore-leg -	0·38	0·255	0·61	- 0·43
Fractured fore-leg	0·52	0·345	0·81	- 0·56
Gross difference -	0·14	0·110	0·20	- 0·13

Weight of the Bone compared with the Weight of the Animal = 100.

	gr.	gr.	gr.	gr.
Healthy fore-leg -	0·100	0·085	0·089	- 0·078
Fractured fore-leg	0·136	0·125	0·119	- 0·102
Difference - -	0·036	0·040	0·030	- 0·024

We see by the inspection of these tables that the increase in weight of the bones of animals submitted to the lacto-phosphate of lime regimen exceeds, by more than 30 per 100, the weight of the bones of animals to the ordinary regimen.

The consolidation appears to follow a proportional course.

This increase of weight is really due to the osseous substance, for the analysis shows that in these parts of new formation there exists the same relation between the organic and mineral substances than in the normal bone.

We will also remark incidentally that when the fracture is situated at the extremity of a member, it is not only the fractured part which bears an increase of weight; thus in our experiments the scapula and the humerus of the same side participate in this increase, determined no doubt by the fluxion of the

extremity of the member. This increase of weight, already sensible in the animals submitted to the ordinary regimen, is still more marked in those to whom the lacto-phosphate is administered.

In fine, we have always observed the production of a callus relatively more voluminous in these animals and in this we agree with several practitioners who had noticed the same fact in patients affected with fracture and taking the lacto-phosphate of lime in doses of 4 to 6 grammes a day.

In presence of these results we have perceived the great interest which there is to establish scientifically, in the cases of fracture in man, how much the time necessary for consolidation would be lessened.

To solve such a problem so simple in appearance, we have seen that it will at first be necessary to establish by a rigorous statistic the normal duration of fractures in individuals comprised in definite limits of age, taking into account, for each series of cases, the seat of the fracture and the physiological state of the patient. We have shrunk from the material difficulties of the problem, but we do not the less persist in thinking that the preceding experiments incontestably establish the fact of the rapid assimilation of the phosphate of lime, and that there is in the greater number of cases advantage for the practitioner to admit the use of the lacto-phosphate of lime, as much as an adjuvant to osseous reproduction, as a stimulant of nutrition.

Bearing in mind the observations and facts, which we have just related, and which all owe their value to direct experiments, do they warrant the assertion that phosphate of lime possesses the virtue we as-

cribed to it at starting, namely, that of being an agent of nutrition?

We are of opinion that it is not possible to give any other rational explanation of the above-mentioned facts.

If any manifestations appear under the same conditions and give rise to phenomena of the same nature, such manifestations are certainly those which are most characteristic of phosphates.

Whether the subject of the experiment be a vegetable or an animal, and whether it consist of a simple cell or an organism ever so elevated in the scale of being, all experimenters, from De Saussure down to Lehmann, have observed that, wherever a cell is being produced, or new tissues are being formed, phosphate is collected in the part which is the seat of this organic process, even in such organisms as molluscs, in which phosphate is very scarce.

On the other hand, its deficiency, entire or even partial, results in sterility, decay, or death.

It is equally certain that a very close connection exists between the azotised substance in living beings and the presence of phosphates combined with lime in animals, with an alkaline or a calcareous base in vegetables, and their correlation is so persistent that it almost amounts to a law.

Furthermore, it has been shown that phosphate of lime, which is very unequally distributed in the animal kingdom, is intimately connected with the activity of animals and with their temperature; so that its quantity is highest in those creatures whose temperature and activity are greatest, and diminishes in proportion as we descend the scale of creation.

But if, instead of endeavouring to explain the influence of phosphate of lime by mere observation of facts, we examine its effects on animals in which its normal quantity has diminished either through disease or inappropriate food, we then have the clearest proof of its influence on nutrition and assimilation.

Let an animal be deprived of mineral food, we soon perceive a considerable decrease of appetite, loss of weight, and an expenditure of phosphate sufficient to cause within a few months the greater part of the skeleton to disappear. If, then, phosphate of lime is exhibited, the food being the same as above, appetite soon returns, activity is restored, and new tissues are formed, as evinced by a continuous increase in weight.

The experiment on the pigeon and observation are conclusive on this point.

For it is impossible to overlook the analogy existing between phenomena as seen in an animal deprived of mineral food, and those which are observed in rickets: experiments have proved in both cases that, while the same feeding is kept to, simple addition of phosphate of lime is enough to put a stop to all the ills which the want of it had produced.

Seeing how easily an animal's organism loses its phosphate of lime under the influence of deficient or incomplete feeding, we are led to the conclusion that in a great number of diseases the effects of what one may call mineral starvation are superadded to the disease itself, and continue during convalescence, which is thus prolonged.

According to Jourdan followed by Bérard : "Inanition, or rather the process which results in it, is a cause of death which silently keeps pace with every disease

which prevents a normal condition of nutrition. So that to re-awaken nutrition is to secure the co-operation of nature."

THERAPEUTIC APPLICATION.

IT is evident from the facts already stated that phosphate of lime is an active factor in vital phenomena, whenever it is presented under a form which secures assimilation, and that it even produces the phenomena of stimulation. This was beyond our expectation.

Experiment on healthy or injured individuals does not exhibit, in fact, any appreciable manifestations excepting those of increase of appetite; but it is not the same when its action is observed in those who are found in a suitable condition for the appearance of phenomena.

Such, for example, are the rickety infant, which presents that state of languor which is neither sickness nor health; the adolescent or the adult convalescent, after a sickness of long duration, wherein destruction of all the organic or inorganic elements is produced.

Then, indications appear that are easily observed; the child who has been seen a few days before suffering, languishing, its physiognomy without expression, appears before us under an entirely new aspect. The face is animated, it is continuously in motion, and cannot remain at rest. Furthermore, the appetite has become insatiable. The rickety child, which its legs can scarcely sustain, walks heavily leaning against the walls of the room.

Amongst convalescents, the dominant phenomenon

is the increase of appetite, that becomes often sufficiently important to compel them to feed at night. In the case of fractures, and even of wounds, there is also exhibited a condition of itching or absorption in the wounded limb.

Accustomed as we had always been, to the current opinion, which considered phosphate of lime as deprived of any physiological activity, it was not without a certain emotion that we saw manifestations, of which some have struck us on account of their intensity.

Claude Bernard and Longet, who interested themselves in these researches, only saw in them very active phenomena of nutrition, and tranquillized us about the nature of their action. We had previously ascertained, by experiments on animals, that even when given in large doses, phosphate is eliminated by natural channels without producing the slightest disorder.

Phosphate of lime is not merely, as Dr. Bouvier demands, a substance "able to harden bones," it becomes an active agent in nutrition, and its most valuable indication is materially derived from this property. Its use in rickets, and in cases of fracture, may be conceived. Forming almost all of the skeleton, impregnating all the tissues, it may be administered in all the cases wherein nutrition is impaired.

The field of our researches is accordingly increased to an extraordinary extent, and by the observations that follow, we may see that our previsions are realized.

Although the general indications that we are about to formulate are enough, we have thought it necessary to explain as briefly as possible, at each particular category of observation, the reasons which have induced us to administer phosphate of lime.

GESTATION AND SUCKLING. ATREPSIA.

GESTATION is a physiological condition which constitutes one of the most powerful causes of mineral inanition, as woman is able to furnish elements necessary for the rapid development of a new being, during the two first phases of its existence. She gives her blood to the fœtus, and her milk to the new-born.

Amongst all the modifications which are conferred on our economy by gestation, there is one which specially interests us, on which authors have not sufficiently insisted, and which they have interpreted in a wrong way. In the first days of gestation, phosphate of lime nearly ceases to be eliminated by urine, although at this period the fœtus borrows very little from the maternal blood. Everything which is not immediately used by the product of conception, accumulates either on the flat bones of the skull, or on the pelvis, to make concretions which have received from authors the name of *osteophytes*, and have been erroneously considered as the result of a deviation of nutritive acts; either in the thickness of all the long or short bones, which latter are rendered by this fact more short and more compact.

Thus, under healthy physiological conditions, when a woman is healthy and well nourished, which, a reserve is formed, decreasing little by little, permits us to contemplate the considerable expenditure of mineral elements, absorbed by the intense growth of the last months, and which furnishes at a later period the normal proportion of calcareous salts to milk. The

example of the accumulation of materials in provision for a future function, is not an isolated fact; we may meet with examples more or less striking in various species of animals. It is thus that before shedding of skin, the lobster contains in its stomach carbonate of lime, under the form of concretions (crab's eyes) which are rapidly absorbed after shedding by the production of the new shell.

When the woman is badly nourished, or too weak to assimilate the mineral substances contained in her food, she is unable to form those reserves that we have described, and is scarcely able to contribute sufficiently to the development of the fœtus or the new-born child. We thus arrive at a situation that may become grave both for the mother and for the child. Placed in these conditions, firstly, we note that the symptoms of the patient may begin with borrowing from her proper substance the phosphates necessary for the child, and which are not derivable from its food. This source is soon used up, and we soon see that all the phenomena developed exhibit the conditions of mineral inanition: paleness and softness of the flesh, swellings which have been often taken for those of plethora, puffing up, and pains in all the limbs. Later on, during the suckling, the intestines annoy the invalid more and more; the mother complains of violent pains in the stomach, and between the shoulders, with inflammation after each suckling.

When the gestations are not too frequently renewed, the health is re-established after more or less long delay, especially if the mother refuses to suckle her child. But in a few years the mother, predisposed

by some hereditary disease, worn out by the gestations that succeed each other at short intervals, has not the time to pick herself up again. It is in this way that the cachexia is shown, which has been described under the name of osteomalaxy, which is a state of anæmia difficult to be helped, and which constitutes a nidus completely ready for the future development of disease, and especially of phthisis.

On its side, the fœtus, which was formed at the expense of the mother, is often born with all the appearances of health; often, in fact, it is feeble and incapable to resist the numerous causes of disease with which it is surrounded. If it also receives a clear, bluish milk, poor in mineral or nitrogenous elements, these unfortunate dispositions, instead of decreasing, rather grow worse. Not merely growth is rendered impossible, but vomiting and green diarrhœa often occur, followed by tympanitis and swelling of the articular extremities of the bones. The child cries, sleeps little, folds its limbs underneath it, and yells each time that it is lifted up. We shall not insist on this picture, which is sufficiently known by all doctors.

The results are different if we interfere from the first times of pregnancy in place of abandoning woman to her own forces, and administer to her lacto-phosphate of lime under the form of wine or of syrup. The absorption of the phosphate acts at the same time on the mother, of whom the appetite and the strength increases, and on the fœtus, of which the growth is made under more normal conditions. In many cases the sicknesses of gestation have been stopped by medicine. But what strikes us often, at

the end of the administration of lacto-phosphate during gestation, is the influence which it exercises on the constitution of the child. It is thus that in many families we recognise, amongst others, children which are born after gestation during which preparations of phosphate of lime have been given for a long while.

When they are only prescribed during the suckling, at the dose of three or four spoonfuls a day to the mothers in whom the force is insufficient, the result will soon be evident. In a few days the digestion and the appetite are re-established, the pains in the stomach disappear; whilst the milk, from being clear and bluish, becomes thick and creamy. The child, better fed, ceases to complain; it sleeps and digests better, and the diarrhœa disappears.

These phenomena, which may be considered as constant, are still produced, although in a fashion less prompt and less striking, when a dose of lacto-phosphate of lime is given directly to children in order to ameliorate the conditions of artificial suckling. This is what we shall see in the few examples which we are about to quote.

OBSERVATION I.

(*Collected by Dr. Pinel.*)

Troubles of Nutrition during Gestation.

Madame G—— had, before her marriage, consulted me for a deep-seated anæmia, with dyspeptic complication, over which I had happily triumphed.

Having become *enceinte* just after her marriage, she saw all the phenomena she had formerly combated reappear with new intensity. Palpitations, apnœa, constipation, to which are joined tympanitis, suffocation, and violent pain in the epigastrium for several hours after each repast.

I only gave the syrup of lacto-phosphate of lime at every meal, and after the second bottle all the symptoms had entirely disappeared. The appetite again became very strong, and maintained itself until the day of the birth, which was easy.

Having become again *enceinte* after several months, and seeing the troubles of her first pregnancy likely to be increased, Madame G—— employed, without consulting me, the same method, and obtained a result as satisfactory as the first time.

OBSERVATION II.

(*Collected by Dr. Cazenove.*)

Troubles of Nutrition during Pregnancy.

During the year 1869, Monsieur C——, employed on the Northern Railway, begged me to attend his wife.

This young lady had had, ten months before, a miscarriage followed by serious accidents. At the present time, arrived at the fourth month of her pregnancy, she complained of obstinate constipation, with loss of appetite, an especial disgust for meat, and heaviness in the epigastrium, lasting two or three hours after each meal.

She is profoundly apathetic, and suffers palpitations and apnœa at the slightest movement. The features are drawn, the face of a dead white, and the aspect without brilliancy. There was no œdema in the legs.

I prescribed the syrup of Dusart in the doses of three spoonfuls per day; and when the appetite and the digestive functions were relieved, which took place at the end of a week, I added pills of tartrate of iron and potassa with extract of centaury.

The constipation disappeared definitely. The forces soon reappeared, and Madame C—— was able to be confined happily at her proper term.

OBSERVATION III.

(Communicated by Dr. de Courtys.)

LACTATION.—DISORDERS OF NUTRITION IN A MOTHER AND HER CHILD.—RAPID CURE.

Madame Loth-Charpentier is suckling her child aged four months.

During fifteen days there have existed in this child vomiting and diarrhœa of greenish matter and rapid wasting of flesh.

The mother, of average constitution, has no appetite ; her milk is thin and bluish.

I advised her to give the child, each time after suckling, a teaspoonful of the syrup of the lacto-phosphate of lime with a little lukewarm water.

In a few days vomiting was stopped, as also the colic and diarrhœa. I advised the mother to take the remainder of the bottle in doses of a tablespoonful at each meal.

Eight days after, I saw this young woman again, who declared to me that she takes only one tablespoonful of the syrup a day, and asked me if she should continue, because her appetite has become all of a sudden sufficiently sharp to force her to eat between meals. This constituted a real suffering.

The child's health continued to be good; seen a year after, it presented a normal development.

OBSERVATION IV.

(Collected by Dr. Dusart.)

TROUBLES OF NUTRITION IN THE MOTHER AND IN THE INFANT AFTER SUCKLING.—CURE.

Madame Angier, aged twenty years, of a rather feeble constitution, was confined, two months before, with a healthy and strong child. The young mother wished to

suckle her baby, but soon she felt violent pain between the two shoulders, and at the epigastrium; at the same time the appetite almost completely disappeared, and even the sight of food produced in her a violent feeling of disgust.

While this alteration was being produced in the health of the mother, the child felt its effects; it constantly cried, and was affected by an abundant greenish diarrhœa.

It was then that I was called, and I was able to assign all the troubles of the infant's health to the bad quality of the mother's milk. This was watery and bluish.

In consequence, I prescribed the syrup of Dusart, which I gave to the mother alone, in the dose of a teaspoonful at the beginning of each meal, advising her to take a second one when the digestion might be made with difficulty. The mother, reassured of the harmlessness of this preparation, then took five to six spoonfuls a day.

The fourth day the mother informed me that the green diarrhœa had passed away in the child, who passed its nights more calmly, and that, on her side, the appetite had been increased.

When I saw her, a week after, the pains in the back and epigastrium had disappeared; the digestion was good, and the appetite very active. In examining her milk, I noticed, with surprise, a complete change of aspect; it had become white and creamy.

The child was entirely re-established. But, as a measure of prudence, I continued the syrup for a little while longer.

In a verbal communication, Dr. Bracon, of Vailly-sur-Aisne, has cited for me a case exactly similar to that which I have now related.

RICKETS.—MINERAL INANITION.

We have named *mineral inanition* that particular state of an animal which, receiving in abundance food rich in nitrogenous or carbonaceous matter, does not excrete in the substances composing its food the quantity of phosphate of lime necessary for the daily expenditure required by economy.

The animal placed in those conditions continues to excrete every day in its excrements about the same quantity of phosphate of lime, though it has ceased to receive it *ab extra*; but at the end of a more or less long time, it has lost its appetite and its activity, there is established in it a melancholy and a rapid thinning. Finally, intense enteritis takes place, and death occurs.

If, not carrying experiments to the extremity, we add to food the mineral substances which are lacking in them, appetite rapidly increases, morbid phenomena disappear, and the animal reverts to the normal state, gaining in a few days its primitive weight.

We give the name of *mineral inanition* exclusively to the lack of phosphate of lime, because, with a few very rare exceptions, the other salts contained normally in the economy are found in food in sufficient proportion, and in such a state of solubility that their assimilation does not present any difficulty. There is no one amongst them of which the scantiness brings disorders comparable to those which are the consequence of the lack of phosphate of lime.

To give a good account of the importance of the element of lime, it is necessary to study more closely

the intimate phenomena of nutrition. We have seen above that the existence of nitrogenous substances is connected necessarily with the presence of a certain amount of phosphoric acid, under the form of phosphate, as well in the vegetable as in the animal kingdom. But what has not been sufficiently ascertained up to this time, is that the nitrogenous bodies remain in a liquid state as long as the alkaline phosphates of soda and potass predominate in them. In order to reduce them to a solid state, and permit life to transform them into cells and fibres of every description, it is necessary that the calcareous element, under the form of phosphate, should render them insoluble.

We thus are able to understand why corn, so rich in phosphates, but especially in alkaline phosphates, constitutes an insufficient food; and why animals experimented on are attacked by inanition if they are deprived of the salts of lime to which they are accustomed, either in mixed food, or, as amongst granivorous animals, in the lime of the earth.

These notions on the position of phosphate of lime being well established, it will be easy to comprehend the progress and the treatment of rickets, of scrofula, or of the various cachexiæ wherein mineral inanition constitutes all the malady.

We can thus interpret the results of its deliberate application to the treatment of various morbid, acute, or chronic conditions, wherein the phenomena of denutrition intervene to an important extent.

Let us remember that the milk of woman, in her first days of suckling, ought to contain nearly 2·50 (nearly $1\frac{2}{3}$ dwt.) of phosphate of lime per litre;

below this number it becomes too weak. Later on this proportion diminishes in a notable manner, and at this time mixed food ought to fill the deficiency. The milk of herbivorous animals is constantly far from this figure, which constitutes one of the principal causes of the inferiority of artificial suckling. As for the foods other than milk, which are given too often to newly-born infants, either they are poor in the salts of lime or they resist the action of the stomach, which is yet weak, and are rejected without being digested.

In fact, in a large number of cases, children issued from syphilitic, tuberculous and scrofulous parents, or those weakened by various affections, are born in a state of weakness of every organ, so that they cannot even normally extract from their food, even if (it be) normal, the quantity of phosphate of lime necessary for their development. Whatever may be the cause, the child who for any one of the causes expressed above, does not assimilate a sufficient quantity of phosphate of lime, becomes rapidly a victim of that state which we have called mineral inanition.

At the commencement of this morbid state, the soft tissues, finding always in the skeleton a certain quantity of phosphates, borrow to maintain the functions of nutrition ; and if the bones soften instead of developing, the weight of the body does not diminish, and the external signs of health are maintained for some time. But this resource is soon worn out, the softened bones become deformed and inflamed, the tissues become limp, and the limbs emaciated ; the digestive juices, too poor to accomplish their functions, permit the food contained in the stomach to

undergo alterations that transform it into an irritating substance. Under the influence of this, the intestines are inflamed, the belly swells, and if a doctor does not interfere in due time, the unhappy little being expires in a state of absolute cachexia. This evolution sufficiently accounts for the pains suffered in all the members, the horror of sick men for movement, and all the phenomena described by authors, and of which the description cannot here be given.

At a more advanced age, amongst adolescents submitted to the influence of some hereditary disease, too great fatigue or various excesses, we may see, especially when they traverse a period of growth too rapidly, and do not receive sufficient food, the manifestations of mineral inanition occur; if the troubles which we have observed, appear at a more advanced period of evolution, they will show certain modifications which ought to be expected. Amongst sick persons the same indifference is shown for movement, and for all the persons around them. Paleness, general softness of tissues, and loss of appetite, are also to be observed; there is, in one word, nearly complete arrest of all the functions of nutrition. The bony epiphyses become painful and enlarged; white swellings are not rare; but the bones, though less cartilaginous, do not curve more, as in the first age. We must not forget, nevertheless, that it is at this date especially that there may be observed scoliosis and various spinal deformities.

On the other side, the ganglia, swelled with nourishing juices, which the lack of calcareous salts render incapable of organization, inflame and suppurate; the teeth decay and fall out.

Mineral inanition taking place in the adult, under

the influence of misery or of sickness, also presents some peculiarities worthy of notice. The weakened bones are not deformed, but their more brittle substance predisposes them to fracture. The complexion becomes earthy, and slenderness makes rapid progress. It is to the adult age that a form of cachexia may be assigned, which happily is very rare, to which the name of *osteomalacia* has been given, and which certain women, predisposed by an hereditary vice, reach after repeated gestations.

What takes place in all these cases if a sufficient quantity of assimilable phosphate of lime is given under the form of lacto-phosphate of lime?

The action of the drug is double. Firstly, when introduced into the stomach, it acts on the foods with which it becomes mixed, and assures their digestion. This is a first cause of the disappearance of diarrhœa, often due to the irritation which is caused by badly digested foods.

In the second place, phosphate of lime penetrating into the circulation with the nitrogenous principles of food, combines with them, and permits them to take, under the influence of vital forces, the form of cells and of tissues of every kind. This originates the desire for new foods destined to replace those which are fixed in the economy. Finally, a part of the calcareous salt is carried into the skeleton, and gives to the work of ossification a new impulse.

Also, when we have to deal with a rickety patient, or an adolescent subject of arrest of growth, we see in a very few days the appetite reappear, the digestions become more easy, and the diarrhœa disappear. At the same time, the muscles are strengthened, the

bones are made upright, and cease to be painful. The moral and physical inertia disappear, and give place to a desire of movement often remarkable, and a turbulence that surprises those who give the medicine for the first time.

The development of teeth retakes its course, renders mastication more complete, and contributes on its own part to the amelioration of digestive functions.

Amongst lymphatics, the nourishing juices organize themselves to the extent of their elaboration, cease to engorge glands and tissues, so that these reassume their firmness, whilst the first find their normal volume. If already suppuration has attacked them, the impulse lent to the acts of nutrition brings a rapid and solid reparation.

We see, in fact, that this picture, summing up the effects produced by the administration of lacto-phosphate of lime, has nothing in it fantastic or exaggerated. We only give here some of the facts accumulated at present by thousands, and observed in all countries by the most experienced physicians.

OBSERVATION I.

(*Hôpital Saint-Lazare.—Reported by Dr. Paquelin, ex-Interne.*)

The following is the exact pathological tableau offered us, on the 14th June, 1869, by Clémence Marie Joséphine Gr——, aged three and a half years.

Habit of body.—One would hardly give her two years, as she is so thin and puny; everything in her indicates exhaustion and suffering persisting for a long time; the countenance expresses depression of strength and pain,

The cutaneous envelope is of nearly waxy pale colour. The eye is heavy and dull, anxious and suspicious; the pupil is largely dilated, the sclerotics bluish. The head is enormous compared to the rest of the body, but it is developed transversely; one would say it was flattened from above downwards; the anterior fontanelle, largely open, is very soft; the forehead is projecting; the part of the scalp which corresponds to the occipital protuberance is bald; the rest is covered with diseased hair, thin and not brilliant.

The belly is so large that it falls over the thighs, of which it covers all the superior parts, and is separated from them. The result of this is that the child is unable to keep up its underclothing, which is fastened to the waist with strings.

The clothing, as soon as the child is laid down, slips to the armpits. I have mentioned this point to give an idea of the obliquity of the line of the sternum, of which I shall speak presently.

Skeleton.—The limbs, all deformed, are in a most complete state of flexion and of mobility; if the least pressure is made, they bend like a sheet of lead, being so soft and thin. Moreover, they are very painful, and cannot be touched without the child crying.

The radius and ulna, the carpian extremities of which are knotted, present a curve with its convexity on the outer side.

The knees, which are swollen, would be drawn inwards in contact with one another, were it not for the great separation of the upper part of the thighs caused by the size of the belly. The legs are strongly thrown outwards; the soles of the feet are directed obliquely outwards and downwards, so that when the foot of the child is placed on the ground, it rests on the internal border of the tarsus.

The femurs and the tibiæ are also deformed; but it is principally at the thorax that the deformity is most

marked, owing to the modifications that the curvature of the ribs underwent. What first strikes the attention are five protuberances, which correspond on the left side to the chondro-sternal articulations of the five last ribs (rickety chaplet) ; then there is the lateral flattening of the thoracic cage and the projection of the sternum in front.

The result is a considerable diminution of the transverse diameter of the chest.

The vertebral column, although slightly affected, has not escaped. We find at the lumbar region only, a slight gibbosity, caused by the projection of the spinal apophyses. I have nothing to say either of the scapula or of the pelvis.

Let us now examine the principal functions of the economy.

One would say that the life of the child is concentrated in the brain. The intelligence, in fact, is very much developed; although she does not speak, for she can scarcely utter a few words, which are intelligible only to the mother, she knows perfectly how to make herself understood.

Her eye and her ear, always on the alert, lose nothing of what passes around her. She appears to observe everything, studies everything as if to profit by it. She forgets neither the persons nor things that she has seen. One day she heard the cries of a woman to whom the actual cautery was being applied ; since then she never would return to the ward whence these cries emanated, and she hid herself crying in the arms of her mother when she perceived the operator.

Motility.—Sensibility.—The deep changes that had taken place in the skeleton indicated that all locomotion was impossible. The child could not only not walk, but she is unable to undertake the slightest motion ; her arms are the only active parts. Where she is placed in her bed in the evening, there she is found the next morning. She has

neither the force to sit up nor to move her head, which rests constantly inclined on the left shoulder. This complete immobility is due, on the one hand, to the rarefaction of the osseous system, and to the pains which she feels on the slightest movement; on the other hand, to the general atrophy of the muscular system. Thus she remains all the time lying in her cradle, or in her mother's arms.

Digestive apparatus.—Teeth: This organic misery is kept up, I may say increased each day, by the bad state of the digestive tube. The teeth, of which the greater part are decayed, shake in their sockets; the gums bleed on the slightest movement of the jaws; mastication is impossible. The appetite is nearly lost, and the little nourishment which is taken is badly digested. Diarrhœa is frequent, the urine is highly loaded: the child disassimilates and does not assimilate.*

Respiratory and circulatory apparatuses.—The deformity of the thoracic cage explains the phenomena which take place in the lungs and in the heart. The respiration is difficult, anxious, the child utters the few words that she can pronounce by sudden jerks, and through the nose. When she coughs, the face turns blue with the greatest facility. The apex of the heart raises the chest with violence; the pulse is so frequent that it can hardly be counted. The skin has a heat nearly febrile, and is covered each night with profuse perspiration.

Such was the state of the little patient when I began to treat her. It was, I repeat, on the 14th of June, 1869: I weighed her on the same day, which was a Monday, at nine in the morning. She weighed 8 kilos 200 grammes. I suspended the treatment (wine of cinchona, cod-liver oil, and dry frictions on the body) to which she was submitted by Dr. Boys de Loury and my colleague, in order to see

* We shall see further on that she loses her weight daily.

what she was going to gain or lose in being left entirely to nature.

On the Monday following she was weighed again, at the same hour and with the same clothes, as has been practised for all the other weighings. She weighed but 8 kilos 170 grammes; she lost therefore 30 grammes.

It would have been interesting for me to continue this experiment one or two weeks longer, but the state of this child became so disquieting that I immediately submitted her to the treatment of the lacto-phosphate of lime, recommending the mother to give her to eat every time she asked for it.

It was on the 21st of June; she received each day three dessert-spoonfuls of syrup, which represents 1·50 gr. of lacto-phosphate of lime each day, and thus during all the time of the treatment.

I am going to give immediately the successive weighings; I shall then indicate in detail the different changes which took place in this little organism so diseased, according as the lacto-phosphate brought the necessary materials for its reconstitution.

(See synoptic table on next page.)

Dates.		Weight.	Observations.
1869. June 14 - - -	8 k. 200 g.	Loss 30 gr.	Without treatment. From the 21st of June the child takes 3 dessert-spoonfuls of lacto-phosphate of lime daily.
21 - - -	8 170	Gain.	
28 - - -	8 450	280 gr.	
July 5 - - -	8 545	85	
12 - - -	8 645	110	
19 - - -	8 730	85	
26 - - -	8 830	100	
August 2 - - -	8 880	50	From 16th to 23rd stools copious. The belly has considerably diminished.
9 - - -	8 955	75	
16 - - -	9 080	125	From 23rd to 30th of August and from 30th August to 6th September, the belly increases and diminishes alternately.
23 - - -	9 090	10	
30 - - -	9 200	110	
September 6 - - -	9 460	260	From 6th to 13th of September there has been slight catarrh, together with loss of appetite.
13 - - -	9 500	50	
20 - - -	9 810	300	

In ninety-two days of treatment, there has been a gain of 1,640 grammes, or a daily average of 17·92 gr.

The first effect of the administration of the phosphate of lime was to rouse the appetite which was lost. From the second day, the child obliged its mother to rise several times during the night to give her to eat. I knew this effect of the lacto-phosphate of lime, and I was not astonished. What surprised me, was the rapidity with which the strength returned in this little patient nearly dead. One would have said that she moved under the influence of electric currents. In fact, during the time the digestive functions received their salutary impulse, the following phenomena occurred on the side of motility.

The child, who until then could not execute any movement, began on the third day to give to its head sideward movements. The vertebral column participated in this movement, which soon became more pronounced. At the end of the eighth day she got up alone in her bed, and moved her legs about as if she wished to walk. She would not remain any more in her mother's arms, and wanted every moment to put her feet to the ground, but her strength betrayed her desire.

However, at the end of the third week she was able to stand up, with the back supported against a tree. I entered the courtyard of the hospital at that moment; the mother gave expression to such cries of joy that I thought she was mad; her child walked, or rather was soon going to do so.

The strength increasing daily, each day the child tried to walk, the mother supporting it either under the arms or by the hand, or the child supported herself by the objects she met with.

But until the 15th September all its efforts had no other result than to strengthen its vertical position.

Not that its bones were not sufficiently resisting to support

the weight of the body, nor is it that the muscles were not sufficiently strong to move the skeleton, but the profound deformity of the osseous system, which is repaired but slowly, is the only cause which opposes itself during a sufficiently long time against locomotion.

Finally, on the 16th of September, Clémence M. J. Gr—— ran alone a distance of two metres, in holding on to one of the benches in the courtyard.

On the 27th September she weighed 9 kilos 910 gr., and had gained 100 grammes more. Some days after the weighing, an intense bronchitis declared itself, with complete anorexia, and the child kept its bed. On the 11th October, all the morbid phenomena having disappeared, she is again brought to the scales, which showed a loss of 510 grammes in her weight, although the syrup was not discontinued. At this moment the improvement in the general state is manifest; the appetite is very sharp, and on the 25th she weighed 10 kilos. She had therefore gained 600 grammes in a few days. During this indisposition, which lasted from the 27th September to the 11th October, the little patient had lost in weight; but we have discovered this interesting fact, that the strength had not sensibly diminished.

From this moment, we can consider our observation as complete.

Let us then take, one by one, the different heads under which we had examined our young patient, and let us compare what she was on the 14th of June with what she is to-day on the 16th of September—that is to say, just three months after.

The features of the child indicate health and life: she is rosy, gay, and smiling. If sometimes she has a slight sulky appearance, it is not that she suffers, but because her caprices are not quickly satisfied. She is so much in the habit of being spoiled by everyone that she has become very exacting.

The eye is animated, the pupil normal, the sclerotics have lost their morbid character; the skin is not so pale as it was.

The form of the head has undergone a complete metamorphosis: from being transversely flattened, it is now quite developed in the vertical direction. The greatest diameter has become the smallest, and *vice versâ*. One would say that the head has been remodelled. The frontal line, from being curved, has become straight. This change in the development of the bones has given to the face an expression altogether different, so much so that the persons who had not seen this child since a long time can hardly recognise it. The anterior fontanelle is nearly filled up, the hair has grown in those parts that were bald; those that were diseased are thickened and have become brilliant. The belly is diminished to more than half the size, at the same time the distance between the thighs is also reduced. The legs are thrown less outwards, the foot can be placed flat on the ground, the protuberances in the front of the chest have disappeared, the chest has assumed its normal configuration. The ensiform cartilage turns in very remarkably towards the vertebral column. The transverse diameter of the chest is considerably increased; the lumbar gibbosity is attenuated. The child has grown a good deal, its clothes are now too short.

She begins to pronounce a few words, and articulates them perfectly.

I have spoken at length of the muscular system, I shall not refer to it again. I shall only add that the members have increased in size, and the muscles are firmer. She does not experience the slightest pain when she moves or when touched.

Her teeth are solidly fixed in their sockets, the gums do not bleed; the child devours, and can well masticate her food.

The diarrhœa has ceased, the stools are regular, the urine limpid; she gains in weight every day. The average gain of eighty-two days of treatment is 17·92 gr. per day.

If we cast a glance over the table of weights, we shall there see that in the first week only, the child's weight increased to 280 grammes, which fact indicates how necessary reparation was; thus the activity of assimilation in the first days was accompanied by considerable elevation of the temperature—the skin was burning hot. The respiration is free, the speech is neither nasal nor jerky. The pulmonary circulation is easy, the cardiac impulse less strong; the pulse has lost its frequency; there is no more dyspnœa, no more palpitations, no more night-sweats.

The cutaneous functions are regularly accomplished; the skin is supple and moist; if the temperature rises sometimes, it is due to the work of assimilation of which I have already spoken. To sum up this case, I should say that Clémence Gr—— required three months to be restored; in this interval she gained 1 kilo. 660 gr.; her health is henceforth ensured.

This transformation, which I can call resurrection, so rapid has it been, was accomplished under the eyes of Drs. Boys de Loury, Clerc and Courot, and of my colleague M. Sarrot, who, like myself, had followed, day by day, with greatest interest, the restoration to health of Clémence M. J. Gr——.

OBSERVATION II.

(Collected by Dr. Riant.)

We were consulted on the 3rd March, 1868, for a little girl, aged twenty-six months. She was only suckled for two months. A feeding-bottle was given to her for some time, and then a mixed food, whereof flour formed the principal element.

This child has its aspect sad, and its eye dull; it does not play, and never laughs. When it is placed upright, it throws itself on its face and cries. It cannot be taken up, nor can its arms be held, without provoking tears. It has, as yet, no teeth. No diarrhœa; the fontanelles are not ossified. The chest is pigeon-breasted, rounded in front, and flattened on the sides. There are pronounced ridges on the ribs, and the breathing is gasping. The extremities of the long bones, especially the upper ribs, are very large. There is acute pain in the direction of the curved fore-arms.

We gave it syrup of lacto-phosphate of lime in the dose of three dessert-spoonfuls every day, at the same time that we have prescribed the lacteal regimen. On the 4th May, we observed an amelioration in the general state of the child; the appetite is lively, and the physiognomy animated. The treatment was continued. On the 29th May, the child had not ceased to take the syrup of lacto-phosphate of lime since we saw it for the first time. She is cheerful and gay, walks and plays. There are no more pains in the direction of the bones. The swelling of the wrists has diminished, the fontanelles begin to unite.

June 17th.—General state normal; the child has cut a few teeth, and its improvement continues.

In this case we have to deal with a child obviously rickety, and the necessity for calcareous salts is evident. We have given the preference to the lacto-phosphate of lime of Dusart, because we have been able to ascertain by physiological experiment, which we have a great many times repeated with the author, and by the results obtained in our practice on a large number of children, that under this form the calcareous salt may be rapidly assimilated, and that a remarkable and wholesome activity is given to the nutrition of the osseous system. Under the influence of lacto-phosphate of lime, we have seen the bones consolidate rapidly

when a physical lesion has taken place from external causes, as fracture, or from an alteration produced by nutrition, such as rickets.

OBSERVATION III.

(*Collected by Dr. Riant.*)

F——, aged two years and a half, has been nourished on the feeding-bottle. When we were consulted for the first time (26th February, 1868) it was extremely weak. Incapable of holding itself upright, the child let itself fall on the carpet whenever it attempted to pick itself up. Head voluminous, fontanelles still very apparent, impetigo of the hairy surface, extremities of the long bones very much swollen. Pain in the bones on pressure. Deviation of the lower limbs into an X; the left leg is very much thrown outwards. There is no apparent alteration of the vertebral column, nor lateral depression of the thorax; the belly is voluminous, and there is a complete absence of appetite. Treatment by syrup of lacto-phosphate of lime. Dose, three dessert-spoonfuls per day.

Seen again 2nd March. There is slight amelioration, the appetite is much developed. The same treatment was pursued: tonic foods, salt-water baths, cod-liver oil.

April 28th.—The child holds itself upright, and begins to walk. The swelling of the bony extremities is less noticeable, and pressure on the bones is no longer painful. The treatment is continued.

May 12th.—The child, to whom we have carried one of Dr. Bouvier's apparatus, remains upright, and runs all day. It was taken to the asylum.

June 10th.—The child progresses better to better. The treatment has been continued during two months.

In September, 1868, it was attacked with measles. The eruption was bad, capillary bronchitis supervened, and the child died.

OBSERVATION IV.

(*Collected by Dr. Riant.*)

As doctor of the Mutual Aid Society of the eighth arrondissement, I was called to attend young C——, living at Sauffroy Passage, in the Batignolles. The child, aged three years, had been attacked for two months with looseness of bowels, which weakened it. The little food it took passed at once into the evacuations.

Emaciation being carried to the last point, the skin literally floated around the limbs. The face was sad, the sclerotics of a bluish-white, the pupils enormously dilated, the crying continual. The child is not able to hold itself on its legs, and must be carried all day. It has not ceased to cough for two months. At the auscultation, strong mucous *râles* spread over the whole extent of the throat; pulse imperceptible. This was not a sick, but a cachectic individual at the moment when it was confided to us. After having warned the mother of the danger that her infant ran, we thought it right, seeing the gravity of the situation, to employ at the same time all the means possible to alleviate, if practicable, the forces of the little sick one. We immediately prescribed the administration of raw meat, prepared according to the formula of Dr. Trousseau. At the same time, we gave to the infant two dessert-spoonfuls of lacto-phosphate of lime.

The sick child, who would not take anything before, drank its syrup with pleasure, and threw itself with avidity on the raw meat. We continued this treatment and this medicine for a month. Then the *conserve* of Damas was useless. The child had so much liked the raw flesh that it stole scraps of beef, to eat them without being cooked. Since the beginning of the treatment the diarrhœa ceased, the thinness diminished, the cough was less frequent, and the strength came back.

We continued the syrup of lacto-phosphate of lime during six months, suspending it from time to time for a week. Under the influence of this treatment the amelioration could not be contradicted.

We consider the use of raw meat, accompanied, or rather preceded, by the lacto-phosphate of lime, as an heroic remedy in this case of extreme debility, in the convalescence of grave maladies, and, in one word, in the conditions where the formal and pressing symptom is the demonstration of the activity of organs, and the necessity for supply to the sick person of a food easily and promptly assimilable.

OBSERVATION V.

(*Collected by Dr. Riant.*)

We were called in February, 1868, to Courcelle ... ee young A——, aged five years. He was the fifteenth child of Madame G——, who was then suckling her eighteenth.

A—— was fed from the breast during ten months.

Madame G—— told us that her daughter had always difficulty of breathing, gasping with access of suffocation from time to time, and with frequent fainting. A—— has the size of a child of three years; the skin is of a livid pallor; the head is very voluminous; the frontal bosses, very prominent, appear to be more so, by reason of the disposition of the anterior fontanelle, which forms actually a median channel cut out between the two parts of the frontal bone.

The chest is globular, but without marks on the ribs; the feet equine; the legs extremely thin, with an absolute impossibility to preserve uprightness. The child only made a few steps before us when it had to support itself alo- g the walls by attaching itself to the furniture. The bust is thrown backwards, in order to avoid a forward fall.

During two years the child had been an out-patient in the hospital of the Rue de Sèvres; frictions had been made on

its lower limbs with aromatic wine, and it had been given syrup of iodide of iron.

We administered to it the syrup of lacto-phosphate of lime in the doses of three dessert-spoonfuls every day at meal-times.

On the 15th March the child, whose appetite had become very sharp, had the face coloured, and the physiognomy animated. It began to descend the staircase, aiding itself with the hands, and it ran to play in the court of the house. The gait was always indecisive and very imperfect, by reason of the state of contraction of the posterior muscles of the two legs. Oppression notably less. The syrup was continued in the same doses, and cod-liver oil was added to it.

On the 3rd April, the child had increased 5 centimetres (nearly 2 inches). Its respiration is much more free. Its appetite is very much developed, as amongst all those persons to whom we have given lacto-phosphate of lime.

The parents left the infant accordingly without treatment during a month.

On the 17th May, the first symptoms, oppression and anhelation, are repeated; the mother came to tell us to recommence the treatment.

The syrup was afresh given to the child.

On the 18th June, a notable amelioration is produced since we saw A——. Its respiration was easy, and not made with the mouth open. The general state being excellent, we advised the application of Bouvier's apparatus, and the continuation of the treatment.

In this case the emaciation, the absence of muscular masses, the excessive weakness, the gasping respiration, the incomplete movements of the thoracic cage, of which the levers were not deformed, but which wanted the muscles to move them—all this proves that the bony system was not alone injured, but that the general nutrition was affected, and for

this purpose the alimentation had been sufficient. It was one of those cases wherein it appears that the organism is unfit to use the materials that are before it. The lacto-phosphate of lime, which has appeared to us the most appropriate vehicle, and the most constant in the effects of the mineral elements destined for the nutrition of bones, is used in this case as a manifestly great exciter of general nutrition, and one of the most powerful adjuvants of tonic and reconstitutive medicine.

Each time that cod-liver oil is administered it may render such useful services, both in the infant as in the adult. We have ascertained how advantageous it is to give concurrently cod-liver oil and lacto-phosphate of lime. The aperient qualities of the lacto-phosphate permit us to administer cod-liver oil in a more regular manner, more continuously and in higher doses, which is more tolerable and easier assimilable.

OBSERVATION VI.

(*Collected by M. le Dr. Blache.*)

X——, aged six months, son of well-nourished parents, was sent to nurse after the day of his birth. Under the influence of insufficient nourishment the child rapidly wasted. Its limbs became thin and slender; the skin was loose, and the face exhibits those wrinkles which recall the signs of old age. The belly is deformed, painful to the touch. No deformation of the chest, no ring on the ribs. The child accepts the food presented to it, and digests it. When an attempt is made to pick it up and keep it upright, it utters plaintive cries and retracts its legs on its belly. Lying on its back, it again stretches forth its legs over its belly, and they are replaced with difficulty. When extended they return at once to their first position.

I prescribed every day six teaspoonfuls of syrup of lacto-phosphate of lime, to be administered thrice, at the moment

when the child was offered to drink from the cow's milk which I had added to the food of the nurse, who did not furnish the sufficient quantity of milk. At the end of ten days I found the child in the arms of its mother, upright and straight. It did not complain of pain in touching the limbs, and maintained its legs stiffened out when it was placed in the cradle. The volume of the belly had considerably diminished, the face had reassumed its colour, and the features were animated. It was transformed and scarcely recognisable.

Towards the twelfth day I observed on the face and on the back an unimportant furuncular eruption. The appetite had become very great. During three months I continued the syrup, diminishing the dose by half. It is at present in a state of perfect health, which has not been once disturbed.

OBSERVATION VII.

(*Hôpital des Enfants Assistés.—Reported by M. Tardieu in the Wards of Dr. Parrot, Sub-Professor of the Faculty of Paris.*)

PROFOUND CACHEXIA IN A CHILD OF THREE YEARS OLD.—PEMPHIGUS.—TREATMENT BY DUSART'S SYRUP.—CURE.

The child which is the subject of this observation is aged about three years, of unknown parents. On her admission into hospital she was in such a state that she was expected every moment to die. It was then noticed that the child was affected with pemphigus which caused a large sore all over the body. Emaciation was extreme.

There was no hope of saving the child; nevertheless they administered after the first day four dessert-spoonfuls of the syrup of the lacto-phosphate of lime, and at the same time some easily digestible food. About the third or fourth day, to the great surprise of the people of the ward, she

asked to eat. Her appetite is increasing; the lacto-phosphate is continued for a month. At the end of this time the child is in a state which would not permit her being recognised; the pemphigus has disappeared. She was then allowed to go down to the division of the healthy children.

Notwithstanding the cessation of the syrup, the appetite is always excessive, and the child is considered by the people about her as eating a great deal too much for her age.

On the 13th November, about fifteen days after having left the ward, the child was readmitted with a pneumonia of the right side, from which she died. This was verified at the autopsy.

OBSERVATION VIII.

(*Hôpital des Enfants Assistés.—Collected by M. Tardieu. —Service of Dr. Parrot.*)

M——, Josephine, aged eighteen months, received treatment on the 13th September for pneumonia. Towards the 27th of the same month, the symptoms of the malady completely disappeared; but the child, who is very thin, would not accept any food. In order to awaken the appetite, on the 4th October she was given by force, three times a day, at the same time as a little broth, a dessert-spoonful of syrup of lacto-phosphate of lime, and this was continued on the following days. On the 9th the child made no resistance, and ate with appetite the soups that were given it. The 13th, she had recovered all her appetite, and ate nearly as well as children of her age. The 15th, we found her sufficiently re-established to be sent to the country.

OBSERVATION IX.

(*Hôpital des Enfants Assistés.—Attended by Dr. Parrot.*)

G——, Léontine, born the 22nd July, 1867, was directly received as a patient in the infirmary on the 31st August, 1867. Her thinness was extreme; she only took a little milk, in quantity insufficient to maintain life; she thus continued to waste away; and during the whole month of September her condition became aggravated. On the 5th October, there was given to her for the first time syrup of lacto-phosphate of lime. Contrary to what occurs in other children, she only took the syrup with repugnance.

Nevertheless, she improved little by little, and continued in improvement for the following days. On the 9th October the sister informed us that the little invalid had an augmentation of appetite. She took food in a much larger quantity than usual. Her appetite began to increase the following days.

She devoured her food, as the sister said; furthermore, the child is very lively, and the mucus which she had in her mouth had disappeared.

On the 14th October it was seen that the right ear, which was suppurating at her entry into the hospital, appeared to be worse. The suppuration augmented both the following days, and the child died on the 29th October.

At the autopsy we found a tuberculosis of the right lung; the ganglions of the neck, especially on the right hand side, were completely affected.

OBSERVATION X.

(*Collected by Dr. Delzenne.*)

X——, a child of two and a half years, son of a wandering artist, and confided to the wife of a labourer, was healthy up

to December, 1868, an epoch at which he was attacked by a bronchitis which was cured after three weeks' duration, but only disappeared by leaving behind it a general grave state.

The child, in fact, had lost its appetite, and a very strong diarrhœa had made it rapidly waste away. The flesh was pale and limp, the belly swollen and painful. I only prescribed for the sole remedy a syrup of lacto-phosphate of lime in the doses of three dessert-spoonfuls a day.

At the end of three days the foster-father informed me that the child was much better. I remained for three weeks without seeing it, and I found it very lively, constantly in motion, the lips pink, the limbs round and very firm; the belly is in a normal state; during all the while, the appetite was insatiable.

OBSERVATION XI.

(*Collected by Dr. Blache.*)

Ch——, a child of two months, was attacked by a very serious and wet eczema, which attacked the whole extent of the lower limbs, the scrotum, and the lower part of the belly. The suppuration is abundant, and weakens the little invalid.

Thanks to a few little local and general means, the affection of the skin disappeared in three weeks, but leaving after it great weakness, with extreme œdema of the two feet.

Called at this moment to combat this general state which threatened the child with an early death, I learnt from the parents that for ten or twelve days all the food has been constantly vomited. A little toast and water is alone given, the only substance which was not rejected. Thus the thinness is carried to an extreme point. For two days the diarrhœa was active, and the child only appears to have a few days to live. I instantly prescribed the repetition of the milk-food in small, frequent and successive doses, and at the

same time a teaspoonful of syrup of lacto-phosphate of lime, carrying the dose of the latter to six spoonfuls per day.

At the first dose, the milk and the syrup were absorbed without the child showing the slightest traces of vomiting, and the first and the second days passed over without the food being once rejected.

This treatment is continued on the following days, and the mother compelled it to absorb a quantity of milk which was every day greater. The sixth day we recorded a considerable increase of appetite, a certain vivacity in the physiognomy, and at the same time the disappearance of œdema and diarrhœa. The stools reassumed their normal colour.

Fifteen days later, we found that the child had reassumed a certain fatness, was lively, full of appetite, and offered all the external signs of health.

OBSERVATION XII.

(*Collected by Dr. Paquelin.*)

Young Fernand G——, aged ten months, is stout and chubby, but presents all the characters common to the lymphatics; his flesh is thin, his lips very thick, and the skin of a dull white without any flesh-colour. This child, brought up by the feeding-bottle, has nevertheless enjoyed up to the present time very good health but for a month; the labour of dentition, very difficult with it, is accompanied by violent and nearly incessant pains. The appetite soon alters, and a diarrhœa occurred which much weakened the little invalid. In vain, subnitrate of bismuth in a large dose, opiates, and raw meat were essayed. No modification took place. I then prescribed syrup of lacto-phosphate of lime, recommending it to be given immediately before meals, in order that it might mix with the food, and intervene as an agent of digestion. After the third day, the child recommenced to eat with pleasure, and the diarrhœa diminished

in a very sensible manner. On the seventh day the diarrhœa had ceased, and the appetite was lively. The child was very gay between the attacks of pain, but these were continuous, and we must not attribute to a modification of this sort the rapid alleviation of the troubles observed.

OBSERVATION XIII.

(Reported by Dr. Malhéné.)

RICKETS AT THREE YEARS.—UNSUCCESS OF COD-LIVER OIL AND OTHER MEDICATION.—DUSART'S SYRUP.—CURE.

We were called, in the course of last year, to treat a child A——, aged then nearly three years. This child, daughter of working people, and in a state next to misery, was a victim to privations which it had undergone in the midst of its family. Of a lymphatic temperament, pale, and without strength, she does not as yet walk. When they attempt to place her upright on her legs, the latter bend under her. The mother, obliged to go and work every day outside her home, finished by giving up the care of this child to her sister, older by four years, who left the little patient seated on a carpet the whole day. Cod-liver oil, salt-water baths, tonics of all kinds, produced no result whatever.

We then had the idea of trying the syrup of lacto-phosphate of lime, and the effect was very rapid. At the end of about one month we observed a very marked improvement in the general state of the child, which already supports herself on her legs with the hands against a chair. The employment of this medicament, to the exclusion of all other, is continued; and finally, after six months, the little patient walked alone, and even went on long errands in the neighbourhood with her brothers and sisters.

Fourteen days ago we desired to see this little girl; so much were we struck with the result obtained, and although

they had stopped the syrup for five months, we found the child so strong and so healthy that we could hardly recognise in her the puny and rickety child which we had seen one year before.

OBSERVATION XIV.

(Collected by Dr. Martin-Damourette.)

RICKETS IN TWO TWINS. — COMPARISON BETWEEN THE EFFECTS OF SYRUP OF DUSART, AND THOSE OF COD-LIVER OIL.

In the first days of 1870, I was called to give my care to two twins in the following conditions:

The father, a dealer in novelties, aged forty-three years, has been phthisical since 1851. The mother, a Spaniard, aged thirty-one years, has had in the space of six years five pregnancies, whereof two are of twins. Since the last accouchement but one, which has given birth to the invalids of which I am going to speak, this lady has herself developed the signs of phthisis.

She is very intelligent, devotes much care to the education of her children, and showed them to me as an inducement to examine seriously an observation of this kind.

The two children, aged two years, could not yet walk. There were some teeth scarcely developed, no appetite, and a meagre appearance. Let us add that since their birth, both had been frequently attacked with catarrhal affections of the intestines or of the bronchiæ.

Neither suffered from diarrhœa or vomiting; the thorax was not deformed; but one of them, less developed than the other, had soft and flexible legs, the belly swollen, and the vertebral column weak and without resistance.

The other only presented loss of appetite, arrest of dentition, general weakness, and impossibility of walking.

To the first I gave syrup of Dusart, three dessert-spoon-

fuls a day. The second took cod-liver oil. All the conditions of hygiene and food were preserved identical in each.

After three months of this treatment had been rigorously adopted, the first, which had become much stronger than his brother, walked early; its teeth grew; its appetite and vivacity had become normal.

The second was found to be better, but only a little. It did not walk yet.

The treatment was kept up for two months. Then the events of the terrible year 1870 produced the departure of the family, which I did not see until the 1st July, 1872.

At this date, the children, aged four years, presented themselves under conditions diametrically opposed to those of the commencement. That one which was then the weakest, and to which the syrup of Dusart had been prescribed, is now by far the strongest, and nevertheless the treatment only lasted five months.

Wishing to assure myself that there was here not a mere coincidence, but in reality the result of the action of two medicaments of unequal efficacy, I recommenced the treatment, and prescribed the syrup of Dusart to the two brothers.

The result was so clear, and the child who had taken cod-liver oil developed itself so rapidly under the influence of lacto-phosphate of lime, that it was soon equal to its brother. I ascertained this fact on the 1st May, 1873.

I do not think that this observation can leave any doubt on the superiority of action of the preparation of M. Dusart.

OBSERVATION XV.

(*Collected by Dr. Delzenne.*)

Congenital Hydrocephalus.—Use of the Syrup of Dusart. Rapid Cure.

Mrs. Baunes, concierge in the Rue Maubeuge, Paris, was confined in October, 1868, with an infant of the mas-

culine sex, presenting the following peculiarities. All the limbs, the abdomen, and thorax, are normally constituted; the head alone attracts attention by its volume and softness.

From the root of the nose to the posterior fontanelle the bones, instead of presenting their normal relations, are separated by a large membranous band.

All the other functions are regular, and although, after the second day, a vehement coryza had declared itself, the child never ceased to suck with real voracity. In spite of that, in spite also of the absence of diarrhœa, the weight of the body, instead of augmenting, diminished every day. The child wasted, while its head, more and more heavy and voluminous, wobbles in every direction, and provokes at every moment cries of pain.

Finally, on the fifteenth day, the midwife who attended it, wishing to protect her own responsibility, called me, declaring to the relations that no chance of success remained.

At my arrival I was struck with the aspect of this child; whilst the limbs were wasted and fleshless, the head, a soft and nearly fluctuating body, is flattened from top to bottom, and seems to bulge out above the ears. The median separation between the bones of the skull is 4 centimetres (1·572 inches) between the frontals, and gradually increases to the posterior fontanelle. I cannot find, either in hereditary causes or in the hygienic conditions of the mother during gestation, the reason of such a condition.

Whatever it may be, after having given the most sombre prognostic, I applied around the head, to maintain it and to preserve it nearly in the normal form, thrice intercrossed series of strips of sticking-plaister. I prescribed at the same time five or six teaspoonfuls of syrup of Dusart each day.

Under the influence of this treatment, the head had sufficiently diminished in size on the fourth day to induce me to renew the bindings, which had become too large,

The eighth day the movements communicated to the child were less painful.

The fifteenth, at the same time that the general state improved, I noticed a commencement of union in the parietal; the frontal suture was next produced, and after two months and a half of treatment, the posterior fontanelle was itself closed.

January, 1872.—I have seen this child, which is to-day aged three years and three months. It is very brown, of middle size, excessively lively, intelligent, and noisy.

The broad forehead between the rather prominent frontal bosses shows a large depression, a permanent vestige of the lesions which have disappeared, and which may be followed as far as the anterior fontanelle.

The dentition was produced normally, and for three years no sickness has interrupted the regular development of the child.

OBSERVATION XVI.

(*Collected in the service of Dr. Potain, Necker Hospital.*)

Rickets.—Cure.

The woman L——, feeble, sick for some time, entered into the hospital to re-establish at the same time her health and that of her child, and was admitted into St. Mary's Ward, No. 13.

We shall not speak of the health of the mother. As regards the child, aged three months, not yet weaned, it presents, on account of the insufficient food constituted by the milk of its mother, all the attributes of rickets: incurvation of the long bones, especially of the legs, and pronounced swelling of their articular extremities; pigeon-breast, with ring on the ribs much pronounced; head voluminous, falling from one side to another, according to the direction of the body; belly developed.

The appetite is *nil;* the child refuses any other nourishment than the milk of its mother, and is weakened by an abundant diarrhœa.

Four teaspoonfuls of syrup of Dusart per day. A month after, lively appetite; the forces are renewed in a remarkable manner; the child plays voluntarily, and holds the head very straight.

For a moment the use of lacto-phosphate of lime was suspended, whilst the condition of the mother compelled her to wean her infant. Under this double influence the child afresh lost its appetite, and its forces diminished.

The mother then recommenced Dusart's syrup, whereof the administration was followed in a few days by such an improvement, that the child from that time did not cease to develop itself; it walked at the seventeenth month; and, when it left the hospital, it was really fat, its legs were almost straight, the ring on its ribs was scarcely visible, and the general condition was satisfactory in every respect.

OBSERVATION XVII.

(*Collected by Dr. Paquet,* Surgeon of the Lille Hospital.*)

Rickets in Twins.—Comparative Treatment by Cod-Liver Oil and Dusart's Syrup.

Peter and Louisa, twins, aged three years, were born of scrofulous parents.

The head was swollen, there was a ring on the ribs, the

* We here reproduce the note which Dr. Paquet has sent to us on the results obtained by him at the Lille Hospital: 'Twenty-two cases have been placed under treatment by the syrup of Dusart since October, 1869. In all these cases the cure has been obtained in a lapse of time much shorter than with the treatment by cod-liver oil and antiscorbutic syrup. In four cases the curvature of the legs and the deformation of the thorax disappeared in the space of one month. The lacto-phosphate of lime constitutes an almost specific remedy for rickets.' (July, 1872.)

belly developed, the knees inbent, the tibiæ arched ; one of them has already eight teeth, still small ; in the other the dentition has operated prematurely.

The mother showed them to me, asking me my advice on the use of cod-liver oil.

Knowing the researches of MM. Dusart and Blache on the physiological effects of lacto-phosphate of lime, I profited by this occasion to control the results announced, and to compare with the action of the new drug that of cod-liver oil.

In consequence, I prescribed to one of these children 30 grammes of Dusart's syrup every day, and I put the little girl under the classic treatment of cod-liver oil.

I was able to be certain that my prescription was carefully followed.

At the end of a month there was scarcely any change ; but little Peter ate better, and was more lively.

At the end of the second month the difference was so much in favour of the little boy, that the mother absolutely refused to try the experiment further, and declared that she wished to give the syrup of Dusart to her little daughter also, which was done.

The treatment lasted nine months.

After this time the signs of rickets entirely disappeared in the two children.

We have observed a number of analogous cases, and we do not hesitate always, in cases of scrofula and rickets, to prescribe the syrup of Dusart; we gave at the same time several preparations of iodides.

OBSERVATION XVIII.

(*Communicated by M. H. Fremy.*)

ARREST OF GROWTH.—SYRUP OF DUSART.—RAPID CURE.

In the month of October, 1871, M. X—— confided to me the inquietude which he felt at the state of his boy. This

youth, aged eight years, lively and intelligent, very ardent for study, grew very much during the summer, and for two months the relations saw successively disappear the appetite, the desire for movement, and the taste for work, which up to that time had been very pronounced. The child had paled much, and presented soft flesh, at the same time that everything in its looks and in its movements gave token of a profound apathy.

Having proved on myself the influence of lacto-phosphate of lime, to awaken appetite and the functions of nutrition, I advised M. X—— to give it to his boy.

My counsel was followed, and in fifteen days all the phenomena had disappeared, to give place to a normal state of health. Once cured, the child went to pass a fortnight more in the country, and came back to take up its studies with a new strength.

OBSERVATION XIX.

(*Collected by Dr. Martin-Damourette.*)

DEVIATION OF HEIGHT.—GENERAL PHENOMENA.—CURE.

In October, 1870, I was called to Madame X——, Spaniard, aged sixteen years. This young person, born of comfortable parents, had commenced her menses without accident at the age of fourteen years, when I saw her for the first time; she was small, very thin, and without energy. The work of a few seconds was sufficient to tire her to excess. The appetite was bad, and the digestion very slow and painful. In fact, her general state may be characterized in these few words: physical inertia—absolute indifference. Besides, though it was impossible for me to ascertain any lesion on the side of the vertebral column, it was bent laterally, and inclined towards the right side.

I advised the application of a mechanical corset to follow

the trunk, and only prescribed, to elevate the forces, Dusart's syrup, in the dose of four teaspoonfuls a day.

The muscular activity and the appetite were awakened so promptly, that at the end of fifteen days the transformation was complete.

The treatment was continued for three months, after which the little invalid left for sea-bathing, where she passed two seasons in 1871.

At the period of her departure, the vertebral column, less askew, was not yet completely straight; but she nevertheless walked, and standing upright was less fatiguing and might be prolonged without exhaustion.

During the winter of 1871-72, the appetite diminished afresh, but Dusart's syrup picked it up as rapidly as the first time.

OBSERVATION XX.

(*Reported by Professor Martin-Damourette.*)

ARREST OF DEVELOPMENT.—PROFOUND WEAKNESS—DEFORMITY OF THE BODY.—UNSUCCESS OF THE COD-LIVER OIL AND OF RAW MEAT.—TREATMENT BY DUSART'S SYRUP.—CURE.

Near the end of the year 1869, M. X——, of Rheims, requested me to treat his little daughter, aged ten years. This child, prematurely weaned at ten months, has been since affected with diarrhœa of an obstinate character, against which all the efforts of Dr. H—— proved ineffectual; the young patient was so thin and weakened that her weight was the same as that at ten months, the period at which the illness began.

I prescribed the use of raw meat, and was fortunate enough to obtain in a short time a complete cure.

I had since lost sight, of this child when she came with her father to consult me in August, 1871.

We may note, by the way, that the father is the subject of several periostitic tumours of a scrofulous nature, and that the mother presents all the characters of the most pronounced lymphatism.

As to the young girl, aged thirteen years, she is tall, thin, fair, the countenance without expression, her demeanour negligent, and the father informed me of the absolute repugnance she has for every sort of food, and the horror she has to move. She is apathetic and indifferent to everything around her.

The vertebral column is deviated laterally, without it being possible to discover any lesion of the vertebra.

After having applied, to support and straighten the body, a mechanical corset, I advised the use of cod-liver oil.

This, unwillingly accepted from the beginning, is discontinued after fifteen days of perseverance, but without effect.

I replaced the oil by raw meat and Dusart's syrup. This regimen is followed for fifteen days more; then the invincible repugnance of the patient for raw meat compelled her to give this up also. Dusart's syrup then constituted the entire treatment; but owing to its action, the impulse communicated to the functions of nutrition sufficed to increase in a short time the appetite and the strength.

Two and a half months after the commencement of this treatment, the menses appeared for the first time without any difficulty.

Since then the general state has not ceased to improve, the strength and appetite continued; and if on the 1st January, 1872, the deviation of the spine still persists, and necessitates the support of the corset, walking, even prolonged, is easy and does not cause any more fatigue.

On the 20th April, 1873, Mademoiselle X—— is now a young lady, perfectly constituted, bearing no trace whatever of the affection of which we have first spoken.

OBSERVATION XXI.

(*Collected by Dr. Lannelongue, Surgeon to the Hospitals, Professor Agrégé at the School of Medicine.*)

Pott's Disease in a Child of Twelve Years.—Cure by the Syrup of Dusart.

We know how certain morbid phenomena of the interesting period of life termed adolescence are vague and indeterminate.

If, among the troubles proper to this age, we limit our observations to those which have for seat the locomotor system, and which stop before having attained the degree which is reached by clearly defined ailments, may we not expect to find phenomena that it is possible for us to follow with certainty in their physiological evolution?

Professor Gosselin has called our attention already to the influence which the development of the skeleton, joined to some slight determinate cause, exercises on the production of maladies proper to adolescence.

It is at this moment, actually, that a large number of the parts of the skeleton pass from their cartilaginous into their bony state, and take their definitive consistency. To obtain this, there is a great and hard labour, and a real physiological irritation.

There exists no morbid substance that does not show, at this time, an augmentation of this irritation under the influence of the slightest cause. This labour takes a physiological character. This is often moderate, but if the territory is prepared by the bad constitution of the subject, it may become more intense.

Nothing is more frequent than to encounter these lymphatic temperaments, tired already by the work of growth of all parts of the body. Amongst these the

troubles of nutrition, especially of the skeleton, give place to various symptomatic variations, from the spontaneous or induced pain of exaggerated function to the more or less lively inflammation of the skeleton, and of its attached parts—periosteum, articulations.

If it is of importance to throw aside the determining causes—fatigue, etc.—it is not less indispensable to furnish to the economy the materials necessary for the formation of all the parts, and especially those of the skeleton, of which the enormous mass absorbs the greatest proportion of the calcareous salts brought by food.

When these do not suffice for such an expenditure, and accidents take place in consequence of this deficit, we have remarked that the syrup of Dusart, combined with various medicinal agents indicated by each variety of facts, will still give the most clear and the most precise indications.

Let us cite an example among many others.

A young child had been sent to us at Lille by one of our friends, Dr. Paquet, Professor at the Medical School of this town.

This little invalid complained of a violent pain at the level of its second dorsal vertebra. The pain is augmented by pressure on the spinal apophysis of this vertebra, as well as on that of the third. These two vertebræ are most projecting.

The child had never presented any peculiar phenomena in relation to the sensibility of the lower limbs; nevertheless, it was tired very soon. It was white, lymphatic, and traverses a period of rather active growth. Its state had inspired Dr. Paquet with lively inquietude; he feared the definitive production of a hump. His fear was so far well founded that at the same time that the pain and the dorsal deformations existed in the lumbar region, a modification of the curve was already appreciable. Our colleague had prescribed the syrup of Dusart; we, after a prolonged examina-

tion, which did not leave us without inquietude, resolved to maintain this treatment, and to survey more attentively the progress of the evil.

During four months the child followed our counsels ; the general health was notably ameliorated, and though he took part in all the games of children of his age, we have seen pain decrease in such manner that at the present day it is not affected by pressure on the apophyses of the indicated vertebræ.

These are not projecting ; the lumbar column has retaken its regular curve, and the child is entirely well.

I have been sufficiently happy to arrest by the same method a case of upright coxalgia, especially in Mdlle. M——, bearing one of the most honourably known names.

WOUNDS AND FRACTURES.

In the first observations which have been given, we have called special attention to the phenomena presented by the patients of Professor Dolbeau, and to which we have already made allusion above. We are about to speak of an itching in the seat of the lesion, and in the whole limb, which takes place when the medicinal dose is raised to 6 grammes a day (almost 4 dwt.), disappearing afterwards, and reproducing itself at will, every time that the medicine is given up or retaken. There is here, if we are not mistaken, an evident proof of the activity of the phenomena of nutrition provided by the absorption of phosphate of lime.

It is this power of action, due to the form which we have given to it, which has saved phosphate of lime from the oblivion into which it has fallen, after the

first attempt made in 1855 and 1856 by M. Milne-Edwards, in the service of Professor Gosselin, and some years later by M. Fano.

Although the results announced by these observers were encouraging, the materials which they used—powder of calcined bones and acid phosphate of lime—afforded so many inconveniences and uncertainty in their action, that they have never entered into practice.

§ 1. COMPLICATED WOUNDS AND FRACTURES.

We have only spoken of the reparation of bones attacked with fractures. But after numerous experiments, showing the action of calcareous phosphates on general nutrition and on the formation of tissues of every sort, results may be expected that are not less satisfactory relating to its intervention in cases of simple wounds or of fractures complicated with wounds.

The occasions to prove this are not lacking, and the unfortunate events of 1870-71 have shown us too many of them. These latter cases are also of importance, as they bear relation to subjects as much depressed by moral causes as by inanition.

We see that under the influence of lacto-phosphate of lime, parti-coloured wounds, with abundant and sanious pus, rapidly change their appearance. In a few days they assume a rosy colour, are covered with serrated and scarcely elevated papillæ, often covered with a layer of transparent plastic lymph, forming a sort of varnish; whilst these local phenomena are produced, the wounded recover their appetite, and the general amelioration is as complete as the local transformation.

OBSERVATION I.

(*Hôpital Beaujon.—Ward Sainte-Cécile.*)

FRACTURE OF THE LEFT HUMERUS.—ABSENCE OF CALLUS AT THE END OF TEN MONTHS.—DUSART'S SYRUP.—CURE.

Alexandrine S——, aged thirty-five, of a sanguine temperament, general health excellent, is admitted on the 13th of July, 1867, in Jarjavay's ward, for a fracture of the left humerus (median part), caused by a fall from a second floor. The fracture is comminuted with the complication of an external wound of trifling extent. At the end of four months the formation of the callus did not appear to have commenced, the broken ends of the bone were rubbed together in order to produce artificial congestion. This produced no result, and on the 1st January, 1868, mobility is as complete between the two fragments as on the first day. Up to the 8th of May, the limb, placed in a silicated apparatus, was found exactly in the same state as above mentioned. At this time, the patient cannot raise the shoulder without pain, and feels, when she moves the arm, a crepitation caused by the friction of the broken ends of the bone. The flexion of the fingers is painful.

The patient does not experience any particular sensation in the fractured portion; the sensibility would rather seem blunted.

On the 8th of May, she got at meals, three times a day, a tablespoonful of syrup of lacto-phosphate of lime, representing 1 gramme of the salt, which dose was doubled on the eighth day.

From the first week the patient, whose appetite was good up till then, eats with avidity, and is unable to wait for the hour of meals; she receives in the interval some bread to

soothe her hunger. This surexcitation of the nutritive functions lasted about three weeks; then the appetite returned to its normal state.

From the fifth day of treatment, the patient says she is stronger, and feels the necessity to move; she feels in the legs, in the arms, and particularly in the fractured part, *a sensation of formication and continual pricking.*

At the end of fifteen days she was able to bend her fingers and move them quickly about without pain; she easily raises the arm, which up till then she could not do.

On the 8th of June, after a month's treatment with the lacto-phosphate, the silicated apparatus is removed, and the presence of a callus, already resistant, is detected; in fact, the patient does not, in moving the arm, feel the crepitation between the broken surfaces.

The administration of the lacto-phosphate of lime was continued in doses of 6 grammes per day, and this large quantity of phosphate introduced into the economy has not in any way disturbed the general health.

The sense of formication felt so acutely during the first week is still experienced, but it goes on decreasing. On the 7th of July the apparatus was removed, the consolidation is nearly complete. The patient left the hospital the following day.

OBSERVATION II.

(*Beaujon Hospital.*)

Charles D——, forty-four years, mason, had, on the 1st May, a fracture of the two bones of the right leg, with a wound on the internal side, at the level of the seat of the fracture, on the internal part of the limb. On the 1st June the wound was cured, but the spot was still very soft; the general state was satisfactory, and the appetite ordinary.

On the 3rd June, there was given to the sick person, at the beginning of each meal and three times a day, two

spoonfuls of syrup of lacto-phosphate of lime, *i.e.*, six spoonfuls per diem, containing 6 grammes of salt. After twenty-four hours the appetite is developed, and towards the eighth day it became excessive. The invalid took nourishment between meals; he felt, especially in the fractured limb, a rather lively sensation, which he compared to that produced by electricity and by continual pricking. The skin is coloured, and the sick person felt in his limbs a great strength, which he assigned to the action of the drug. On the 20th June there was a callus observed, that was already resisting. It had still some moveability. The limb was placed in an immoveable apparatus.

OBSERVATION III.

(*Beaujon Hospital.*)

Francis G——, forty-two years, carpenter, entered on 1st March, with fracture on the left clavicle, on the ribs and on the median part of the humerus of the same side, caused by a fall from the second story; lesion of the lungs, subcutaneous emphysema, very dangerous state during many days. On the 22nd June, there was felt in the humerus a commencement of consolidation; the callus nevertheless offered a certain softness. The general state was satisfactory, the appetite excellent. On the 23rd, there was given to the sick man six spoonfuls of syrup of lacto-phosphate of lime, distributed at the three meals. At the end of a week, the general state being the same, the appetite had not suffered increase, but the sick person felt itching in the fractured parts, which went on to increase and became very lively during the first month of July. At the moment he was seized with the desire of walking, and was obliged to get up and walk for a short distance to satisfy the restlessness he felt in his legs. Towards the 20th the state was the same, but the prickings became more feeble.

OBSERVATION IV.

(*Beaujon Hospital.*)

X——, who entered the hospital on the 12th June, 1868, had a fracture of the humerus in the middle portion. He is erect, though very pale; his appetite is ordinary. Since his entry into the hospital the arm is placed in a silicated apparatus, and the formation of the callus follows its normal course. On the 9th July, the apparatus being taken away, it was observed that suppuration had already advanced. Interrogated on the sensations which the fracture manifested, the invalid declared that he had never felt anything like it.

The arm was then replaced in the silicated apparatus, and a week was allowed to elapse before administering lacto-phosphate of lime.

During this time the sick man was interrogated many times; he mentioned every time the same state of insensibility.

The 17th, a spoonful of lacto-phosphate of lime was administered at the three principal repasts, say 3 grammes a day. The 19th, there was a strongly marked augmentation of appetite. Up to this time there was no particular sensation in the fractured portion.

The dose of syrup was doubled on the 22nd. The appetite became excessive; the invalid stated that he felt 'working in the fractured part,' which he compared to itching. The following days the sensation was more lively. The medicine was suspended for four days; all phenomena disappeared at the fifth. The syrup was again retaken in the same dose. The third day after the attack the invalid suffered fresh itching.

These facts are above dispute, and it may be admitted easily that an agent susceptible of provoking

local phenomena of such intensity, at the same time as sleep or the augmentation of the functions of nutrition, may not be without influence on the duration of treatment.

This influence of the medicinal substance on the duration of treatment will be more clearly shown by reading the facts demonstrated by Dr. Paquet, who has made a sufficient number of comparative observations. Nevertheless, we believe that the following facts will not be read without interest.

OBSERVATION V.

(*Collected by Dr. Delzense.*)

On the 5th August, 1869, young Ferry, son of a rich farmer, playing with his brother, had so unhappy a fall that he broke his leg, 10 centimetres (nearly 4 inches) above the ankle. The wounded, aged eighteen years, is of a lymphatic temperament, and a health that is usually good. The appetite is mediocre.

I brought without difficulty the bones to each other, and after having applied an apparatus, I prescribed four spoonfuls a day of the syrup of Dusart.

Three days after the appetite was intense, and persisted until the end of the treatment. I instantly recommended the most absolute repose; forbade the sick man to get up, or to make any movement without my formal authorization.

In spite of the remedies, on the twentieth day the invalid, too young to be prudent and careful, by a violent shove of his body, tore away the apparatus, and put his foot on the ground.

On the twenty-second day I found him up, and leaning strongly on the wounded member. In fear, I made him lie down, examined the fractured limb, and did not find any

deviation. The callus was very voluminous and resisting. I went away, advising him to abstain from any exercise which might affect the results which had been gained.

My advice was not taken, and a month after I met this wounded person, who was able to walk with the sole support of a stick. But I was able to be satisfied with the persistence of the cure.

OBSERVATION VI.

(*Collected by Dr. Dusart.*)

Maurice J——, aged seven years, underwent, on the 8th June, 1867, a fall of 4 metres (13 feet), through the trap-door of a loft. Called to the case, I was able to observe the fracture of the right neck of the femur. The reduction was very easy, and I used no other apparatus than a large splint, to which were attached a number of india-rubber bands, destined to oppose the retraction of the limb, and taking their support in the fold of the thigh and above the malleoli. The child, essentially lymphatico-nervous, is pale, irritable, indocile, and usually without appetite. In a state of health, it is only in the middle of games that he may take a little nutrition. Thus, after the first day, he refused all foods. The next day, I prescribed three spoonfuls of lacto-phosphate of lime, and at the end of twenty-four hours his relations observed a very notable appetite, even after his sojourn in bed.

The results of the fracture are the usual ones; the twenty-second day I commenced to execute a few movements, which, on the twenty-fifth, I extended.

On the 8th July, the invalid was able to rise.

Sometime after, he made on foot a journey of two hours to pay me a visit, without fatigue and without limping. It was impossible to recognise the wounded side, and the child, whereof the appetite was always maintained, enjoyed a fatness which he did not experience before his fall.

OBSERVATION VII.

(Collected by Dr. Dusart.)

FRACTURE OF THE NECK OF THE FEMUR IN A MAN OF FIFTY-FIVE YEARS.—LARGE ANTHRAX ON THE LEFT SCAPULA.—GRAVE TYPHIC PHENOMENA.

R——, hand-labourer, aged fifty-five years, well built and robust, fell from a scaffold; broke the lower extremity of his right radius, and the neck of the femur on the same side, on the 30th June, 1869.

Called to see him, I noticed, besides the existence of the two fractures, that an ecchymosis had extended from the arm-pit to the knee of the same side.

I applied the apparatus prescribed, and gave three spoonfuls a day of the syrup of lacto-phosphate of lime. This advice was not actually followed until the 15th July.

At this date there was developed, at the level of the subspinous fossa of the left scapula, an enormous anthrax. The fever was lively. On the 21st and 22nd there was agitation —three very violent shivers; the appetite is absolutely *nil.*

On the 22nd, the face is earthy, and without expression; the skin of all the body is dry and burning; the eyes are hollow; the lips, the teeth, and the tongue covered with a sooty coat, denoting a condition so grave that the report of the death of the unhappy wounded man spreads in the neighbourhood. I learn that the lacto-phosphate of lime had not been taken, and I administered it at once, two spoonfuls in my presence, recommending strongly the administration of six spoonfuls a day.

This time I was obeyed; on the 23rd the patient had no more shivering, but the general state had not improved.

On the 24th the sick man slept. He ate with pleasure. The diarrhœa, which was abundant, had stopped.

On the 26th, there was no more fever; there was a com-

plete change; the features of the case are as prominent as those which had been shown four days previously. The appetite is enormous; the suppuration of the anthrax is less abundant and well thickened. The wound, as long as 9 centimetres ($3\frac{1}{2}$ inches) and as broad as 6 ($2\frac{1}{3}$ inches), was washed with alcohol, and healed rapidly.

In spite of this grave complication, the fractures were so rapidly consolidated, that from the 18th August, forty-five days after the accident, the sickness commenced to abate. The patient returned to his duties on the 30th September.

§ 2. FRACTURES WITH COMMUNICATING WOUNDS.

To abridge the treatment, to prevent the production of a fibrous calculus by assuring a perfect union, finally, to maintain during the residence in bed, and to produce a satisfactory general state—such are the advantages that may be procured by lacto-phosphate of lime in the above cases.

These are neither the only nor the most important ones, as the treatment of simple fractures is rarely interrupted or followed, by unsuccess.

The action of the drug is especially useful in cases of complicated fracture-wounds communicating with their focus. In these circumstances, in fact, where the patient is found constantly menaced with complications, such as erysipelas, gangrene, diffused phlegma, necrosis, the majority of the modifications of nutrition will always remain insufficient.

Even when grave accidents are avoided, the treatment is so long, and the suppuration so abundant, that the patient breaks down, and remains depressed for a long while after the closing of the wounds. We

may assimilate to these facts the amputations practised on subjects, weakened either by a general affection or by anterior suppuration.

Here it is not merely a localized agent in its intervention that may be observed in phosphate of lime, but a general excitant to the functions of nutrition. The facts observed by Drs. Lacronique, Paquet, Pinel, and Chéron, show us that it facilitates and renders more easy the cure of complicated fracture of wounds, and that it allows to operate with success in maladies where every operation appeared impossible owing to the gravity of the general state.

This is how Paquet, a professor of operative medicine and a surgeon of the Saint-Sauveur Hospital, resumed, in 1878, the results of his first therapeutic researches on syrup and on wine with lacto-phosphate of lime.

The employment of this syrup and this wine appears to me necessary wherever there is a profound trouble of nutrition in any part, or in the whole organization. At the Saint Sauveur Hospital, in the service of surgical medicine, with which I was charged in this town, I have remarked that the use of lacto-phosphate of lime has abridged the consolidation of the callus.

A fracture of the anatomical neck of the humerus had been completely cured in the interval of thirty-two days.

A fracture of the olecranon in eighteen days.

Two fractures of the thigh in fifty-two to fifty-five days.

One fracture of the lower jaw in fifteen days.

One fracture of the leg, with exfoliation and considerable wound communicating with the seat of the fracture, in seventy-two days.

If one compares these results with those that are obtained by patients to whom lacto-phosphate of lime has not been given, we may find considerable divergencies, all to the advantage of lacto-phosphate of lime.

We think that the following case may be referable to these facts, wherein we see an amputation followed by osseous lesions that remain the seats of constant fistulæ, to the day when phosphate of lime effects, with the cure of bone, the closing of fistulæ.

OBSERVATION VIII.

(*Communicated by Dr. Lacronique, Surgeon-General of the Army.*)

OSTEOMYELITIS AND NECROSIS OF THE FEMUR, FOLLOWED BY AMPUTATION. — PROFOUND WEAKNESS. — SYRUP OF LACTO-PHOSPHATE. — CURE.

L——, with a gunshot wound in the thigh. The amputation of the broken limb is necessary for him.

After the operation, an osteomyelitis declared itself in the whole upper part of the femur, with necrosis and issue of numerous *sequestra* by many issues.

Called to him on the 6th October, 1871, I found him much weakened by a long suppuration. From this time to the 9th June, 1872, I have successively had recourse to all the local and general means to combat the evil; all has been without any remarkable result.

I prescribed at that time the syrup of Dusart, commencing by four tablespoonfuls, and afterwards diminishing gradually, so long as the amelioration had made progress.

The nutrition was elevated; the strength revived; the fistulæ closed successfully, and on the 28th July, 1872, the sick man was entirely cured.

In the following observation, phosphate of lime has

first acted so as to ensure sufficient strength to bear the operation, and then to ensure a complete cicatrization of the wound of amputation.

OBSERVATION IX.

(*Communicated by Dr. Lacronique, Surgeon-General of the Army.*)

FUNGOUS DEGENERATION OF THE TARSUS.—CACHEXIA.—RETURN OF STRENGTH UNDER THE INFLUENCE OF LACTO-PHOSPHATE.—AMPUTATION.—RAPID CICATRIZATION.

M. C., aged fifty years, was attacked after eighteen months with a fungous degeneration of all the bones of the tarsus. This patient had lost his appetite since the commencement of this malady, and is now very thin and weak, presenting a characteristic straw-coloured yellow complexion. He evinced an entire repugnance to food of every sort.

Not being able to operate on him in such a state, I prescribed the syrup of Dusart in the dose of three spoonfuls a day on the 13th January, 1872.

The sixth day, the invalid ate without disgust for the first time.

The general state gradually improved; the colour became brighter; the lips coloured, and the thinness diminished.

The operation, which was then thought practicable, was carried out with success; and on the 18th September, the wound of amputation being perfectly cicatrized, I left the sick man in an entirely normal state of health.

We think it useful to call attention to another observation by the same surgeon, because it appears to us very convenient to demonstrate also the influence of the drug on the general state as well as on the bony lesion.

The fact is also interesting as a pathological case.

OBSERVATION X.

(*Collected by Dr. Lacronique, Surgeon-General of the Army.*)

Bobilia, of an excellent constitution, born of healthy parents, did not present any scrofulous or syphilitic antecedents. This man was attacked, without any cause being discoverable for the evil, with a painful swelling of the whole maxillary region of both sides.

The affection broke out on the 20th February, 1872, and rapidly increased. The teeth loosened themselves and fell out; numerous abscesses formed, followed by fistulas, producing an abundant suppuration, and giving rise to bony sequestra. The 20th May, a finger exploring the region did not encounter any appreciable seat of bony resistance.

The invalid, weakened by the suppuration and by the impossibility of nourishing himself, arrived in a condition close to cachexia.

From the 3rd March to the 7th June, I prescribed in vain all the tonics and the general alteratives indicated by the affection and the condition of the invalid. Finally, on the 7th June, I commenced the use of lacto-phosphate of lime in the doses of four spoonfuls per day.

From the fifth day, the appetite reappeared; the invalid took food with pleasure, according to the state of his mouth. Little by little the fistulas became dry, the swelling diminished. In the middle of the general pasty condition of the region, there were felt some resisting points, indicating a commencement of ossification. The lower part of the face retook its normal form, and, on the 15th September, the maxillary being partly rebuilt, and all the wounds closed, I ceased my visits.

§ 3. WOUNDS OF THE SOFT PARTS.

We know with how much difficulty phosphate of lime has been accepted as a remedy for the treatment

of fractures and other bony lesions, such as rickets and scrofula. With such dispositions, it was entirely natural that no one should have thought of introducing it for the treatment of wounds. There were, nevertheless, two good reasons for another course being adopted. In the first place, phosphates, it is not now denied, increase the appetite, stimulate the functions of nutrition, and put the sick man in good general conditions to effect an active reparation.

The second reason is less generally known, and has scarcely now struck anyone but the physiologists. We have developed it in the first chapter of the volume, entitled *Mineral Inanition.*

We wish to speak of the active part that phosphate of lime has taken in the constitution of all the vegetable and animal tissues of a nitrogenous nature. No part of these tissues can be formed without the intervention of phosphate of lime, and this cannot be extracted without bringing about the complete destruction of the albuminoid substances.

Phosphate of lime is less abundant here than in the bone ; but it is demonstrated that the activity of formation of the soft tissues varies with the proportion of phosphate of lime contained in the nutritive sacs ; it is thus not less indispensable. As a consequence of this last fact, we are able to say that in all the cases wherein a wound may be produced, the economical liquids destined for reparation as much as for plasticity contain a greater proportion of salts of lime.

We see, by some examples cited further on, that the administration of lacto-phosphate of lime always brings a double result. On one part, the appetite of the wounded is increased and becomes lively, bringing with

it health and moral amelioration. On the other side, the surface of the wound, rapidly modifying, presents, in place of parti-coloured surfaces, covered with pus of a weak nature, papillæ of a lively red, not much elevated, covered with a transparent lymph like varnish, and only producing a small proportion of pus of healthy nature.

It appears, then, legitimate to affirm that chemical observation has justified on all points the forecasts inspired by the result of physiological experiment.

OBSERVATION XI.

A Large Wound caused by a Shell.—Suppuration of an Unhealthy Nature; General State Bad.—Dusart's Syrup.—Cure.

During the siege of Paris, a young marine, struck by several fragments of a shell, was brought to the ambulance in the Rue de Londres, under the direction of Dr. Chéron. The face, the arms, the thigh were struck in six different parts, but without gravity.

The seventh wound, on the contrary, was more serious. It measured, in fact, 31 centimetres by 18, and occupied the place of the right calf, which was entirely removed by the principal fragment of the projectile.

Continued irrigation succeeded in preventing the violent reaction which one had to fear. But when it was suspended, the entire wound was covered by a slough, the edges of which being grey, furnished an abundant suppuration, sanious and very fetid.

No work of elimination was performed, and, on the other hand, the patient, already depressed by excessive fatigue and the damp and cold of the casemates, remained in a state of stupor and apathy.

The appetite was gone; his strength diminished day by

day : the dark skin, the pinched countenance, made me fear an early fatal termination.

It was then that Dr. Chéron resolved to have recourse to the use of Dusart's syrup, which was given the first days in doses of five to six tablespoonfuls a day, then successively diminished.

From the third day, the patient asked to eat. Since then the appetite, each day sharper, became such that it is impossible to restrict the patient to a fixed number of meals. At the same time the skin is becoming coloured and the patient more lively.

The wound rapidly washed ; the suppuration, from being sanious and fetid, became thick and healthy. It diminished day by day, and, near the eighth, the discharge did not exceed a small liquor-glass.

The slough is detached, and leaves a clean and large wound, of a bright red, the surface of which is covered with fine granulations, and, somewhat velvety, appears coated with a layer of transparent varnish. Since then the cicatrization made such rapid progress that, on the sixty-eighth day, the young marine left perfectly cured.

That which, in this observation, particularly drew the attention of Dr. Chéron, was the rapidity with which the influence of M. Dusart's preparation transformed the general state, whilst the surface of the wound took on another character.

OBSERVATION XII.

(*Communicated by Dr. Pinel.*)

Wound of the Thigh by Explosion of a Shell.—Reunion by Primary Intention.

In the first days of May, 1871, there was brought to the ambulance of the Rue Balzac, which I directed, an artillery-man named B——, a very muscular man, of previously excellent state.

Being at the Maillot Gate, he was struck in the thigh by the explosion of a shell, which had produced a large wound, measuring 20 centimetres in every direction, with tearing of the divided muscles.

The very day of his arrival, I took the hanging strips of flesh and supported them by a plate of india-rubber.

I prescribed, at the same time, syrup of Dusart, in the dose of six spoonfuls a day.

At the end of forty-eight hours I removed the dressing. The shreds had reunited with primary intention.

The fever was moderate, the appetite excellent. The wound looked bright, and the pus was of good quality.

Since this day, the surface of the wound is covered with papillæ of flesh in rows, and not large; the suppuration, although rather abundant, preserved its good quality.

Nevertheless, two cases of erysipelas having declared themselves in the ward, the invalid felt the results, as suppuration appeared to delay itself during nearly half a day, after which it was perfectly re-established.

All progressed well; the wound of the integuments disappeared from day to day. The appetite and the forces of the sick man being maintained in excellent state, indicated a speedy cure, when the regular troops entering into Paris, the ambulance was abandoned, and I lost this invalid from sight.

OBSERVATION XIII.

(*Communicated by Dr. Lacronique, Surgeon-General of the Army.*)

WOUND BY EXPLOSION OF SHELL. — BAD LOCAL AND GENERAL STATE. — SYRUP OF LACTO-PHOSPHATE OF LIME. — CURE.

M. B—— was wounded on the 26th May, 1871, by an explosion of shell, which produced a vast wound in the popliteal space.

From this year to the 10th June, 1872, the cicatrization

had not made any progress. The sick man, weakened by an abundant suppuration, had lost his appetite. He is nearly cachectic.

On the 10th June, 1872, two spoonfuls of syrup of lacto-phosphate of lime were given; later on, I increased the dose to four teaspoonfuls.

On the 15th June, the appetite recommenced, the wound became more open, and the suppuration less abundant.

On the 2nd August, cicatrization had made great progress, the general state was satisfactory, and the invalid suspended the use of syrup.

On the 15th, hospital septicæmia attacked the wound, and destroyed all the result of the cicatricial work.

On the 8th September, the syrup was again taken; the functions of nutrition reappeared; cicatrization began with activity, until the definite cure, which took place on the 20th November.

Here is, at last, an observation, due to Dr. Lannelongue, wherein the action of phosphate of lime has not been less manifest than in the preceding cases. It concerns a child weakened by the abundance of suppuration of a burn, and who has been rescued by phosphate of lime from the most critical situation.

OBSERVATION XIV.

(*Communicated by Dr. Lannelongue, Agrégé Professor, Surgeon to the Hospitals.*)

VERY EXTENSIVE BURN, COVERING THE TWO LEGS, IN A CHILD OF EIGHT YEARS OLD.—WEAKENING BY SUPPURATION.—SYRUP OF LACTO-PHOSPHATE OF LIME.—LOCAL AND GENERAL MODIFICATION.—CURE.

My excellent colleague, Dr. Paul Hybard, called me into consultation for the son of M. de C——, 20, Rue Ver-

neuil. His clothes had caught fire, and had produced, a little more than a month before, vast burns on both legs, which extended on the left from the popliteal cavity as far as 4 or 5 centimetres above the heel, and occupied in surface the two posterior thirds of the circumference of the limb. To the right, the burning, less extended in length, presented the same breadth.

On each side the lesion had attained the third degree, except at the edges, where it was at the second.

The two wounds produced a very abundant pus, which weakened the invalid. He became so irritable that people hesitated to go near him, even to put on his dressings, and he was insupportable to all around him. The digestions were difficult, and the appetite nil, all food being refused. Pressure above the umbilicus, and to the right, developed a rather sharp pain.

My colleague and myself resolved to have recourse to the following methods: 1. Loose dressings, for which we made choice of those made of tow. 2. The general state was elevated by tonics, in the first rank of which was the syrup of Dusart, whereof I had stated the good effects. This drug was prescribed at first in a dose of three, then four, and finally five tablespoonfuls per day.

In a little while we were able to notice a happy modification in general state. The appetite increased; the digestions became easy, and the nervous erethism tended to disappear.

At the same time that the suppuration diminished, we were struck with the change produced on the surface of the wounds, which covered themselves with a firm and grained series of buds, and took a lively red colour.

Having obtained this first success, we were able to transport this young invalid to Neuilly, where the treatment was continued under more favourable hygienic conditions.

Later on, the surface of wounds reduced more and more,

and the general state having become excellent, young C—— left for Belgium with his family, where he finished his cure.

PHTHISIS AND CACHEXIA.

PHTHISIS.

WE have said that phthisis is the manner of death of those of whom the vitality is weakened, either by some hereditary disorder or by individual causes.

Whether we accept the opinions promulgated up to the present time on the nature of tubercle, or whether it is admitted to have been produced by the action of a *Bacillus*, the above few words do not less sum up, from the clinical point of view, the whole etiology of the ailment.

What do we find, in fact, regular and constant in the study of its evolution? Sometimes it is a still young subject that had parents attacked with phthisis; or, weakened by chronic affections, syphilis, scrofula, various cachexies, or poverty, have transmitted a weak constitution. Sometimes it is an adult in whom sorrows, misery, excessive fatigue of the body or of the mind, diabetes, or any other cachexy, have removed all vital resistance. Any occasional irritation, however weak, is sufficient to bring on an attack, to provoke a congestion, or inflammatory exudations. These, thanks to the weakening of the organic forces, instead of undergoing the transformations observed in vigorous subjects, cannot be absorbed. They degenerate into elementary granulations, with a tendency to ulceration, to the gradual destruction of the

lung, and of all the organs successively invaded. If the special action of a *Bacillus* is further admitted, we are forced to recognise that the latter cannot live and reproduce itself except in an organism the victim of physiological malady, the only one capable of constituting a nidus suitable for its development.

Thus, whatever may be the hypothesis admitted on the intimate nature of tubercle, there is one point which remains above all contest: that it can only be born and developed in subjects wherein the organic forces are depressed, and that its progress is arrested by the return of the functions of nutrition to the normal state. Against such an affection, of what value are specifics, even admitting the existence of the *Bacillus?* The question appears to us entirely solved, and especially so in presence of two capital indications which must be complied with before everything.

1. To arrest the progress of organic decay.
2. To revive the functions of nutrition, and to furnish to the economy replacing elements.

1. The first indication is answered by drugs, which in the last few years have been employed to obviate the loss of tissue. These agents lower the temperature, diminish the intensity of combustion, consequently of organic losses. They relate more especially to nervous and irritable patients, and to the periods of fever, during which respiration is null, and denutrition excessive.

We range in this first class cocoa, tea, maté, coffee, alcohol, digitalis, arsenic, etc.

2. In the second class are, firstly, found bitter excitants and aromatics, which revive the energy of the

digestive functions, and favourably influence above all the first act of nutrition. But their action is entirely temporary, and they do not bring by themselves any reparatory elements.

It is not the same with the last substances of which we have to speak, and of which the principal ones act in two different fashions. Firstly, in the stomach, by exciting digestion; secondly, after absorption, in contributing directly to the repair of tissues. Such are cod-liver oil, common salt, lacto-phosphate of lime, iron, etc. Cod-liver oil is a precious drug, of which the double action does not appear to have been generally understood. Too often there has only been seen in it a fatty body, food properly so-called, and we have entirely passed over in silence that series of aromatic *fatty acids* which render it impossible to replace oil by any animal or vegetable fat. This explains to us why the use of oils of the coarsest description, and most repugnant to taste, succeeds better than that of white and colourless oil. Unhappily, oil cannot be taken in any form by a large number of adults; and its digestion is almost impossible for all sick persons during hot weather. It cannot be administered to sick persons subject to fever.

When we have cited chloride of sodium, of which the addition to food has often produced good effects, and iron—combated with exaggeration by Trousseau and a certain number of his pupils, but susceptible of rendering great service to lymphatic invalids, and at the commencement of the torpid forms of phthisis—we have passed in review nearly all the agents that may be mentioned, until the time when will appear our

first essays on the physiological and therapeutical value of phosphate of lime.

What we have said dispenses us from protesting against the specific position in which it has been placed. Let us merely remember that the digestive action of lacto-phosphate of lime permits its use during periods of fever which suspend the secretion of the gastric juice, or during great heats which plunge the entire organism, and especially the stomach, into atony ; in all the cases, in one word, where cod-liver oil is least to be endured.

We have seen, besides, that its action does not stop at the stomach ; and that, fixing in the flesh the tissues of nitrogenous elements with which it is absorbed, it is itself a food, and one of the most indispensable.

It is not, therefore, surprising that among infants, and especially among lymphatics, wherein the faculties of assimilation are suspended, it, with the aid of local agents, and especially of well-chosen food, elevates the functions of nutrition, stops the movements of disassimilation, and repairs the disorders already caused by phthisis at the commencement.

At a more advanced age, especially when phthisis has passed its first stage, the results are necessarily less clear and already more difficult to obtain. Nevertheless, even at this moment, we must strive to remind ourselves of what the best authors have said of incontestable cases of cure.

" Pulmonary phthisis," says James Henry Bennett, " is not necessarily a mortal ailment ; I am myself a convincing proof. It is possible to cure it, and I have cured myself many undoubted cases."

The facts are now too numerous and too well controlled for any doubt to take place, that the organism retaking all its vigour, we may observe the elimination of the foreign body with cicatrization of the wound produced, or its enkysting by a chalky transformation which renders it inoffensive.

In presence of a phthisical person, it is always necessary to repeat the words of Fonssagrives: "Every individual predisposed to phthisis, who passes through a period of thinness, confines himself to chronic phthisis."

And the affirmation of Bennett, already cited: "If a phthisical person can obtain improvement in his general health; if by this he can arrive at sleeping and eating; if he digests well and assimilates his food—the victory is half gained."

It is because they have this belief that clinical physicians, whatever theory they may have adopted, endeavour, by all the means in their power, to raise the functions of nutrition in those who are attacked with the threats of phthisis, and that they use lacto-phosphate of lime as one of the most active agents in the contest against organic decay.

Finally, there is a period of phthisis when all hope should be abandoned. It is that wherein vast cavities are formed, and the surfaces destined for hæmatitis, are notably diminished; at the same time that the blood is charged without cessation with gaseous or liquid septic products. Nothing can check the march of hectic fever. Nevertheless, here even, a doctor can, in certain cases, elevate for a few days the digestive faculties, give a little of working energy to the organism which is depressed, and prolong the illu-

sions of the sick people fatally condemned. It is for this object that he has recourse to forced feeding, with excitants and tonics of every sort; in the first rank of which we find the syrup and the wine of Dusart.

CACHEXIÆ.

What we have said with regard to the 'reconstituents,' and especially regarding lacto-phosphate of lime in phthisis, may be applied to all the affections whereof the progress closely verges on cachexiæ, such as diabetes, albuminuria, scurvy, etc.

We do not insist on diabetes mellitus, an affection the causes and mechanism of which are yet so little known; we here merely repeat that lacto-phosphate of lime has taken an honourable place among all the tonics and reconstituents to which everyday recourse is had to check its career, and to lessen the griefs it brings with it.

It is not so with albuminuria.

We do not speak, as may be understood, of that which is due to a parenchymatous or interstitial nephritis. In this case, albuminuria is a symptom and a consecutive phenomenon. Lacto-phosphate of lime can then only intervene with all the other tonics and reconstructing bodies. On the contrary, whenever albuminuria appears to be the primitive phenomenon, as Gubler has especially studied, the lacto-phosphate of lime intervenes in quite different conditions.

Here, in fact, we may admit with the learned professor of therapeutics, that the blood is overcharged

with albumen, either because its alimentation is too abundant in an absolute manner, or because the forces of assimilation of objects are not sufficient to fix in the tissues the nitrogenous bodies at the same rate as their introduction into the blood. From this is derived *hyper-albuminosis.* In this case, the superabundant albumen is eliminated by the kidneys, which it gradually irritates and renders ill, if the condition last too long a time. There is then found, if no efficacious treatment is opposed, the presence of a secondary nephritis, and the situation will be a hopeless one. But if we have a chance of intervening at the beginning, there is no method which can be put in parallel with lacto-phosphate of lime for the treatment of absolute or relative hyper-albuminosis. It alone fixes albumen in the tissues, and consequently disembarrasses them from blood whenever it is contained in excess by any part.

We do not think that any other interpretation can be given to the cases cited afterwards, and which leave no doubt as to the result of the intervention of lacto-phosphate of lime.

The lacto-phosphate of lime has acted as a tonic in the cases of cutaneous diphtheria on a very sick invalid and in the cases of croup of Drs. Fillean and Riant. May we not admit, as we are much inclined to think, that it is opposed directly to all exudation of albumen ?

Whatever may be the interpretation, the facts remain, and are not the less worthy of interest.

We think, also, that great advantage will be derived from the use of lacto-phosphate of lime in cases of scurvy, one of the most striking, and at the same

time happily the most rare forms, at present, of mineral inanition.

OBSERVATION I.

(*Reported by Dr. Girard.*)

POTT'S DISEASE IN THE CERVICAL REGION, TUBERCULIZATION OF LEFT LUNG.—RAW MEAT AND DUSART'S SYRUP.—CURE.

On the 26th August, 1871, I was consulted for a young child of five years, about whom they gave the following details.

The parents are healthy. It is not possible to find any hereditary trace direct or indirect. As for the little patient, she was at first confided to a bad nurse, from whom she was removed in an emaciated condition, the belly puffy, fatigued by diarrhœa.

Regular alimentation restored her to health, and she reached the age of four years without having experienced any new accidents.

At this period, without it being possible for me to find the cause, low-spiritedness, incapacity to move, loss of appetite, acute pains in the loins and between the shoulders appeared; then gradually incurvation of the vertebral column, including the two last cervical vertebræ, and the two first dorsal. The natural curve of the lumbar region disappears little by little. The chest is deformed, and the ensiform cartilage is protruding.

For one month the child has a violent cough, which prevents the unfortunate patient from sleeping; it has also diarrhœa, profuse sweating, and absolute loss of appetite.

Under the left armpit there exists a very acute pain, which is increased by motion, cough, and frequent return of hiccoughs. These pains are so intense, and weakness so great, that the patient was compelled to remain for

whole days immoveable in a corner, and prevented from playing.

I was called to examine this child. Let us see in what state she is found.

Small, extremely thin, eyes intelligent, but the expression sad; she answers divers questions with precision, and with the voice of a punchinello, more blown than articulated. The head is strongly thrown backwards, and sunk between the two shoulders: the inflection of the vertebral column is at right angles; several apophyses are projecting in the lumbar region; at the level of these two points there are spontaneous pains aggravated by pressure; chest depressed laterally; the ensiform cartilage very prominent; at a level with its extremity the skin is violet, painful, and appears ready to ulcerate. The belly is but little developed; emaciation of all the body excessive; the muscular masses of the limbs are scarcely visible.

My attention having been attracted by the oppression with cough, continued pains, I examined the chest. The right side is normal; on the left there is dulness on a level with the clavicle; at the same place there are large râles which have invaded the upper third and anterior portion of the lung. Under the armpit of the same side auscultation elicited a very strong and rude pleuritic friction-sound, which fully explains the pains occasioned by movement, the cough, and the hiccoughs. At the back, in the upper portion, and at the base in front, expiration is rude and prolonged.

The patient, treated at first in the country by cod-liver oil and iodine preparations, only presented a state of aggravation of the symptoms, which the physician considered as a hopeless case.

I only prescribed Dusart's syrup in doses of four dessert-spoonfuls a day. On the 12th September, appetite normal since the fourth day of treatment; the skin is less red at the level of the ensiform cartilage; no cough except in the

morning. On auscultation I found the râles smaller and particularly less abundant. Same treatment, to which I added 50 grammes of raw meat a day.

On the 20th September, bronchitis is generalized, invading the two lungs. Expectoration abundant and easy, the appetite keeps good, in spite of this complication, and the diarrhœa, which disappeared since the first days, has not come back.

The same treatment, to which I have added the balsam of tolu of Tournois.

Sept. 24th.—Bronchitis much less. Sleep calm. No more pains, either spontaneous or communicated, under the arm-pit; the child jumps and plays with the hoop, and has become very turbulent. The voice is still weak, although better articulated.

Since this day to the 25th October, the improvement progressed in all respects in a manner so satisfactory that the pains have disappeared at the level of the two gibbosities, which have remained stationary since a month, and that the most attentive auscultation hardly discovers any crackling under the clavicle.

October 26th.—The child has taken cold at the school, and returns home with a violent catarrh.

November 4th.—Bronchitis altogether cured; child is gay, and continues to play without experiencing pain or fatigue. Appetite excellent.

Application of the tincture of iodine to each side of the vertebral column, at level of the two gibbosities.

January 4th, 1862.—The general state leaves nothing to be desired: the legs are always weak, it is true, which I attribute to the deformity of the vertebral column, but the muscles are firm and coloured, the voice is strong. It is impossible for me to find any trace of pulmonary affection.

To continue Dusart's syrup, and underdone meat.

May 28th.—Called to the mother, affected with phthisis. At the beginning I examined the child again, which I found in

a perfect state in all respects, with the exception of the weakness in the legs, which persists.

May 1st, 1873.—The young girl, Marie T——, coughed during winter; but the appetite remained good, and some preparations of tolu have sufficed to overcome these accidents. She is to-day quite well.

OBSERVATION II.

(*Reported by Dr. Delzenne.*)

Hereditary Phthisis.—Cure.

Mademoiselle R——, aged eight years, residing at 7, Rue Audran; in a very bad state of health. I was sent for by her parents on the 8th of October, 1868.

Several members of the family had already succumbed to phthisis.

I found the patient to be very tall for her age, fair and lymphatic; until lately in good health and of precocious intelligence.

Three months since she became dejected, lost her natural vivacity and appetite, followed by gradual emaciation, slight but frequent cough, dry and paroxysmal; diarrhœa, profuse perspiration, and slight hæmoptysis. The diarrhœa had become such that the ingestion of the smallest quantity of food compelled her to immediately evacuate undigested substances.

Gradually she became very thin, and a state of profound debility, physical as well as mental, supervened.

In the apex of the right side of the chest, I found dulness on percussion in the upper third of the lung; and in the corresponding part, a cavernous rattle was distinctly heard.

I applied several blisters successively, sometimes in front, sometimes at the back.

At the same time I prescribed the syrup of lacto-phosphate of lime in doses of three tablespoonfuls a day.

The fourth day the indifference for food had diminished. Raw meat was taken without causing diarrhœa.

October 15th.—The appetite has returned; patient asks for food; diarrhœa stopped, and perspiration less profuse. The patient, having become less apathetic, begins to take an interest in what passes around her.

At the end of the month the cough has nearly gone; the rattle is less frequent and weaker, and the general condition is singularly ameliorated.

Henceforward the progress of cure underwent no interruption, and I paid my last visit near the end of December.

June 25th, 1872.—Mademoiselle R——, now more than eleven years of age, is in a most satisfactory state of health. The three winters which have since passed have not caused the slightest bronchitis. Auscultation and percussion do not occasion anxiety.

The menses have not yet appeared.

OBSERVATION III.

(*Collected by Dr. Bouland.*)

Hereditary Phthisis.

Madame N——, aged thirty-four years, *concierge* in the Rue St. Quentin, No. 85, lost her father, her first husband, and a child, as well as many of her relations, by phthisis.

She lived in a damp room on the basement, near the yard.

Tall and well built, she had enjoyed good health up to the age of thirty-three years. But since then she has occasionally coughed, especially in the morning, with a dry and hacking little cough. She had no diarrhœa, but got thinner, and her appetite had nearly disappeared.

For a month, the cough, which had become more frequent, was accompanied by pain in the right clavicular region, and

by sputa streaked with blood. Finally, after a week, she took to her bed, and called me.

Sept. 21st, 1871.—I saw her, and after having learnt what I have stated above, and satisfied myself that there was a febrile attack every night, with profound sweats lasting the greatest portion of the night, I began to examine the physiological state of the invalid, which revealed the following facts. The pulse was at 124; the tongue thick, charged with a yellowish fur; at the right top of the lungs, dulness, with coarse and long wheezing; to the left, the respiration was scarcely heard.

Emetic. Blister on the right side, in front.

Sept. 23rd.—Same condition. 0·50 grammes [= 7·717 grains] sulphate of quinine each day. Blister at the back to the right.

Sept. 25th.—Wheezing less strong on the right. We hear in front and behind humid cracklings everywhere. To the left the respiration is better heard.

The night-sweats are less abundant. The febrile accessions diminish. Pulse 110. No appetite.

Sept. 27th.—Fever less strong. Pulse 100. The sleep is better. The left lung is entirely free. Third blister to the front and right.

Bordeaux wine; broth; four tablespoonfuls of syrup of Dusart.

Sept. 30th.—Appetite much better. Pulse at 90. Prolonged respiration always to the right, but without rough wheezing. The humid crackling sounds are very rare.

From this time the sick woman got up; the appetite became firm and imperious, and the patient became fatter.

In December she was so well, that she was able to wax the stairs of the house whereof she was *concierge*, and to watch, without fatigue, a part of her nights.

Nevertheless, as she would not restrain herself by taking the precautions necessary for the state of her lungs, she

exposed herself to frequent chills, followed by the reappearance of the cough, loss of appetite, and weakness.

Every time she contented herself with taking a little rest, and adding three or four spoonfuls of Dusart's syrup to her ordinary food.

She passed very well through the winter.

Such was the information which she gave me on the 12th April, 1872, when I met her.

She complained still of a little dry cough every morning, and a slight febrile attack in the evening. The appetite was capricious, but relieved periodically by Dusart's syrup. The appetite was bad.

Though these conditions were so unfavourable, I only found on the affected side long breathing, and a slight rattle at the top of the lung.

July 8th, 1872.—In spite of my recommendations, the invalid did not take any precautions; thus, a week after a sharp cold chill in the evening, she was attacked with almost complete aphonia, with pain in the right clavicular region, and between the two shoulders, a feeling of oppression, sweats, and feebleness to such an extent that she could scarcely raise herself.

This time also she had recourse to the syrup of Dusart, of which she drank two bottles in five days. The voice came back; the appetite and the strength were revived, and I found her working at her ordinary occupations when I went to see her.

She preserved a normal fatness, and I only found at auscultation the prolonged respiration already pointed out, and very clear cracklings, which, however, were very rare, especially in front.

In fact, the affection has remained entirely stationary, in spite of all the unfavourable chances accumulated.

OBSERVATION IV.

(*Reported by Dr. Dusart.*)

PHTHISIS ON THE RIGHT SIDE.—CURE.

On the 12th July, 1871, Dr. Delzenne requested me to see Mademoiselle C—— with him, 124, Faubourg Saint-Denis, aged twelve and a half years, affected with phthisis. He wished to make me witness the results which the treatment he proposed to institute could produce.

The following is the information we have been able to collect.

There are no morbid antecedents, direct or indirect; there was no particular privation during the siege.

Near the end of February, about eleven o'clock (a.m.) each day, nausea with vomiting set in; the appetite diminished. This child did not wish to complain, and almost always threw away her food which was given her to take to school.

In a few days, from lively and industrious, she became sad, had no inclination for anything, gave but little attention to her studies, and had continual cephalalgia. There was an alternation of constipation and of diarrhœa, the latter manifesting itself by the production of three or four liquid motions immediately after the ingestion of food.

Near the middle of March, her cough was dry, fatiguing, frequent, particularly at night, and rendered sleep impossible.

In the first days of April the child became so negligent, taciturn, indifferent to everything, and incapable of learning, that the mother, not suspecting the cause of such a state, reproached and accused her of laziness. The patient, on her part, did not express her sufferings.

In May the epigastric pains, presternal and dorsal, became so acute, the diarrhœa and the perspiration so abundant, that the young patient complained; but the mother, a widow, anxious about her affairs in the midst of the terrible events which we had passed through, did not pay much attention,

and things went on thus until the middle of July, when, becoming seriously anxious, she sent for Dr. Delzenne.

As I have said above, I accompanied Dr. Delzenne, and the following is the state in which we found the young patient.

She is of average height, very thin, eyes hollowed; speech slow, scarcely articulated; answers with apathy. Skin burning hot, moist, frequently covered with perspiration. Pulse 130; respiration short and frequent; no appetite, and sleep is rendered impossible by continual fits of coughing. The expectoration is not abundant, and does not appear to have ever contained any trace of blood.

On percussion we find in front and at the back of the right side of the chest, in its upper half, a well marked dulness. In the same part there are large cavernous rattles, which are very abundant; sounds rough and prolonged; vibration of the voice strongly felt.

The following treatment was adopted: a blister of 10 centimètres by 15 was applied to the diseased side of the chest; four days afterwards, a second blister behind the same side. If the modifications were not sufficient, we were to have recourse to a third blister, and to the applications of the tincture of iodine.

Internally, raw meat, 30 grammes a day at first, increasing day by day; three tablespoonfuls of Dusart's syrup daily.

On the 16th July the appetite is a little improved, the diarrhœa and the perspiration are lessened; the patient slept for some hours last night.

Since then, such rapid and uniform improvement has taken place, that on the 1st of August the patient was jolly and full of vivacity. She has begun again to work with care at the school; the nights are perfect; the fits of coughing occur only now and then during the day. No more sweating nor diarrhœa. Appetite exacting. The eyes are quick; the cheeks less hollow. However, fatigue and oppression still take place rapidly during play.

The pulse is 84. There is still dulness on percussion, and a few small crackling sounds with a hard respiration. The voice still vibrates, but much less than before.

Dr. Delzenne, accustomed to similar results, does not appear surprised at the rapidity of the improvement; it is not the same with me, who had never met with anything of the kind.

No more blisters were required; raw meat was taken in doses of 60 grammes; as to Dusart's syrup, the appetite was so intense that it nearly constituted suffering, and her parents were obliged to limit the dose to two tablespoonfuls a day.

We recommended them to continue this dose for a long time.

On the 10th August, there remains, as the only trace of the disease, a slight prolonged expiration.

June 12th, 1872.—The patient, aged thirteen years and a half is taller than the average of children of her age; well developed physically and intellectually; she has a remarkable appetite, and feels no indisposition whatever during the winter.

The menses have not appeared yet.

March 1880.—The improvement is still maintained.

OBSERVATION V.

(*Collected by Dr. Peraté.*)

Pulmonary Phthisis.—Cure.—Later on, Menstruation and Marriage without Accident.

Mademoiselle D——, aged fourteen years, tall, blonde, extremely nervous and irritable, has for the last three months coughed in a very disquieting manner.

Since then, no more sleep, excess of fever every evening, profuse night-sweats, weakness even greater since the appetite has entirely disappeared.

No hæmoptysis and no diarrhœa.

Nevertheless, when I was called, on July 5th, the cachectic appearance of the invalid struck me very much.

At the right top of the lung, I found a hollow sound, and, at a corresponding point, humid cracklings, but no hollow rattles.

I had recourse to the treatment which had already succeeded, that is to say, blisters, repeated behind and before, and afterwards energetic applications of tincture of iodine.

At the same time, I advised the use of old Bordeaux wine, of raw meat, and of the syrup of lacto-phosphate of lime.

In a few days the appetite increased, at the same time that the strength and the fatness reappeared ; the nervous erethism and the accesses of fever diminished. Soon the apyrexia was such that I was able to prescribe iron.

Before I could count on a definite cure, or at least an amelioration of some duration, I wished to see how Mademoiselle D—— would pass through the critical period of menstruation.

This was not established without difficulty. I had to combat with several attempts, violent colics, and congestions near the lungs, but I triumphed over these obstacles, and the general health was not altered in a serious manner during this epoch.

Five years later, Mademoiselle D—— was presented to me by her mother, who asked me if there would be any imprudence in permitting marriage.

The examination which I made enabled me to find only a trace of her past illness, and this consisted of a slight dulness of the respiratory sounds. I thought it right, therefore, to give a favourable answer.

Mademoiselle D—— has now been married for six months, and no surprising phenomenon has yet been revealed.

June, 1881.—The subject of this examination has had since her marriage two children who are alive.

OBSERVATION VI.

(*Collected by Dr. Pinel.*)

RICKETS IN INFANCY.—PHTHISIS.—CURE.

In the month of March, 1869, I was called to Mademoiselle C——, 119, Boulevard Magenta.

This young girl, scarcely aged fifteen years, was born of a scrofulous mother; constantly coughing, and presenting at auscultation unequivocal signs of *tuberculosis*. Mme. C—— confided her to the care of an excellent and careful nurse; she only walked at her nineteenth month; was extremely thin, small, delicate, without any activity and without appetite; she had never taken any part in the games of children of her own age.

The teething was effected with great slowness; the teeth are badly arranged, and black; the gums, which are soft and tumefied, bleed at the slightest contact.*

Since the month of January the cough has commenced, and is now becoming very fatiguing; the appetite, at first feeble, is now entirely gone, and the weakness, constantly increasing, has arrived at its maximum.

There are neither sweats nor diarrhœa.

Under the right clavicle, I noted a hollow sound on percussion; at the same point I could hear cracklings, rare and disseminated, but nevertheless so clear that they cannot leave any doubt of their existence.

I made, in front and behind the right top of the lung, energetic applications of tincture of iodium. I advised the use of raw meat, of old wine, and of the syrup of lacto-phosphate of lime.

* Dr. Magitot, in a verbal consultation, told us, that for two years he advised the administration, in a constant and regular manner, of the syrup or the wine of Dusart to infants and to adolescents in whom the development of dentition was affected by an hereditary vice, or by the bad state of the general nutrition.—*Dr. Dusart.*

On the 25th March the appetite reappeared, and her digestion had improved.

Little by little the cough diminished, the sluggishness in which the invalid was immersed had entirely disappeared, and the walks for which she had shown so much disgust were now agreeable to her.

In the month of July she became stouter; the menses, which had only taken place once in December, began to reappear. The desire for muscular activity, and for motion, increased. The teeth projected, and the gums became hardened.

Finally, attentive auscultation of the lung has not revealed a single abnormal sound.

I allowed a season's sea-bathing.

In March, 1872, I went to see Mademoiselle C——, of whom I had lost sight, and was surprised to find her, instead of the invalid and wretched young girl, whom I attended for three years, a woman, perfectly developed in every respect, very happy, and very lively. It was impossible to suspect the previous existence of an evil as grave as that described above. Mademoiselle C—— took from time to time, especially when her appetite diminished, a bottle of syrup of Dusart; this was the only precaution taken. She informed me of the following fact: Many times the prolonged use of lacto-phosphate of lime had checked the sharp pains in her legs, which appeared to have their seat in the bones.

Although she is now only eighteen years old, the wisdom teeth begin to show.

OBSERVATION VII.

(*Communicated by M. Delzenne.*)

ARREST OF GROWTH AT SIXTEEN AND A HALF YEARS.—ONE YEAR LATER, PHTHISIS, WITH INSIDIOUS ORIGIN.—VERY GRAVE LESIONS.—FATAL PROGNOSTIC GIVEN BY MM. BARTH AND POTAIN.—PRESENT EXCELLENT STATE.

In July, 1871, I was called to Mr. L——, 88, Boulevard Magenta, aged sixteen and a half years, whose size had increased with an excessive rapidity during the last two years, and made the following observations.

For more than six months the appetite had entirely disappeared; the muscular masses, soft and emaciated, did not sustain the trunk, which dropped easily. Cephalalgia, pains in all the limbs, and especially in the pelvis and the lumbar region. Breathing was difficult at the slightest effort.

The face was pale and thin; the physiognomy without expression, and as if intoxicated. Intellectual labour was at an end; the sick youth remained motionless for several hours, and no longer showed to his relatives, who were very much affected on this point, any marks of affection. Intellectual inertia was so great that the friends of the family feared that he would lose his reason.

This young man refused all food, and attempted to run away at the hours of meals.

Three tablespoonfuls of Dusart's syrup first brought back the appetite, after which I had recourse to iron.

The results were perfectly clear; three months after the commencement of treatment, the physical and intellectual state of the patient were so well re-established, that Mr. L—— entered into a special institution to recommence his interrupted studies, and to prepare for the examination for the fellowship.

I heard nothing of him until the 19th of November, 1872. On this day I was called to attend Mr. L——, the father, who asked me to examine his son, who, he said, had a weak spot in his side.

Before my examination, I questioned him, and learnt that after a year passed in the above-mentioned institution, Mr. L—— had made a long voyage in the South, had then passed a few days at Eaux-Bonnes, where he had had several cold sulphur-douches. Since then, he had frequent epistaxis, which did not so much surprise him, the general health appearing satisfactory, and no new phenomena having appeared, excepting the slight spot in the side, which had existed for a few days, and was accompanied by loss of appetite.

On examining the chest, I found at the left-hand side a hollow sound in the whole space corresponding to the upper lobe of the lung, and at the same point, suffocation of the tubes, and strong liquid rattles in abundance.

On the right side, there was the same hollow sound over an extent of 7 or 8 centimetres, prolonged expirations, and some disseminated liquid rattles.

I expressly ordered him to stay in a room sufficiently aerated, but with an even temperature. I applied large blisters before and behind, to the left first, and afterwards to the right, thirteen in all.

There was a strongly-furred state of the stomach, which I altered by an emetic; and a rapid and vibrating pulse, which I calmed by digitalis.

Perchloride of iron, in successive doses, acted against the epistaxis, and was several times repeated.

To bring up the nutrition : raw meat and pepsine ; Dusart's syrup, and afterwards Dusart's wine. Old wine.

On the 28th of November, Professor Barth, called in consultation, declared that the lesions were too pronounced to

afford any chances of success; he approved the treatment, and insisted on the use of lacto-phosphate of lime.

On the 24th December, M. Potain made the same declaration as M. Barth; he advised me to add to the means cited above the use of arsenical preparations.

In consequence, I began by giving each day 5 milligrammes of arseniate of soda. I successively augmented the dose, which I carried to 3 centigrammes (nearly $\frac{1}{2}$ grain) a day.

On the 1st May, the local state was not improved, but we had not lost ground. The appetite was very good. Nevertheless, the sick man was discouraged, and I sent him to Bellevue to enjoy rest, under the direction of my excellent colleague, Dr. Chauset, of Meudon.

The latter only accepted this responsibility with misgivings. Nevertheless, reconstituents, under the form of raw meat and wine or syrup of Dusart, were alternately maintained. At last, a better condition arose; the invalid made more or less long walks, and left in October for Cannes, directed by me to Dr. Cavasse. This colleague wrote me on the 8th January, 1874, the following lines, which I copy, word for word:

"Mr. H. L—— gets better and better in his general state. He makes long journeys and notable ascents without feeling exhausted. The palpitations of the heart are generally frequent, sometimes irregular; there is no fever. In the back, and especially above, on the left side, there are dry rattles, of which the number tends to diminish. In front there is a sound of wheezing, without any extent, which has much diminished since his stay at Cannes. There is very little cough, and no expectoration. All the appearances of good health are maintained. I wish you to often make cures like that of Mr. L——."

OBSERVATION VIII.

(*Reported by Dr. Monod.*)

ALBUMINURIA WITH ŒDEMA IN A PHTHISICAL PATIENT.—DUSART'S SYRUP.—CONSIDERABLE IMPROVEMENT.

I was called on the 7th October to a "Maison de Santé," in the Avenue de Neuilly, to see M. X——, aged fifty-six.

This patient, who is tall and well-proportioned, traces his disease to two years back.

Up till then his health was excellent, and he was but rarely affected with cold.

Since this period he has had a frequent, dry cough, without violent fits, or traces of blood; no pain in the side, the local phenomena being but slightly pronounced.

But with this cough, emaciation commenced, accompanied by loss of appetite.

Then followed abundant night-sweats. No diarrhœa at any period.

Thirst very great, urine abundant and clear.

To-day, the patient has reached the last degree of emaciation and weakness, whilst the legs, invaded by œdema, which mounts up the scrotum, contrast strikingly by their size with the rest of the body.

At the apex of the left side of the chest, in front and behind, dulness on percussion. At the same place, a cavernous sound with large moist abundant rattles.

The urine, treated by heat and nitric acid, becomes immediately coagulated.

Prescription.—Cinchona bark and tonics.

On the 11th, aggravation of the general and local state. I stopped the cinchona, and I prescribed infusion of gentian with salts of nitre, and to excite the appetite, three tablespoonfuls a day of Dusart's syrup.

I advised the patient to eat a little meat.

In three days appetite returned, the œdema diminished

the strength returned gradually; and we have had a proof of the arrest of disassimilation in the small quantity of albumen contained in the urine.

On the 19th, I ordered a purgative weekly.

On the 26th, I stopped the salts of nitre, and prescribed tannic acid in doses of 40 centigrammes.

The improvement made such progress that the œdema had entirely disappeared on the 15th November.

At this date, the feet were a little swollen; I ordered again salts of nitre, and it all disappeared.

On the 22nd of November the patient was completely transformed. A certain amount of embonpoint has replaced the excessive emaciation of the beginning; the appetite is excellent.

Heat and nitric acid elicit but slight traces of albumen in the urine.

As to the state of the lungs, it is not sensibly modified.

OBSERVATION IX.

(*Communicated by Dr. Paquet, of Lille.*)

Acute Albuminuria submitted to the Influence of Phosphate of Lime.—Cure in a Month.

In February, 1871, I was consulted by one C. N——, aged sixteen years, printers' compositor (type-setter).

This workman, free from all hereditary deficiencies, and enjoying ordinarily good health, was, four months after his entry in the workshop, exposed to a sudden chill, which produced the following consequences:

Pain in the lumbar region with fever, during four days; the appetite disappeared, the face became pale and puffy. Afterwards diarrhœa, with œdema of the legs, appeared.

The pale and abundant urine showed by reactives an abundant precipitate of albumen.

I made him stop working, and prescribed the use of raw

meat and of 50 grammes (about 1½ oz.) of syrup of lacto-phosphate of lime per day.

The fourth day after treatment, the diarrhœa stopped, and the appetite was restored. The fifteenth day the face was less puffy. The urine was still a little albuminous.

On the thirtieth day the albumen had completely disappeared, and the young man, feeling himself sufficiently strong, began working again, in spite of my opposition.

He, nevertheless, consented to take lacto-phosphate of lime a few days longer, in doses of 25 grammes of the syrup.

The cure was maintained; and at present, two years after these facts, his health is still very good.

OBSERVATION X.

(*Reported by Dr. Paquet, Hospital Surgeon, Professor at the School of Medicine of Lille.*)

LEAD POISONING.—CHRONIC ALBUMINURIA.—DUSART'S SYRUP.—CURE.

N. B——, plumber, has had on different occasions symptoms of lead poisoning in a variety of ways. Four years ago, a commencement of paralysis of the extensors was treated with success by electricity.

For eight months, there has been loss of appetite, complexion cachectic, puffiness of the face and limbs, well marked leaden hue of the borders of the gums.

Suspension of work ordered.

The treatment by purgatives and sulphuric lemonade produced no result whatever. The strength decreased with such rapidity that the patient was obliged to keep his bed altogether.

An examination of the urine elicited a strong proportion of albumen.

I prescribed each day 50 grammes of Dusart's syrup, and in fifteen days the position of the patient was transformed. The appetite came back, and the strength increased so rapidly, that at the end of two months he returned to his work.

This was an imprudence on his part. Six weeks after, there was a relapse. The patient, being much esteemed by his master, was maintained at his expense, and he exacted absolute rest and return to the treatment by Dusart's syrup until completely cured.

During four months the urine still contained albumen, but in decreasing proportions.

After this lapse of time, N. B—— was able to return to his work, from which he has not been stopped a single day for a year.

A remarkable fact is that before the albuminuria and its treatment by Dusart's syrup, N. B—— never was three months without experiencing lead symptoms; for a year, he has had nothing of the kind, notwithstanding his return to his work.

OBSERVATION XI.

(*Communicated by Dr. Delzenne.*)

GRAVE PLEURO-PNEUMONIA.—ADYNAMIA.—THICK FALSE MEMBRANE ON THE SURFACE OF A BLISTER.—GOOD EFFECTS OF PHOSPHATE OF LIME.

M. Bl——, fifty-three years, of a very weak constitution, was attacked every year with prolonged bronchitis. After a fresh attack, on the 8th February, 1871, of feverish cold, he remained until the 25th March without thinking of taking serious care of himself.

At this date diarrhœa commenced, which did not cease until after eight days, leaving the patient very weak. The cough had not ceased.

On the 14th April there was pleurisy on the right side, with dyspnœa. Pulse 130.

Three large blisters, covering the side of the chest, were successively applied.

On the 18th, the diarrhœa reappeared, with the remarkable character of fœtidity and abundance. I stopped this in a few days; and after the 24th the pulse fell to 90, and the local and general state improved so much that I considered convalescence definitively established.

Nevertheless, the same evening, I was called afresh, and I found myself in presence of a pneumonia which had invaded the right lower lobe. Amongst other methods employed to combat this new affection, I prescribed on the spot affected, a blister of 15 centimetres by 20 (about 6 inches by 8).

On the 25th, a new return of colliquative diarrhœa, with profound prostration. I combated it by Todd's potion, Bordeaux wine, and extract of quinia, 4 grammes. The pneumonia appeared to follow its regular course; but in spite of tonics, the general state did not improve.

On the 28th, a fourth attack of diarrhœa occurred, and the surface peeled by the previous blister was covered with a grey pulp, which bled at the slightest contact, producing each time a pain which the patient compared to that which results from the application of red-hot iron.

On the 29th, a false membrane was found, several millimetres thick, allowing the exudation of an abundant sanious pus. The patient, extended on his left side, was motionless, and in such a state of weakness that his voice could scarcely be heard.

May 1st.—No change.

May 2nd.—The appetite has revived, the face is less livid, and the eye brighter; the false membrane came away in one piece, without causing any flow of blood, and leaving a crude surface.

I ordered mustard plaister and lead ointment.

May 3rd.—Appetite very good; surface of the blister rapidly giving forth normal surface, with very little pus. It has ceased to be painful.

May 7th.—The cicatrization is complete; on the 10th, the sick man got up, and from this moment convalescence was not delayed.

OBSERVATION XII.

(*Communicated by Dr. Blache.*)

CROUP.—RISK OF TRACHEOTOMY.—LACTO-PHOSPHATE OF LIME IN LARGE DOSES.—CURE.

Dr. Riant, to whom my friend Dusart and I had communicated our desire of prescribing lacto-phosphate of lime in croup and in putrid angina, profited by the following occasion in realizing this desire.

"I was called," he wrote us on the 24th November, "to little V——, who then only presented symptoms of feverish bronchitis. Mucous rattles extended throughout the whole breadth of his chest.

"On the 25th he had also laryngitis, and the fever had increased. Ordered an emetic.

"In the night, Dr. Vivier was called in my absence, and noted much dypsnœa, with hoarseness of voice. About five o'clock in the morning there was an access of suffocation. The false membrane had not been noticed in the throat, and the vomiting produced by the sulphate of copper ceased.

"In the morning the threatened asphyxia was repeated. Then Dr. Archambault was called into consultation, who, after having examined the little invalid, judged the operation necessary, and ordered everything to be prepared for tracheotomy, which might become urgent from one minute to another.

"Finally, loss of voice was absolute; the inspiration, difficult and whistling, was marked with a great depres-

sion of the belly at each respiration. The pulse was uncountable, and the agitation extreme; at every moment the child clenched its hand to its throat, as if to tear away something which would choke it.

"It was at this moment that there was given to the child lacto-phosphate of lime, by dessert-spoonfuls from hour to hour. I gave her at the same time a little food, which she at first refused, but afterwards accepted more readily. Under its influence, she became calmer, and finally sleep asserted itself during some hours of the night, and did much good.

"On the morning of the 27th, Dr. Archambault, who had thought it time to operate on the little invalid, observed first a diminution in the phenomena of asphyxia, and postponed the tracheotomy till a later time.

"All day, on the 27th, the lacto-phosphate was continued; in the evening the child was much better, with an easier respiration.

"On the 28th, the operation was no longer considered necessary, and on the 29th we might answer for success, as the child ate with appetite, and did not offer any difficulty in respiration.

"In spite of the absence of the false membrane in the throat, we could not, nevertheless, doubt that we had had to deal with a heavy croup, which the use of lacto-phosphate of lime had been sufficient to cure."

OBSERVATION XIII.

(*Communicated by Dr. Filleau.*)

CROUP IN A LITTLE GIRL OF TEN YEARS. LACTO-PHOSPHATE OF LIME.—CURE.

On the 1st March, I was called, during the night, to M. Mal——, a child living at No. 8, Rue Chapon, who had been suddenly attacked, in the middle of her sleep, with a succession of coughs and suffocation.

I found a girl of ten years, whose scrofulous temperament was sufficiently demonstrated by a ciliary blepharitis and by an old cicatrix of ulcerous keratitis on the right cornea.

Fifteen days previously the child had slight measles, for which no doctor had been called in. Since then she had preserved a catarrhal cough without grave symptoms.

By interrogating the relations, I learnt that for two days there was loss of voice, and the cough came on in fits.

The child's nose had bled during the evening.

The parotid region presented a double swelling, especially sensitive on the right side.

False membranes covered entirely the tonsils, the extremity of the pharynx, the end of the epiglottis, and ascended to the nasal fossæ.

Pulse 110.

At auscultation, I found the vesicular murmur weakened.

An emetic, administered at once, produced numerous retchings, with expulsion of the false membranes, which resisted, and an abundant bleeding at the nose.

In the morning there was a fresh nasal hæmorrhage, sufficiently abundant to weaken the invalid and to give great uneasiness.

Called into consultation Dr. Chéron, who, struck with the weakness of this child, was of opinion that the emetics should be ceased, and that Dusart's syrup should be administered in large doses to bring up the strength.

The child took four tablespoonfuls in the day of the 2nd March.

In the evening she took some soup with tapioca. A second (plate) was given to her in the night, according to her wish.

The 3rd, in the morning, emetic. No epistaxis. Six spoonfuls of syrup, and some soup. Six hours of good sleep followed. On the 4th, the false membranes ceased to spread.

I detached a large part of them with ease. The parotid swellings diminished.

Soup. Six spoonfuls of syrup. Quinine wine. On the 5th, a false membrane of small extent appeared to the right side. I detached it like the first one, passing a sponge over the inflamed parts. To the left, the excited mucous membrane, seemed to be endued at certain points with a light opalescent layer. Six tablespoonfuls of syrup. Raw meat. The exposed surfaces rendered swallowing difficult.

The 6th.—The same dose of syrup. The throat was then clear. To the left, the cicatrization was complete.

On the 7th, the tonsils have reverted to their normal state. The reconstructive treatment was maintained to the 17th; the dose of syrup was gradually diminished. The phosphate was then abandoned to the 30th, except one spoonful every two days, to maintain the activity of the nutritive function.

The voice, which had remained for many days choked, finally adopted its normal sound towards the month of April. At this moment, no trace of the past could be observed.

OBSERVATION XIV.

(*Communicated by Dr. Filleau.*)

Grave Putrid Angina in an Adult.—Lacto-Phosphate of Lime.—Cure.

On the 30th April, 1874, I was called to No. 5, Grand Chantier Street, to one Julian J——, a rug-maker.

This man, of good temperament, and living in the middle of good hygienic conditions, complained for several days of pains in the throat, over the tonsils, accompanied with fever and lumbago.

At the examination I found the tonsils, the mouth of the pharynx, and the *velum palati*, intensely inflamed. The tonsils were so large that, deglutition having become impossible, I made a few incisions with the bistoury. Emetic.

May 1st.—Much agitated during the night. On the right tonsil there was a false membrane covering the points attacked by scarification.

May 2nd.—The false membrane had invaded both sides. Lemon-juice.

May 3rd.—The throat was covered by false membranes, adhering strongly. The parotid region was turned on the right-hand side. The submaxillary ganglia were developed on the same side. Fever, exhaustion. Every two hours a tablespoonful of syrup of Dusart.

May 4th.—Same state. Continuation of treatment.

May 5th.—The false membranes were removed with ease on nearly the whole surface.

May 7th.—The false membranes not reproduced. The surface which they covered presented an opaline tint.

May 8th.—A sponge soaked in syrup was wiped over the throat.

May 9th.—The part which had been attacked was now perfectly clean. The invalid, who desired to drink a little rapidly, had a part of the liquid rejected by the nose.

May 11th.—The throat was scarcely more inflamed than in the normal state. The paralysis of the *velum palati* very clear. Solids could be much more easily swallowed than liquids, and the voice was nasal.

Until the 20th I was able to maintain the dose of syrup by four tablespoonfuls.

May 20th.—The paralysis was localized on the right-hand side of the *velum palati*, and invaded all the muscles of the corresponding side of the face.

The hemiplegia gradually disappeared. At present, 25th June, it has given place to a paraplegia, which makes progress in spite of all my efforts. The general state is good.

ACUTE MALADIES AND CONVALESCENCE.

ACUTE MALADIES.

At present, in acute febrile maladies, we may almost say that bleeding is a thing of the past. From the first days of the malady, absolute diet and debilitating drinks are replaced by treatment which, instead of weakening, sustains the strength within a certain limit. Ought we to admit that this significant modification is originated by a change of the general constitution? We do not think so; on the contrary, we believe that it has been brought about by a more comprehensive study of the intimate alterations of the tissues, under the influence of fever. The post-mortem observations of Laennec and Louis on muscular lesions; of Zencker, Hayem, Laverate, Bordier, on those of the heart and the viscera; of Carville and Bochefontaine on those of the nervous tissue, have shown that in the first week of febrile affections, especially in adynamic forms, all the tissues were the seat of an intense work of denutrition, of an actual organic decay, which rendered the muscles friable, and condemned the nervous system to impotence, often even to paralysis. At the same time the urine is observed to contain a superabundant elimination of nitrogenous food and of phosphate of lime, the absorption of which is always coincident with that of the albuminoids.

Guided by these studies, clinical authorities seek at present to limit the work of nutrition during the attack of febrile maladies, by the employment of

antithermics, alcohol, digitalis, etc., to bring down the temperature of the body, and to diminish the intensity of combustion. At the same time, they prescribe reconstituants, to repair in part the inevitable losses, and to hasten convalescence as quickly as possible.

It is thus that, in the first days of sickness, milk, broth, and liquid foods are given. But these precautions, however rational they may be, are often useless. Fever, in effect, suspends almost completely the secretion of gastric juice, whilst on its side, the muscles labour under the most unfavourable conditions of assimilation.

The administration of lacto-phosphate of lime makes this double inconvenience disappear, it acts on the food by the lactic acid, which assures its digestion in the stomach, and by the phosphate of lime, which, introduced with them into the blood, it fixes them in the bosom of the tissues, of which it repairs the losses, and delays the movement of excessive disassimilation.

Thus, it has been proven that invalids attacked with the most severe fevers, to whom the drug has been given in the form of wine or of syrup (destined to sweeten drinks), are subject to less depression, and rarely present sloughs; the latter, when they are produced, progress rapidly towards reparation.

The lacto-phosphate of lime answers thus, very clearly in the two-fold direction which has so exclusively occupied the medical world during the last ten years.

CONVALESCENCE.

We understand, by the preceding, that convalescence may be more quickly and surely induced in invalids to whom the calcareous salt has been administered.

Further, that the digestive functions not having been completely suspended, are revived with greater activity when the febrile period touches its conclusion. On the other hand, lacto-phosphate of lime, administered during convalescence, regulates the functions of the stomach, and prevents the relapses due so often to indigestion, which it renders less frequent and distressing.

This drug we at present consider adapted for convalescents who, at the conclusion of certain grave or eruptive fevers, scarlatina, measles, etc., remain indifferent to all food.

From the second to the third day which follows its administration, we see the appetite revive, the physiognomy regain its vivacity, and the general forces increase rapidly. This application of the drug is so rational, that it has not produced any objection, and since the beginning it has been adopted by all physicians without exception. We do not think it necessary to insist further, and we limit ourselves to cite some examples of the cases wherein we may have recourse to lacto-phosphate of lime with the certainty of success.

OBSERVATION I.

(*Collected by Dr. Delzenne.*)

GRAVE TYPHOID FEVER.—VERY LITTLE CONVALESCENCE.

Mademoiselle Jane D——, aged twelve and a half years, daughter of one of the officers of the Metz army, was attacked at Paris, the 14th November, 1870, with typhoid fever, with predominance at the beginning of thoracic phenomena, a characteristic found in the greater portion of cases observed during the siege of Paris. It was easy to keep the bowels open. The tympanitis was almost *nil.*

As far as the twelfth day, I combated pulmonary congestion by white oxide of antimony associated with opiates.

On the 26th, the belly became inflated, the diarrhœa was continuous, involuntary and fœtid; some delirium.

Nov. 27th.—Perfect sleep; coma. From time to time, and especially when it was sought to awaken strongly the attention of the invalid, she gave vent to prolonged and acute cries, recalling to mind those of a hydrocephalous patient. There was no articulate speech.

Following this there was no repose; the cries were more frequent, and more acute at night than during the day. There was no more stiffness of the neck. Could scarcely make her swallow water reddened with wine, and sugared with Dusart's syrup, and the little amount of broth which it is possible to procure.

Chloral and bromide of potassium gave scarcely an hour's sleep.

Against abdominal phenomena, 60 grains extract of cinchona were given, subnitrate of bismuth, 60 grains.

Nov. 28th.—Pulse fallen from 120 to 108. Persistence of delirium.

December 1st.—Delirium much less. The invalid understands questions, but her attention has not been long fixed. She repeats, as an echo, the last words of each phrase addressed to her.

December 3rd.—No more diarrhœa nor tympanitis. Pulse at 90: cough rare, eye brighter, speech clear: the invalid desires to eat. Always the same dose of syrup.

We succeeded in finding a few preserved eggs, which were well digested. The invalid ate with avidity flesh of horses and dogs, and all that she could find to nourish herself.

Thanks to Dusart's syrup, no indigestion took place, in spite of the voracity with which the food was taken. The forces revived rapidly, when on the 6th there was shown an

eruption of mucus, which invaded in one day the mouth and throat.

Some applications of borax, energetically administered, freed us of this complication; and things from that time progressed with such rapidity, and the convalescence was so short, that on the 12th, Mademoiselle Jane D—— went on foot from the barracks of the Louvre as far as the middle of the Faubourg Saint-Honoré, without being affected by the rigour of the season.

OBSERVATION II.

(*Reported by Drs. de Courtys and Dusart.*)

PNEUMONIA.—SUPPURATING PAROTIDITIS.

On the 27th July, 1871, in the absence of Dr. de Courtys, I was called to see Madame H——, aged fifty-five, tall, very thin, profoundly weakened by previous disease and by the privations incurred by the recent events.

She has had already three attacks of pneumonia of the right side.

It was easy for me to detect, on arrival, a fourth attack of pneumonia, always on the same side. From above downwards on this side, there were fine crepitant rattles to be heard, with blowing in some parts. Under the armpit, pleural friction-sounds were distinctly heard. At the same place, there was acute pain at each inspiration.

Pulse 112, face pale, without expression; speech slow and difficult. This depression may be explained by the coincident existence of abundant perspiration and of diarrhœa.

White oxide of antimony, 2 grammes; extract of cinchona, 2 grammes. Blister to the painful part. Broth and wine and water.

29th.—Same general state. General blowing sound heard in the lungs, treatment to be continued. Added to the wine and water four tablespoonfuls of Dusart's syrup.

31st.—Voice clear and strong. No more diarrhœa; a few rattles disseminated here and there. Pulse 90.

August 2nd.—Improvement continues; the appetite is returning.

August 3rd.—Pulse 80, numerous sharp rattles; appetite satisfactory. However, the face has lost a good deal of its animated expression: there exists a disposition to sleep which nothing can explain.

August 4th.—Pulse 120; profound prostration; the whole of the right side of the face is invaded by marked tumefaction, which is painful, and which extends to the middle of the neck.

In the left lung large subcrepitant rattles are distinctly heard.

Five spoonfuls of Dusart's syrup; extract of cinchona, 3 grammes; Bordeaux wine; two half-boiled eggs; broth.

August 6th.—Pulse 108. Same general state: two superficial scarifications.

August 7th.—Dr. de Courtys returned and continued the treatment; I think I cannot do better than copy textually the note he sent me:

"On my return from the country, I found Madame H—— with an intense fever: pulse 115; cough, abundant expectoration. On the right cheek, parotiditis, characterized by swelling of a violet-red colour, which is extensively invading the whole side of the face and of the neck, accompanied with an acute lancinating pain. The jaws drawn together scarcely admit the tip of the tongue between them.

"The scarifications have given temporary relief, but to-day the fever has returned, accompanied with shivering.

"Four tablespoonfuls of Dusart's syrup; a small pill of extract of opium, 1 centigramme. Lotions and emollient poultices.

"During five days this state continued nearly stationary; the patient takes no other nourishment than a little broth and wine and water sweetened with Dusart's syrup.

"On the 6th day, the fluctuation being evident, although the pus was deeply situated, I made a large incision, by which a few drops only of very thick fœtid pus escaped.

"A second incision was necessary; the patient refused obstinately.

"A few days after, the purulent matter pointed across the hollow of the ear; at the same time, the skin becoming thin at the inferior part of the jaw, ended by giving rise to two fistulæ, which did not heal until the end of the month of August.

"During more than a month, Madame H—— was subject to fever, suffering, and taking but little substantial food, as it was extremely difficult for her to open her mouth. Nevertheless, her strength was kept up, her system furnishing the necessary elements of reparation and of suppuration, and the convalescence was so short that it might be said that she had none.

"To what can this result be attributed? In my opinion doubt is impossible: it is entirely owing to the reparative action of lacto-phosphate of lime, and to the resistance to denutrition afforded by it to the tissues.

"Dusart's syrup was first administered in doses of four tablespoonfuls, and continued for more than fifteen days in doses of six and even seven tablespoonfuls in twenty-four hours."

OBSERVATION III.

(*Collected by Dr. Blache.*)

Typhoid Fever.—Continual Vomiting.

On the 10th April, 1871, M. L——, a young boy of eleven years, was attacked with typhoid fever, which, as far as the seventh day, appeared of a mild character.

On the 17th a continuous delirium commenced, with vomiting of all substances that had been ingested, whatever form they might be in.

The pulse was 130 to 138, the thirst ardent; I advised the drinks to be sweetened with Dusart's syrup.

The first spoonful stopped the vomiting. A flask of syrup was almost entirely emptied in forty-eight hours.

The second day there was more delirium; the pulse was at 110.

I permitted milk and soups, which were taken with pleasure, and well digested.

On the 21st, the invalid demanded solid food; pulse 90; thirst almost *nil*.

I gave the syrup by a dessert-spoonful every four hours, and I augmented the proportion of food.

Since then the malady re-assumed the mildness of its inception, and convalescence was so short, that on the 8th of May, M. L—— enjoyed full health.

OBSERVATION IV.

(*Collected by Dr. Lesage.*)

Typhoid Fever.

Miss M——, large, well developed, fair, eighteen years, had only had her menses for a short time, and very irregularly.

December 1st, 1871.—She complained for several days of loss of appetite, with constipation, some palpitations, and a little angina; sleep being agitated with dreams and nightmares.

December 6th.—Cephalalgia well-marked. Epistaxis frequent, with giddiness; constipation continuous. Every night there is delirium, but the patient is quiet.

I was not called till the 10th. Found the skin hot, dry, the pulse at 104; the respiration was murmuring, and in gasps; percussion of the chest showed sonorousness everywhere. Sub-crepitant rattles disseminated in the two lungs.

There is gurgling and pain in the right iliac fossa.

The tongue is dry, and red. The intelligence is not troubled during the day; the answers are clear. There is no stupor in the face, but a few lenticular rose-coloured patches.

Purgative lemonade. Potion with oxide of antimony, cherry-laurel water, and extract of henbane.

Three tablespoonfuls of Dusart's syrup in water reddened with wine. Soup.

December 14th.—Pulse 100; rattles numerous and voluminous; tongue dirty and dry; no sleep. The purgative lemonade has been vomited. Ipecacuanha, 3 grammes. Sinapisms on the thoracic walls. Three glasses of Dusart's wine, instead of syrup.

December 15th.—The emetic has given good results. Night calmer. Respiration always difficult, but less sighing; some twitchings of the tendons. Pulse at 96.

December 16th.—A little agitated; the tongue is a little drier; the cough frequent, and the sounds abundant.

A little branny layer covers certain portions of the tonsils.

The henbane withdrawn from the draught; a gargle of borax. Mustard plaisters. The bowels kept open.

December 17th.—The amelioration was sensible on all points. Nevertheless, there remained much difficulty of respiration, and violent pains in the throat. The bowels open. The intelligence clear. Dusart's wine was augmented, and the white oxide of antimony kept up in the dose of 5 grammes.

December 19th.—Pulse rose to 104; she was agitated, even a little delirious, during the day; complained of a pain in the throat, more or less violent, and a constriction of the thoracic walls. The tongue wet, and a little redness only in the pharynx.

Knowing the extreme impressionability of Miss M——, I attached little importance to her complaints; nevertheless, fearing that the higher dose of oxide of antimony would be harmful to her, I reduced it.

December 21st.—Transformation of the invalid. Skin fresh; sleep calm; stools natural; very little delirium at night; pulse 88; tongue clear.

Soup, wine, milk.

December 25th.—Fair appetite. Recurrence of constipation, followed by slight fever. Pulse 96. Purgative lemonade.

December 27th.—No further constipation ensued, and a general improvement in her condition appeared to be taking place rapidly.

December 29th.—The sick woman got up. Excellent appetite; digestion easy. To continue Dusart's wine for eight days, in the dose of two glasses a day.

The general state of this patient, who was of a very nervous temperament, has been maintained in a satisfactory degree throughout. There has been no tendency to sloughing, and convalescence has proceeded with great rapidity.

OBSERVATION V.

(*Reported by Dr. Blache.*)

Relapse of Typhoid Fever.

I was called on the 14th June, 1871, to see young B——, aged six years, who had reached the twenty-sixth day of typhoid fever, from which he appeared to be recovering without any untoward circumstance, when a slight imprudence in diet brought on a return of the fever.

The symptoms presented by young B—— were very alarming: violent fever, alternations of coma and of acute delirium, tympanitic distension of the abdomen, etc. A purgative administered had been vomited, and the physician treating him desired a consultation.

I advised in the first instance 10 centigrammes of calomel in ten powders.

Abundant stools, and the suspension of the delirium, were the results of this first measure.

For drink, I gave nothing but water, combined with a strong dose of Dusart's syrup, during the two following days.

On the third day, the child accepted a little broth, which it had till then absolutely refused; two days after, the patient asked for food, and persisted so much that he was obliged to be scrupulously watched, to avoid a fresh recurrence.

The pulse, which at the commencement was 128, diminished regularly, and was found to be 80 on the eighth day, without any evening exacerbation.

I recommended that his food should be gradually increased, and as the patient drank but little, I substituted Dusart's syrup for wine.

This time convalescence has not been stopped, and on the fifteenth day after my first visit, the patient was able to go out.

DYSPEPSIA.

WE have not to occupy ourselves here with those complex questions, still so little understood, having reference to the ætiology of dyspepsia, and its relations with the various morbid states. We limit ourselves to recall and to interpret, from the therapeutical point of view, the chemical phenomena of stomachal digestion, when it has been troubled by a pathological cause.

In the normal state, the introduction of food into the stomach provokes the secretion of gastric juice, of which the two essential elements are pepsine and lactic acid. The peptonization of food is regular if the substance acted upon attains a certain degree of acidity. It stops, on the other hand, if the acid is

superabundant, and is not produced when it is secreted in weak proportions.

Sometimes, in very nervous and impressionable subjects, the acid solution provoked by the presence of food is excessive; it is really dyspepsia by the excess of acid. The digestion is stopped, and the stomach, irritated by its contents, contracts, drops toward the intestine, and provokes the violent diarrhœic stools which are often observed even at the commencement of meals. It is then sufficient to blunt the sensibility of the mucous membrane by the employment of narcotics in weak doses, taken a few minutes before meals, to re-establish the equilibrium of functions.

At other times, the stomach, through excessive weakness, does not react on contact with food, which remains unattacked for a time; until the mucous membrane, assisted by the mixture of fatty bodies, feculents, and albuminoid bodies, undergoes fermentation, and the formation of very irritating acids ensues. Then follow, especially a few hours after the meal, those gaseous and bitter eructations, pyrosis, cadaveric odours, which are erroneously considered by some as signs of dyspepsia by excess of acid. For here, the activity being secondary, and due in reality to the lack of secretion of the normal acid, we find dyspepsia has been set up by default of gastric juice. In this last form, generally, the medical man may intervene in many ways, or rather he can administer at the beginning of meals a weak solution of alkaline mineral water, the presence of which, as Claude Bernard demonstrated, provokes the normal acid secretion of the

stomach; or, when the fermentation has already begun, simple or alkaline water may be taken in small doses, in order to dilute or to saturate the acids in excess. This method, in place of freeing the stomach, obliges it to secrete in abundance digestive liquids, which, however, ought to be avoided whenever we have to deal with organisms already fatigued or worn out, and from which it is not reasonable to demand too great efforts.

Experience has shown us that it is better to introduce with food, the substances which *promote* digestion, as acids and pepsine, particularly lactic acid. The stomach, then, continues of itself the work of digestion, commenced under normal conditions.

It is in cases of this sort that the intervention of lacto-phosphate of lime is indicated, and produces the best effects. It is equally rational in the cases wherein the food remains for many hours without modification, and only produces a feeling of more or less painful fulness, but without acid fermentation. Some traces of an acid are sufficient, in fact, to ensure the commencement of natural digestion.

The use of lacto-phosphate of lime after meals is the more legitimate in these two forms of dyspepsia resulting from weakness, as its action is not limited to the intervention of its acid in the functions of the stomach. The calcareous salt accompanies the albuminoids into the organization, whilst lactic acid assures the digestion; it fixes it there, and by this assimilation gives back to the organs all their activity. A feeling of hunger is thus awakened at the same time as the general forces, which the medical attendants have noticed in the cases we are about to describe

where malnutrition was found to be ameliorated in its two essential phenomena, digestion and assimilation, by the use of lacto-phosphate of lime.

OBSERVATION I.

(*Collected by Dr. Bouland.*)

M. C——, aged forty-six years, of a good constitution, and a sanguino-nervous temperament, has suffered from dyspepsia for a long while. This affection, against which many methods have been employed in vain, and especially pepsine, has been maintained, not to say augmented, by the sedentary occupation of the invalid, who has led a private and very absorbing life.*

Under the influence of too much work, or of some anxieties, the digestion was entirely deranged, accompanied by severe headaches and vomiting, and under these conditions, which had often been repeated once or twice a week, M. C—— was obliged to renounce all continuous work, to abstain from food, and often not even to lie down.

These were his conditions, and being much depressed, he had renounced all treatment, when towards the end of July, 1869, we proposed that he should try the effect of the wine of lacto-phosphate of lime, which M. Dusart had placed at our disposal.

This preparation, by reason of the convenience of its application and agreeable flavour, was readily accepted by the sick man; a glass of the wine was taken very regularly at the end of each meal.

* In certain forms of dyspepsia, especially among clerks, to whom we have given lacto-phosphate of lime as a hygienic aid, this medicament appears to have been very useful. To combat the habitual constipation of these men, we have administered to them for some time a simultaneous treatment by Dusart's Syrup and by syrup of rhubarb, and the effect of this treatment has not deceived our experiences.—*De Paquet.*

No immediate effect was observed, except that his digestion was re-established, by being progressively less difficult, the headaches became less severe, and greater intervals elapsed between them, at the same time that the vomiting stopped.

We discontinued the drug for a few days, to assure ourselves that it was really the cause of the improvement; again the headaches speedily manifested themselves, but less strongly than before. The treatment was then resumed, and followed for two months with care. The amelioration was rapid, and at the present time M. C—— finds himself in the most satisfactory state. A few days ago, after numerous annoyances, the invalid had to endure a disadvantageous change in position. Under these conditions, so well calculated to renew his previous sufferings, he has told us that he had not undergone the slightest alteration in his health, and that he merely attributed this change in his general state to the use of the medicine.

OBSERVATION II.

(*Reported by Dr. Delzenne.*)

DEBILITY THE RESULT OF FATIGUE AND SORROW.—DYSPEPSIA.—VOMITING.—DUSART'S SYRUP.—CURE.

Consulted by Madame B——, dressmaker, aged thirty-five, who had had three years of excessive work, with nights almost completely devoted to sewing. During the day, bad food, and very frequently severe mental shocks.

Under the influence of these multiplied causes her health was seriously affected, her appetite disappeared; she had palpitations; difficulty of breathing followed the least movement; finally, her state of debility was such that she was obliged to keep her bed, and found herself during a whole day in a continued state of lipothymia, alternated with complete syncope. Could not bear food, and when taken it was immediately rejected. Being absent when first sent for to see the patient, I found her, on my return, a little

calmer. I prescribed a tablespoonful every hour of a cordial mixture. The pulse, at first imperceptible, now showed a little strength. Nevertheless, no food could as yet be retained, and it was vomited immediately after its ingestion. I then administered syrup of lacto-phosphate of lime, a tablespoonful before each cup of broth. From this time, no more vomiting; on the third day, chops and different sorts of meat, wine, broth were taken, and all perfectly digested. I insisted upon the syrup being administered with the food.

Every two hours the patient feels the want of food, and does not experience the least difficulty in her digestion. At the end of fifteen days her appetite is really excessive, and she eats with voracity. For two months she has experienced but twice her appetite failing under the influence of her menstrual period; the other symptoms have completely disappeared, and a fresh administration of the syrup was sufficient, on the eve of the appearance of the menses, to restore this function to its normal condition.

OBSERVATION III.

(*Collected by Dr. Riant.*)

Mademoiselle X——, nineteen years of age, a glove-maker, after prolonged watchings and troubles, felt her appetite disappear, and soon showed all the symptoms of the most pronounced anæmia. I noticed a very advanced state of thinness; constipation was constant; the slightest walking produced palpitation and shortness of breath; every night sleep was disturbed by fits of dry hacking coughing. The sight of food caused an invincible repugnance, and if by accident the invalid took any nourishment, it was only to suffer violent pains in the stomach for several hours. Her mind became affected; she considered herself phthisical, and destined to an early death. A doctor consulted perfectly recognised the nature of the evil, but his advice was not followed. Up to the present time, the invalid had not been

subjected to any treatment. I then proposed as a drug, syrup of lacto-phosphate of lime, which she took, and actually consumed very regularly. In four days we observed a complete and unexpected transformation.

The appetite returned, and any kind of food was taken, and enjoyed. Sleep became calm, and on the tenth day the distressing cough had disappeared, and with it all the phenomena which frightened the invalid. The menses appeared easily and abundantly.

OBSERVATION IV.

(*Collected by Dr. Cazenave.*)

DYSPEPSIA SINCE INFANCY. — NERVOUS PHENOMENA. — SYRUP, AFTERWARDS WINE OF DUSART. — CURE.

Madame O——, an invalid from her childhood, has always possessed what is termed a capricious stomach. Since the commencement of the menopause, dyspepsia has attained a high degree of intensity. Diarrhœa, pain in the belly, borborygmus, and acute pain in the pit of the stomach, led us to think that there was a scirrhus which was spreading towards the vertebral column; there were frequent emissions of wind for several hours after each meal, having the flavour of rotten eggs.

Dusart's syrup was taken at each meal. The taste of rotten eggs, the borborygmus, and the diarrhœa have disappeared, as well as the pain.

Nevertheless, the only foods which can be supported are ass's milk and sago soup. All others produce great pain.

We had recourse to Dusart's wine; the appetite continued to increase, and little by little the foods up to that time refused were accepted, and the cure may now be considered as complete.

OBSERVATION V.

(Reported by Dr. de Courtys.)

DYSPEPSIA.—PROFOUND CACHEXIA.—DUSART'S WINE AND FRENCH MALT BEER.—VERY RAPID CURE.

On the 8th December, 1871, I was called to see Madame L——, aged thirty-five. Under the influence of repeated sorrow, this lady languished for more than two months, without wishing to accept any medical treatment whatever. She has reached a state of debility so profound, that she feels it impossible to leave her bed.

Sensation of burning all along the digestive tube, constant eructations with acidity, disgust for nourishment, difficult digestion, vomiting after the ingestion of all food, obstinate constipation, frequent desire to micturate; has the whites, and pain with sensation of heat invading the lower part of the abdomen, and radiating down to the knees; has a painful sore between the shoulders, palpitations, oppression, frequent syncope—such is the train of symptoms, during the evolution of which Madame L—— nearly beeame a skeleton.

Attentive examination discovered nothing abnormal, either in the chest or in the uterus; the hypogastric sensibility on pressure is little pronounced.

On the first day, I prescribed a spoonful of Riviere's mixture every hour, and a spoonful of cold milk combined with lime-water between each.

Towards the end of the second day, the vomiting diminished, and ceased entirely on the third.

I then ordered the extract of French malt of Déjardin; at first half a bottle, then one bottle a day. Broth is now tolerated, but not solid food.

To obtain this last result, I prescribed Dusart's wine in tablespoonfuls, diluted with water, immediately before meals. Under the influence of this preparation, the appetite im-

proved at the end of a few days. Meat is now retained, and under this double influence the strength is being restored.

The patient has given up the extract of malt, and takes four glasses of Dusart's wine a day.

Convalescence progressed with such rapidity, that on the 20th—that is to say, the twelfth day since the commencement of the treatment—the patient got up twice a day, an hour each time.

On the 25th, first drive in a carriage. I discontinued my visits.

On the 8th of January, 1872, Madame L—— came to my consulting-room. I could scarcely recognise her at first, so much did the state of her present health contrast with the excessive emaciation which I saw a month before.

I asked her if she still suffered sometimes from her stomach after meals: "Oh no!" she replied. "I still take the wine daily, and now I do not eat, but I devour!"

OBSERVATION VI.

(*Communicated by Dr. Blache.*)

DYSPEPSIA.—GREAT WEAKNESS.—FERRUGINOUS SYRUP OF DUSART.—CURE.

In the first days of November, 1872, one of our colleagues, Dr. C——, took me to see his little child, who occasioned him much uneasiness.

The child, aged four years, was not fully developed; during the last year digestion had been irregular, accompanied by alternations of diarrhœa and of obstinate constipation, which had produced such weakness that the little invalid, always on the knees of her mother, refused to walk, and easily collapsed. Her temper had become very difficult and capricious.

Since the month of September, the loss of appetite, which had become complete, manifested itself by a repugnance for every sort of food.

The state of pallor and anæmia of all the tissues led me to prescribe for this child ferruginous Dusart's syrup. I wished to combat the dyspepsia and the loss of appetite by lacto-phosphate of lime, the anæmia and the atony of the mucous membrane by iron, the action of which, as a tonic of the intestine, and also as a vermifuge, has frequently rendered me real service in the management of children's diseases.

I therefore advised this preparation to Dr. C——, who approved it in all points, and began the treatment.

On the fourth day, a little appetite reappeared ; food was well tolerated. On the tenth day, the food was eagerly taken by the child, who commenced to play a little in the room. The stools became more regular.

A month had scarcely passed away, when the child became transformed. She went out, played with animation, and presented perfect regularity in all her functions.

At the end of December, Dr. C—— suspended treatment, and all went well until the 12th January, 1873. But from this moment, the morbid phenomena that we had combated reappeared, and it was necessary to have recourse to the drug, the success of which has been as great as in November.

This time, the cure being well established, Dr. C—— took care for several months to give to his little daughter, who received it with pleasure, a dessert-spoonful of syrup every day, and afterwards every two days, before ceasing completely. At the commencement of the treatment, the dose of syrup had been three and often four dessert-spoonfuls a day.

I saw her in January, 1874, she was then strong and lively, and her digestive functions were regular and without constipation or diarrhœa.

THE ACID OF GASTRIC JUICE.

WHEN we, with Dr. Blache, commenced these researches, our chief object was to prepare phosphate of lime in a soluble, and at the same time physiological, form. The works of Claude Bernard and Barreswill, undisputed until the present day, have served us as guides. We have thus chosen lactic acid.

This organic body, an isomeron, having the composition of sugar, offers the advantage of being burned in the organism as if it were a food, and of abandoning the phosphate of lime to the tissues destined to use it. This acid already existing in the animal economy, the use of another body would have thrown us into the unknown, and uselessly complicated the problem.

The remarkable results which have been obtained in therapeutics naturally produced a reference to the analysis of Schmidt, and to the theory of the action of hydrochloric acid in the gastric juice which the experiments of Claude Bernard and Barreswill had apparently buried for ever. These authors, by precise and delicate manipulations, had proved distinctly that it was impossible to demonstrate the presence of this acid in a free state; that the acid which might be obtained from it was lactic acid, already discovered in the muscles by Liebig, and that the contrary opinion only rested on an error of analysis. In fact, Schmidt never traced the presence of hydrochloric acid, and his analytical method never applied to it; but, weighing the chlorine before and after the calcination of the gastric juice, he decided from the quantity of this body which had disappeared,

upon the nature and the quantity of existing acid. In one word, it was a determination by difference, a process absolutely condemned by experimental science.

In conjunction with Dr. Laborde, Director of the Physiological Experiments at the School of Medicine, we endeavoured to discover new reactions permitting the direct proof of the presence or absence of hydrochloric acid in a free state in the gastric juice.

These may be summed up in a few words.

We know that hydrochloric acid in a rather small dose (2 or 3 per cent.) transforms at 100° (C.) starch into dextrine or into glucose. We have found that this action is infinitely greater when the temperature is carried to 150° under pressure. Thus, with water containing a thousandth part of hydrochloric acid, a dose one-fourth that which they admit in the gastric juice, all the starch is transformed in two hours, but even with a twelve times smaller dose, the reaction is complete, the acid imparting no longer the characteristic blue colour to the solution.

If, instead of the hydrochloric acid, we substitute gastric juice, or lactic acid, we find merely a paste of starch; but if to the gastric juice we add the smallest perceptible quantity of hydrochloric solution, the starch is transformed into sugar or into dextrine.

Another experiment of the same order is not less conclusive. A small quantity of hydrochloric acid determines the transformation of cane-sugar into glucose; organic acids, like lactic acid, have a much weaker action. The reactive agent which serves as the element for the dose is cupro-potassic, the solution employed for the examination of urine.

We find that with a solution containing 5 milli-

grammes of hydrochloric acid, ten minutes after, there is formed only 74 per cent. of glucose; in the same time, with 10 milligrammes of lactic acid, 34 per cent.; and with gastric juice also containing 10 milligrammes of acid, 38 per cent. The resemblance of these figures is eloquent, but we can give better: 9 milligrammes of acid in natural gastric juice are augmented by 2 milligrammes ($\frac{1}{10}$ grain) of hydrochloric acid. Heated for ten minutes, the percentage of glucose reaches 57 per cent.

These two series of experiments, of a purely chemical order, would be sufficiently demonstrative; but we wished to make it still more striking by speaking to the eyes, that is to say by the use of colouring reagents. Thus, Professor Bécard has often repeated them before his audience in the School of Medicine. They are, in fact, very striking didactic experiments. Four vessels, each of several litres' capacity, are disposed beside each other; they are filled with distilled water, holding in solution 50 centigrammes of colourless sulphate of aniline per litre. The first vessel received 15 or 20 cubic centimetres of a hydrochloric solution to the $\frac{1}{1000}$; the second, a similar dose of lactic acid; the third, some cubic centimetres of gastric juice; and finally, in the fourth, a mixture of equal parts of gastric juice and of the hydrochloric solution. We pour into each of these a few drops of a watery mixture of binoxide of lead. Each drop which falls produces a coloured shade, but of a different tint: with hydrochloric acid, it is deep mahogany; with lactic acid and with gastric juice, it is a clear vinous violet; with the mixture, the mahogany colour reappears.

The explanation of these facts is simple; on the one hand, hydrochloric acid and binoxide of lead give chlorine, which colours the aniline salt; lactic acid, on the other hand, produces oxygen, which gives a colour of another nature.

The second experiment is made with a ready prepared colour, the solution of Violet of Paris, containing 10 centigrammes (1½ grains) of this substance per litre; the four vessels are disposed as before: distilled water, hydrochloric acid, lactic acid, and gastric juice mixed with hydrochloric acid and gastric juice. When 30 or 40 cubic centimetres of Violet of Paris solution are dissolved in hydrochloric acid, all the liquid takes a greenish-blue tint; with lactic acid and gastric juice, violet is not modified; with a mixture, the greenish-blue colour reappears. These facts are beyond all question. They have been published before the Société de Biologie.

While we made these investigations, a young and learned professor of physiology at the School of Medicine, M. Richet, succeeded in destroying the theory of hydrochloric acid. Having, like M. Beaumont, the good fortune to possess a subject with gastric fistula, he was able to procure enough juice to extract lactic acid by the Liebig process—dry evaporation, treatment by sulphuric acid and by ether; but this treatment, although useful to ascertain the presence of the acid, will not serve for doses. M. Richet could only demonstrate the presence of half of the lactic acid supposed to exist according to acidimetric doses, and attributed the rest to hydrochloric acid. To extract the lactic acid in such quantity was sufficient to demonstrate the incorrectness of the analysis

of the German chemist, Schmidt. M. Richet went further; he demonstrated in the juice the presence of hydrochlorate of leucine. This time, the cause of the error was explained.

In fact, in the analysis of Schmidt, the gastric juice was calcined to a red heat, and the chlorine remaining after this operation rarefied; but chloride of sodium, hydrochlorate of ammonia, hydrochlorate of leucine are volatile, and make that loss by difference whereon rested the theory of hydrochloric acid.

In conclusion, let us add that if these facts have interest for the physiologist, who may wonder that it can be as positively affirmed that a living organism secretes a mineral acid! With this fact the clinical student is not less interested. Hydrochloric acid is of all the acids the one which, in a small dose, exercises the most destructive action on albuminoid matter; and a distinguished savant, M. Rabuteau,* has published before the French National Academy experiments wherein he demonstrates that chloride of calcium is a poison on the muscles. This substance is evoked as a matter of course when phosphate of lime is acted on.

Experience and clinical observation have thus proved to us that we were right in taking Claude Bernard as a guide.

* "Comptes rendus," 1873, page 349. Meeting of the 10th February.

THE END.

Baillière, Tindall & Cox, 20, King William Street, Strand.