

Under circumstances of emergency they might, like the meat biscuit and the extracts of meat, prove invaluable; occupying, if packed up in tin cases, a very small space, and admitting of being kept for an indefinite period.

From the preceding considerations, the following practical conclusions in reference to the question before our naval and military authorities may be made.

1. That in the supplies of troops and mariners, especially in time of war, black bread should be selected, as more nutritious, more wholesome, more easily procured than white bread.

2. That as an aliment biscuit is superior to either, and as such might be more often employed.

3. That if possible, the bread and biscuit should be made with upper-malt dough and flour, as being then more nutritious.

4. That preserved meats, similar to those introduced by Mr. Goldner, should continue to be issued; care only being taken to ensure their careful preparation, if necessary, under Government control, and means adopted to prevent their being carelessly stowed away in damp places.

5. That measures should be adopted to encourage the manufacture of meat biscuit, extracts of meat, for field and hospital service, and for provisioning fortresses, especially in time of war.

6. That in the supplies served out to the navy, especially in addition those enumerated above, it would be well to conjoin prepared extracts of blood, milk, coffee, tea, cocoa, etc., and preserved vegetables for more general use.

19, Dorset Square, May 1852.

AN INQUIRY INTO THE *MODUS OPERANDI* OF THERAPEUTIC AGENTS UPON THE HUMAN FRAME.

By R. HUTCHINSON POWELL, M.D.Lond., etc.

“Les observations au lit du malade sont le fondement de la science, mais elles ne suffisent pas et donnent lieu aux plus grossières erreurs. De même que la physiologie éclaire l'histoire des maladies, de même les recherches chimiques, les expériences faites sur les animaux, en fournissant les moyens d'étudier les modifications que le médicament produit ou subit et les changements qui en résultent dans l'activité des divers organes, font connaître les vertus essentielles du médicament. C'est la route que la science doit parcourir.”

THIS extract, taken from a French Review, aptly represents the tendency of modern investigation; with what propriety, or leading to what result, the future must decide. The safe course, however, would appear to be a resolution to carry out that eclectic system in medicine, successfully pursued in other partly intangible sciences. The search after the *origin* and *cause* of natural phenomena has been wisely abandoned; one being satisfied, after close observation of these operations, to determine the laws by which they are governed, and the necessary conditions without which they cannot be developed.

The following remarks do not lay claim to the precision or completeness of a scientific arrangement; such not being attainable in the present state of the *ars medendi*. They are suggestive, merely, and may further serve to give a connected, though very circumscribed, view of the subject. This, as a science, is only in its infancy, and demands a thorough revision, together with the appliances of modern physiology, in order to lay its foundations on a secure and lasting, because trustworthy, basis. It needs but a cursory survey of the recorded experience of writers on *materia medica*, to evince to the philosophic observer what a luxuriant field the imagination of crude theorists has wandered over—wherein hypothesis has been permitted to encroach excessively upon the province of fact. Indeed, the subject is beset with difficulties, which will require the associated efforts of true *savans*, for a lengthened period, in order to the attainment of the requisite knowledge in this department of medicine, and to the overcoming of the obstacles presented through our unsettled notions on the physiological and abnormal action of the human organism. To arrive at any degree of precision in the scientific administration of drugs, there is presupposed an exact knowledge of the relative and absolute composition of the body, of its fluids and solids, and of their properties, in health and disease: as well as an experimental proof of the changes induced in those from the exhibition of remedial or tentative agents, which in turn may undergo more or less decomposition, the result having an important bearing upon therapeutics. The fact that drugs exert a different action upon the system, according as they may be taken during health or disease, must not be lost sight of in endeavouring to make out their peculiar mode of action. Our stock of information on all these points being but scanty and superficial, we need not expect the healing art to rest on a truly scientific basis until they are solved. There has been of late years an advance made in true knowledge, and the inductive method has been adhered to in many praiseworthy attempts to arrive at general conclusions. Thus, Mitscherlich, of Berlin, has determined, from his researches, a few laws, which are, he states, all but invariable. He has found from extended experiments, that medicines of similar chemical composition always produce the same effects; the reverse obtaining from dissimilar medicinal compounds. Substances of *analogous* composition, possess analogous, but not identical, properties in relation with the organism. The combination of substances possessing different properties, preserves the qualities of one or other. We shall again revert to the points here referred to merely in illustration. In some instances, as, *e.g.* in the *antacid* class, it is permitted us to note the precise *modus operandi* of remedial agents; the resulting compound subsequently producing antiplastic effects in traversing the circulation prior to elimination (altered or unchanged) from the system, and thus evidencing the *multiple operation* of any given agent. But, in most cases, it appears that we should at present not expect to acquire more than a remote link in the chain of action of many potent remedies; deducing the peculiar operation, either from the mode of reaction, or modification of the economy in certain morbid conditions, or from some relation with its excretions and secretions, and so forth. Thus our information is partly *direct* and *positive*, but chiefly *indirect* and *inferential*. How does *quinia* act?

ex. gr., its controlling influence over periodic disease, points to the nervous system as its seat; and its *high* atomic constitution, being so far related to *urea*, which usually modifies injuriously the intra-organic nervous textures, significantly denotes *some* connected operation. M. Baud found a double salt of *ferrocyanate* of *potass* and *urea* to act as a substitute for *quinia* in ague; thus indicating that an agent, though for the most part noxious to the organism, may, under certain circumstances, replace another, successfully used as an antimorbific medication. Again, the analogy obtaining between *casein* and one of its products, *valerianic acid*, affords another instance of the (in this case) close relation existing between respectively interchanging bodies of animal and vegetable origin. In all these instances, however, the attempt to give a *rationale* is baffled, when we try to come to "close quarters" with these reconдите operations and analogies. The entire subject of inquiry is so vast in extent,—involving, moreover, every hidden operation in physiology, pathology, and other collateral sciences,—that the mind recoils from the endeavour to clear up the almost chaotic mass of (often) conflicting, complicated, and obscure explanations, heretofore given of the *modus operandi* of remedial agents. Hence, the writer simply proposes to state the conclusion arrived at by recent investigators; being also guided by his own experimental observations, in indicating the direction in which those should advance who may be desirous of extending the boundaries of our at present very limited stock of information herein.

Many remedies may be considered to undergo some change in the stomach, or other portion of the digestive tube. The absorption of the active principles would seem to depend chiefly upon their solubility in, or their being presented in fine division to, the digestive fluids; the insoluble residue being ejected with the *fæces*. Some are decomposed either prior or subsequent to their gaining access (in an altered state) to the blood-vessels. The resulting compound is probably owing to a recombination of some of its constituents with certain organic materials in the blood, to which the therapeutic action is due. Medicines obtained from the mineral kingdom, and some of vegetable extraction, as the alkaloids, do not for the most part suffer decomposition in their transit through the system. The less potent constituents, as the gummy, extractive, and other principles of drugs of vegetable origin, are doubtless separated and distributed through the animal economy, according as they may serve its various purposes; or they are removed with the alvine excreta.¹

The following are the conclusions of Professor Mitscherlich under this head, which will serve to introduce more clearly the subject under notice. "The decomposition of a medicine, when coming first in contact with the stomach, follows the laws of physics and chemistry. The same reactions result equally during life or after death. Some agents undergo no alteration by contact with that organ, being ejected unchanged. Others are not at all altered; some are partially, some

¹ The local effects of these latter agents must not be overlooked in endeavouring to account for their operation on the system at large. Thus, the therapeutic class termed *emollients*, containing oily and mucilaginous drugs, etc., expand the tissues, alleviate pain, and protect sensitive surfaces from acrimonious matters.

completely decomposed, before being absorbed; the latter forming new combinations with the organic materials, prior to absorption, as likewise do those which are partially changed. Whatever may be the preceding chemical phenomena, absorption takes place through the epithelium, epidermis, or lymphatics, if these agents are analogous to the organic constituents; if otherwise, absorption ensues through the veins. It is not improbable that the *vasa brevia* effect the purpose of retarding the absorption of, and modifying very active ingesta, by the assimilating process they undergo when commingled with the splenic blood, which takes a more circuitous course than that conveyed by the mesenteric veins. It is extremely difficult to detect these substances in the chyle or blood; but they may be found in the solids, or fluid excreta or secreta." The professor contends that, in all these cases, the phenomena are referrible to the laws of chemical action. But limited indeed must be our perceptive powers, or blind to fact, if we do not speedily recognise a new element for observation, when we come to study the *organism* in relation with these *extraneous agents*. Phenomena for which we are unable to assign an explanation, termed *vital* or *dynamic*, come into play, and render our task so difficult of elucidation.¹

We shall now proceed to notice very briefly the several modes of action of therapeutic agents. Here it may be observed, that numerous medicines exert a mixed operation, as before alluded to; and it becomes next to impossible to define the *precise amount* due to each *mode of action*, whether purely physical, chemical, or dynamical; the result depending upon the morbid conditions to be dealt with, and other complex elements presented in this problem. The merely *mechanical* and local action of many useful therapeutic agents is obvious; as animal charcoal given in dysentery, etc. Again, it appears from M. Monneret's experiments, that trisnitrate of bismuth mainly acts by sheathing a morbidly sensitive mucous membrane abraded of epithelium; the large doses that may be given, proving the result to have but little reference to any ulterior chemical effect, prior or subsequent to its partial absorption. This view is corroborated by its *isomorphous* affinities, which will be now referred to.

In the absence of separate experiments, we may hope to attain a positive knowledge of the *modus operandi* of remedies by their *iso-*

¹ Some medicinal agents hold an intermediate place between those properly so termed, and the materials of food. Phosphate of lime, or other calcareous salts, meeting with phosphoric acid—the product of albuminous oxidation—would seem to act, according to MM. Beneke and Heller's experiments, by forming, in conjunction with albumen and fatty matter, the pabulum for healthy cellular nutrition and growth, or by supplying some definite element required in the process of expelling a morbid principle from the blood. The saline constituents of mineral springs, as the alkaline carbonates and the chlorides, appear to operate in the former way, by contributing some necessary material in the construction of the proximate constituents of the body, the absence or diminution of which may constitute the point of departure from health. Cod-liver oil, and other fish oils, appear to act in virtue of the oleaginous principle, and not from their containing minute portions of iodine. Simon found the blood to become rich in solids under the use of cod-liver oil, especially the red corpuscles and albumen; the fatty matter smelling of the oil. Its essential operation, as of others similarly constituted, is that of a conservative agent, by becoming readily oxidised, and thus protective of the tissues.

morphous relation with some one of a group, whose precise action has been experimentally determined. Thus, in conformity with the effect of magnesia, though differing in degree of activity, may be considered lime, manganese, and bismuth, as just stated; the latter especially approximating, as shown by Mialhe, to magnesia. Again, iodine typifies the action of chlorine, and of bromine; antimony, that of phosphorus, and of arsenic. Their action has been shown by Mr. Blake, with much ingenuity and probability, to depend upon each indifferently combining with, or replacing, some normal element of the blood, to form a similar organic compound. We are here forcibly reminded of the theory long ago promulgated, as to the mechanical action of medicines, which, it would appear, amidst a heap of error, concealed some fragments of truth. In connexion with this indirect (analogical) mode of attaining an insight into the peculiar action of medicinal agents, it may be observed, that if the operation of some vegetable production be determined with any precision, we may often get a clue to the mode of action of remedies taken from members of the same, or a related natural family of plants, whose action may be rationally concluded of a like nature.

Another occasional property of bodies—their *isomeric* condition—serves as a transition to the next head, and throws some light on their peculiar action as remedial agents. Thus Lehmann has shown that salicine, the bitter principle of willow bark, is converted in the system into a body made up of the same elements, in like proportions, as are contained in benzoic acid, and which is *equally* productive of hippuric acid in the urine.

Animal chemistry, with the aid of histology, affords, without doubt, the most likely channel through which a just conception of the *modus operandi* of many potent remedies may be attained. Purely chemical action, especially when excessive,—as when powerful agents are exhibited in poisonous doses,—must not be confounded with the proper therapeutic operation of drugs. Moreover, the application of this science to elucidate therapeutic action, requires a more profound insight into the nature of morbid processes, than is implied in the mere neutralising of the secondary changes induced in the animal fluids or solids. We have in iron, exhibited in anæmic states, a familiar and forcible illustration of the manner of action of agents exerting their effects through chemical affinity. Numerous and able experiments have determined that this agent, either simple or oxidised, has for its office the introduction and distribution of oxygen through the organism; being, as it were, the servitor of this potent element.

Therapeutic agents, it will appear, are used with greatest success, when removing a cause of disordered action in the vital organs, by forming some organic compound, which is ejected by the secreting or excreting apparatus. They in this manner aid the natural operations of the organism, in its efforts to remove a *materies morbi*; without them, the inherent power of the system might prove inadequate. Again, by arresting blood-changes, they may strike at the root of disease, and facilitate the operation of the conservative functions of the system previously antagonised. Among the former agents, may be arranged those containing oxygen largely, and in loose combinations; as nitric acid, nitro-hydrochloric acid,—which, be it observed, con-

sists of nitrous acid, and chlorine dissolved in water,—chlorate of potash, citric acid, and others. These drugs seem to act through the respiratory function, by supplying oxidising materials to the blood; thus facilitating regressive metamorphosis of tissue, or forming with materials in the blood morbid compounds of innocuous and removable character. The writer has repeatedly satisfied himself of these effects, occurring under conditions which mostly excluded any other extraneous influence, but which the very contracted limits of this paper preclude him from giving in detail. Some cases of jaundice may be just instanced, in which all other remedial agents proved useless, and wherein the nitro-muriatic acid exerted a marked control; the yellow colour and accompanying morbid state, it may reasonably be presumed, undergoing regression and removal, during its exhibition; or returning when omitted, and again disappearing on its resumption. Those drugs or remedies which seem to operate by setting up a cumulative change in the circulating fluids, analogous to the effects of zymotic agents, are numerous and important. This *catalytic* order of agents, it is highly probable, will be considerably extended, as we get more precise information as to the changes induced in the blood from special drugs, having a notable control over certain morbid processes, and will include many agents differently arranged at present. Belladonna acts very likely in virtue of this (catalytic) quality in preventing scarlatina, as well as in another manner, hereafter to be mentioned. Yeast being a substance itself undergoing change, probably induces a similar alteration in the contents of the intestinal tube of a curative character, in the course of excretion from the system. Salts of mercury and of other metals, would seem to bring about their peculiar effects by hastening cacoæmic change; the morbid products being subsequently excreted through the glandular apparatus; each and every gland throughout the system being (in accordance with special affinities) more or less acted upon, thus showing these agents to possess *general* catalytic properties.¹

Dr. Prout's opinion regarding the mode of operation of agents termed by him *merozoydes*, is worthy of notice here. He considers these bodies to act in virtue of their imparting a resisting power to organic constituents, whereby purely chemical attributes are prevented from coming into operation. Many saline springs probably act in this manner.

Before adverting in brief detail to remedies comprised under their therapeutic heads, and in concluding this general outline of the subject under notice, it may be mentioned that many remedies seem to owe their efficacy to the potency of some of their decomposed elements being set free in the *nascent* state in the circulation, or to their capability of entering into union with *nascent* organic elements undergoing

¹ Did space permit, it would be interesting to inquire into the physiological action of the glandular organs, as having a very close and essential relation with the development of the effects of drugs. No theory seems to harmonise so well with the mutual reactions going on between these factors and agents when brought in contact, as that of viewing the former as a congeries of microscopic conduits or cellular bodies, of more or less minuteness in each instance, whose office is to bring within the range of chemical combination those blood constituents having an affinity for each other, often in a nascent state, but which are previously placed without that degree of contiguity in the circulation required for the formation and removal of a new compound.

retrogressive change; being thus promotive, in their removal from the organism, of the healthy condition of its solids and fluids. We have an illustration of the latter mode of action in the exhibition of benzoic acid, which appears in the urine as hippuric acid; extractive matter being largely excreted under its use: remedies of this class seeming to fill up, as complementary bodies, the constituents required by the economy in the ejection of its effete products. The resulting highly acid urine becomes capable of holding in solution an abnormal amount of phosphatic salts, excreted as the effect of a morbid process progressing in the system, and being thus eliminated; the benzoic acid further serving to restore the urinary mucous membrane to a healthy state, acting indirectly, by preventing the production of an ammoniacal salt, which affects injuriously the solvent power of the urine.

(To be continued.)

21, Edward Street, Portman Square.

AN INQUIRY INTO THE REASONS WHY THE HORSE RARELY VOMITS.

By JOSEPH SAMPSON GAMGEE, Esq., Student in Medicine in University College, London.

THIS subject has, within the last two centuries, engaged the attention of numerous physiologists, the object of whose inquiries, however, has differed somewhat from ours; for the majority of them have been imbued with the prevalent opinion that the horse NEVER vomits. Thus Lamorier¹ addressed to the French Academy of Sciences *Une mémoire où l'on donne les raisons pourquoi les chevaux ne vomissent point*; and M. Flourens² recently published a paper on non-vomiting in the horse, heading it with the following dogma, "*Le cheval ne vomit point; c'est là ce que chacun sait.*"

Were it not that M. Flourens is one of the most recent, as well as most renowned, writers on this subject, we should not deem it necessary to contradict this statement, because it has long been known that horses occasionally, though rarely, do vomit. True it is that, since as a general proposition we cannot assert that the horse does vomit, it might be supposed that the converse statement would hold good; and so it does; but only in a sense that is too vague to warrant its being adopted as the title of a vexed scientific question.

In the pursuit of our inquiry, under present circumstances, it being indispensable that we should clear the path from error before we can hope successfully to attain the truth, we shall, firstly, quote cases of horses having vomited; secondly, analyse the opinions which, at various periods, have been propounded on this subject; and, thirdly, adduce reasons to prove why vomiting in the horse is of rare occurrence.

I. CASES OF VOMITING IN THE HORSE. In relating the history of a horse affected with spasmodic colic, M. Charlot¹ makes the following

¹ Histoire de l'Académie Royale des Sciences. Année 1733.

² Gazette Médicale de Paris. Année 1840, No. 5, 3 Février, p. 79-81.