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PHYSIOLOGY

AS A

BRANCH OF GENERAL EDUCATION AND OF NATURAL SCIENCE FOR STUDENTS IN ARTS.

AN ADDRESS

DELIVERED TO THE ROYAL MEDICAL SOCIETY OF EDINBURGH,
NOVEMBER 6, 1868

BY

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Copenhagen, Amsterdam, etc. etc.

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AN ADDRESS

ON

PHYSIOLOGY AS A BRANCH OF GENERAL EDUCATION.

GENTLEMEN—On looking around me, I cannot but be reminded that it is exactly thirty-two years ago, when, a fourth year's medical student in our University, I last addressed a crowded meeting of the Society from this chair, as its President. I then thought that position was the greatest honour a student could obtain, and I think so still. It gives me very great pleasure, therefore, on being asked to open the present session, to address you on some topic of passing interest. Amidst the multiplicity of such topics that suggest themselves, it has occurred to me that we might spend a little time on the consideration of the usefulness of making physiology the subject of general study, or one of education for all classes of society. And I am induced to adopt this matter for the present address, because at a meeting of the General Council of the University last May it was determined that physiology should not be added to other natural sciences opened up for study in the curriculum of Arts. You are aware that an effort has recently been made to introduce a certain amount of scientific knowledge into general education. It had been agreed that the student of arts should have the option of attending classes of geology, botany, or natural history, and I moved that physiology should be added. The objection that was urged against this by my very excellent and distin-

guished friend Professor Blackie, was that this subject was far too technical—was too professional for the public to know anything about. Now, I fear, the same idea prevails very largely among the people, who think that there is something mysterious about physiology. Some persons even shrink from the idea of knowing anything of the structure and functions of their own frames. The higher and educated classes generally are perfectly ignorant of all that relates to it. Certainly among the monied world there are few individuals who think of leaving endowments, founding fellowships, bursaries, or scholarships in physiology or medicine, whilst there is abundance of such things in the Faculty of Arts.

The chief reason for this is, that in the opinion of some a cultivation of the dead languages is what best trains the mind; "therefore," said Mr. Lowe in the excellent address he gave us last year, "a boy is put through the torture of elaborate grammars, which he is forced to learn by heart, and every syllable of which he forgets before he is twenty years of age. It is a common idea that a thing cannot be good discipline for the mind unless it be something that is utterly useless in future life." Heine remarked, "How fortunate the Romans were that they had not to learn the Latin grammar, because if they had done so they never would have had time to conquer the world." Others think that it is not Latin only that should be studied. They say that Greek is essential, and you are aware that Greek has been rendered imperative by the authorities of our University for the degree of M.D. Now, I do not think Greek is of the slightest necessity in the study of medicine. When conversing with a very distinguished member of the Medical Council on this subject, he said, "Why, sir, there are many medical students who don't know even the Greek derivation of the word 'Physiology.'" Now, it is derived from φύσις, nature, and λογος, a discourse, and it so happens that a knowledge of the meanings of these Greek words does not give the slightest idea of what is meant by physiology in the present day—viz. a study of the

minute structures and organs of the human body—their properties and functions, and the laws which regulate them.

Others suppose that the cultivation of literature, poetry, and rhetoric, leads to the highest kind of knowledge. Well, if we desire to improve the fancy and give wings to the imagination, such perhaps is the best way of doing it. I don't undervalue the graces of literature, of poetry, of music, painting, or other of the fine arts ; but I argue that, if we wish to penetrate into the mysteries of nature, if we desire to learn the secrets involved in the health and longevity of man—if, instead of imagination or what *may be*, our object be to discover truth and what *is*—then it is not the ancient classics and a love of poetry we should cultivate, but the severer studies of logic, mathematics, physics, and experimental physiology. I am far from denying the advantage of studying geology, botany, and natural history. But why exclude physiology? If it be useful to know the composition of the earth, to learn something of plants and of the animal kingdom, are we to remain ignorant of the structure and functions of our own bodies? to know nothing of how we walk, speak, breathe, digest, or feel, and the relation which exists between the healthy state of man and the numerous conditions on which that health depends? Yet at a time when our country is crying aloud for sanitary knowledge—when the ignorance of the public regarding it is poisoning our rivers, depriving us of wholesome drink, asphyxiating us in our houses, and increasing our taxes and means of living, physiology is to be excluded from the other natural history sciences in the arts curriculum of the University of Edinburgh!

I am happy to know that all thinking men do not agree on this subject with my distinguished colleagues the Professors of Greek and of Rhetoric.* In his address to the University of

* Professor Masson has since explained that, without wishing to prejudice the general study of physiology, he was anxious at the meeting of the General Council in May to limit the natural sciences to those mentioned in the 18th ordinance of the University Commissioners — viz.

St. Andrews last year, Mr. John Stuart Mill says, speaking of sciences which should be introduced into general education :—

"The first is physiology : the science of the laws of organic and animal life, and especially of the structure and functions of the human body. It would be absurd to pretend that a profound knowledge of this difficult subject can be acquired in youth, or as a part of general education, yet an acquaintance with its leading truths is one of those acquirements which ought not to be the exclusive property of a particular profession. The value of such knowledge for daily uses has been made familiar to all by the sanitary discussions of late years. There is hardly one among us who may not, in some position of authority, be required to form an opinion and take part in public action on sanitary subjects, and the importance of understanding the true conditions of health and disease, of knowing how to acquire and preserve that healthy habit of body which the most tedious and costly medical treatment so often fails to restore when once lost, should secure a place in general education for the principal maxims of hygiene, and some of those even of practical medicine. For those who aim at high intellectual cultivation, the study of physiology has still greater recommendations, and is, in the present state of advancement of the higher studies, a real necessity. The practice which it gives in the study of nature is such as no other physical science affords in the same kind, and is the best introduction to the difficult questions of politics and social life."

None, I hope, will read these words and not be struck with their truthfulness. As to physiology being too technical or abstruse, surely there is no more difficulty in comprehending the structure and functions of a man than of a plant or of a bird. Yet it is argued that a study of rocks, of vegetation, and of animals generally, is useful, but the laws of life and of health as they affect man are not !

But physiology suffers more, probably, in the public opinion of this country from the apathy and carelessness of scientific and medical men generally as to its progress, than it does even from such educated opponents as a Professor of Greek and a Professor of Rhetoric. I once showed to a distinguished surgeon the electrical currents that are to be demonstrated in a piece of muscle with the aid of a galvanometer. He saw that they caused de-

Geology, Botany, Natural History, and Chemistry—which last, strange to say, is not a natural but a physical science. It is exactly against this limitation my motion and observations were directed.

flection of the needle, sometimes in one direction, sometimes in another, and admitted that he had never witnessed such a strange phenomenon before. After pondering upon it, he said, "Yes, it is a pretty toy," and then took his leave. At a discussion which once took place in our Senatus, it was stated of microscopes, kymographs, ophthalmoscopes, myographs, and other instruments which in recent times had done so much to advance physiology, that they were "toys, the employment of which was not only useless but injurious to medical education." I would refer you to an interesting paper by Dr. Marion Sims, in the *British Medical Journal* of only last Saturday, in which he says, "I am ashamed to say that, even ten years ago, I was one of those who believed the microscope to be merely a scientific toy. Fortunately my ignorance was dispelled, and I now look upon it as essential to the daily duties of the physician." Gentlemen, there is a class of men whose ignorance is never dispelled. They have been in all ages the enemies of progress; they could not understand the circulation when it was brought forward by Harvey, whom they persecuted; they opposed vaccination, ridiculed steam navigation, declared locomotive engines on railways to be impossible, and that George Stephenson was mad. I heard them declare stethoscopes to be utterly useless when I was a student, as they now denounce the ophthalmoscope and the laryngoscope—the use of which instruments they won't take the trouble to learn. On this subject allow me to read a paragraph from a recent introductory lecture by Professor Beale of London. He says—

"This reluctance to encourage modern modes of work, and the fixed determination to ignore modern thought, is much to be deplored, for it is doing serious harm to medicine. What can be worse than old examiners encouraging a low standard of excellence among students, and endeavouring to force teachers belonging to another generation to teach that which is known to be antiquated and useless, while at the same time the examiners refuse to incur the responsibility of teaching themselves, or even of stating publicly exactly what, in their opinion, ought to be taught? When several persons act together to promote some common cause, to raise some new institution, have we not almost invariably to admire their resolution, their devotion to the cause, their determination to yield to one another, or at worst to agree to differ, their longing for progress, their

disinterested work, their patience, their readiness for suggestions, their consideration for all who work under them, and their respect for the individual, his energy, and his work? But what is but too often the case with regard to the managers of institutions well established in popular favour, and invested with the authority which this confers? Devotion to themselves, a high sense of their own dignity, almost invariably laziness, and often weakness and timidity, always a hatred of change, disbelief in progress, impatience of suggestion, disrespect, if not a manifest contempt for the individuals they govern, improper delegation of their authority to some representative and often paid officer, a fixed determination not to inquire or improve, with but one rallying cry, but one feeling in common—an implacable hatred of change, a solemn determination to resist innovation, from whatever source it may come."

It is melancholy to see such men chosen by public bodies, as they too frequently are, to legislate on important matters—more especially for a future education, whether in medicine or anything else. I myself despair of seeing any remedy for this except by a cultivation of physiology and the laws of health among the people at large; and that such is necessary is, I think, proved by facts of daily occurrence far too numerous to mention, but to some of which I will allude as illustrations.

Mr. Mill says, after the paragraph I have read to you, that "the nerves and brain are admitted to have so intimate a connection with the mental operations, that the student of the last cannot dispense with a considerable knowledge of the first." Now, the latest utterances on this subject were made on Wednesday last by my new colleague, the present Professor of Moral Philosophy, who, if he be reported correctly, says—

"In conjunction with this revival of sensationalism, there is eagerness not only to combine physiology and mental science, but even to question the sufficiency of our investigations regarding the facts of consciousness, and to make nerves and muscles the only safe approach to a science of mind, and to proclaim the 'necessity of making physiology the basis of psychology.' The consequence of this is, not only that mental philosophy is being encumbered with irrelevant investigations concerning such physical processes as mastication and respiration, and such physical experiences as toothache and cramp in the stomach, but we are involved in all the hazard connected with the use of a false method. That mind and body are closely related and work in harmony, and that

most important help to mental philosophy may be expected from physiological research, are considerations worthy of constant attention; but to assert of body and mind that the one cannot be contemplated without the other, or of physiology and mental philosophy that the one may dictate a method to the other, is to affirm what can be maintained only on a theory of the identity of body and mind."

I would remark of this passage—1st, that as a physiologist I am quite unacquainted with the meaning which is attached to the word "sensationalism;" 2d, that I am not aware how the study of muscles can be regarded as a safe approach to the science of mind; 3d, that toothache and cramp are unfortunate illustrations, as assuredly, instead of being physical, nothing can be more purely vital; and, lastly, that it is utterly impossible that any physiologist could ever confound organ with function, or, as a consequence, maintain the identity of body and mind. With great deference to my colleague, I infer from his statements that he, at all events, is no student of physiology. In another passage he says—

"It must be reckoned nothing less than a calamity that the philosophy of our country should sever itself from the religion of the country, as if philosophy were afraid to come near to the territory of religion, or religion feared the approach of philosophy. There can be nothing but gain if the philosophy of the country be distinguished by a religious spirit. The philosophic spirit, in its high and noble sense, reverence for truth, is indeed identical with the religious spirit, reverence for God. It is, therefore, altogether a poor account of philosophy if it shrink from sustaining a spiritual religion. It is a poor account of the religion of any land if it fear the investigations of philosophy."

Now, these are noble words, and I fully agree with their import. But if it be a poor thing for philosophy to shrink from religion, it is surely a much poorer thing for philosophy to shrink from physiology. What are we to think of a so-called science which is taught by the priesthood, and founded exclusively—observe, I say exclusively—on the dogmas of religion? Is not truth only to be arrived at by knowing all the facts of a case? and if a knowledge of the brain itself, as the instrument of mind, be excluded from consideration, how is it possible to comprehend the existence of life, mind, and soul, as we find it in man alone?

To talk of what is called mental philosophy or psychology as essentially connected with religion, must ever to the physiologist be eminently absurd. He knows that our hopes of immortality are based on a very different kind of evidence from what psychology teaches ; and that mind, which may reach a high state of culture in the brain of an elephant, and be very acute in many of the lower animals, has no necessary connection with religious beliefs. Nothing, in my opinion, is so likely to bring religion into contempt as any one-sided view of mental philosophy ; whilst in attempts to arrive at just notions concerning mind, omitting all knowledge of the structure and functions of the brain, must be very like performing the play of "Hamlet" without the principal character. Is it not reasonable that a class of gentlemen who are continually discoursing from their pulpits about the body, life, mind, and soul, should know something of the relation one bears to the other—and especially of what modern science tells us of body, life, and mind? And yet when science is largely cultivated by the people, when physiology is being successfully studied in our public schools, as I shall subsequently show you, the Faculty of Arts in the Edinburgh University will not associate it with geology, botany, and natural history, as an optional study in their curriculum! Should this be persevered in, my firm conviction is that the education of the clergyman will soon be very seriously compromised.

In further illustration of this subject, it may be well to point out how utterly helpless an educated man is, if ignorant of the physiology of mind, when brought in contact with an intelligent savage who has no religious belief whatever. It is stated by moral philosophers that there never existed a community of men that had not some idea of a Supreme Being. But Sir Samuel Baker came in contact with a tribe in Central Africa who had no notion of a God or of a future state. He held the following conversation with its chief, Commoro, one of the most clever and common-sense savages, he says, he had seen :—

Baker.—"Have you no belief in a future existence after death?"

COMMORO (*loc.*)—"Existence *after* death! How can that be? Can a dead man get out of his grave, unless we dig him out?"

BAKER.—Do you think man is like a beast, that dies and is ended?"

COMMORO.—"Certainly. An ox is stronger than a man, but he dies; and his bones last longer, they are bigger. A man's bones break quickly; he is weak."

BAKER.—"Is not a man superior in sense to an ox? Has he not a mind to direct his actions?"

COMMORO.—"Some men are not so clever as an ox. Men must sow corn to obtain food, but the ox and wild animals can procure it without sowing."

BAKER.—"Do you not know that there is a spirit within you more than flesh? Do you not dream and wander in thought to distant places in your sleep? Nevertheless, your body rests in one spot. How do you account for this?"

COMMORO, laughing.—"Well, how do *you* account for it? It is a thing I cannot understand; it occurs to me every night."

BAKER.—"The mind is independent of the body; the actual body can be fettered, but the mind is uncontrollable; the body will die and will become dust, or be eaten by vultures, but the spirit will exist for ever."

COMMORO.—"Where will the spirit live?"

BAKER.—"Where does fire live? Cannot you produce a fire * by rubbing two sticks together, yet you *see* not the fire in the wood. Has not that fire, that lies harmless and unseen in the sticks, the power to consume the whole country? Which is the stronger, the small stick that first *produces* the fire, or the fire itself? So is the spirit the element within the body, as the element of fire exists in the stick; the element being superior to the substance."

COMMORO.—"Ha! Can you explain what we frequently see at night when lost in the wilderness? I have myself been lost, and wandering in the dark, I have seen a distant fire; upon approaching, the fire has vanished, and I have been unable to trace the cause—nor could I find the spot."

BAKER.—"Have you no idea of the existence of spirits superior to either man or beast? Have you no fear of evil except from bodily causes?"

COMMORO.—"I am afraid of elephants and other animals when in the jungle at night, but of nothing else."

BAKER.—"Then you believe in nothing; neither in a good nor evil spirit! And you believe that when you die it will be the end of body and spirit; that you are like other animals; and that there is no distinction between man and beast; both disappear, and end at death?"

COMMORO.—"Of course they do."

BAKER.—"Do you see no difference in good and bad actions?"

COMMORO.—"Yes; there are good and bad in men and beasts."

BAKER.—"Do you think that a good man and a bad must share the same fate, and alike die and end?"

* The natives always produce fire by rubbing two sticks together.

COMMORO.—"Yes; what else can they do? How can they help dying? Good and bad all die."

BAKER.—"Their bodies perish, but their spirits remain; the good in happiness, the bad in misery. If you have no belief in a future state, *why should a man be good?* Why should he not be bad, if he can prosper by wickedness?"

COMMORO.—"Most people are bad; if they are strong they take from the weak The good people are all weak; they are good because they are not strong enough to be bad."

Some corn had been taken out of a sack for the horses, and a few grains lying scattered on the ground, I tried the beautiful metaphor of St. Paul as an example of a future state. Making a small hole with my finger in the ground, I placed a grain within it; "That," I said, "represents you when you die." Covering it with earth, I continued, "That grain will decay, but from it will rise the plant that will produce a reappearance of the original form."

COMMORO.—"Exactly so; that I understand. But the *original* grain does *not* rise again; it rots .like the dead man, and is ended; the fruit produced is not the same grain that we buried, but the *production* of that grain. So it is with man—I die, and decay, and am ended; but my children grow up like the fruit of the grain. Some men have no children, and some grains perish without fruit; then all are ended."

I was obliged to change the subject of conversation. In this wild naked savage there was not even a superstition upon which to found a religious feeling.*

In these passages, it will be observed, Sir Samuel Baker thinks the mind of man different from that of an ox, not only in degree, but in kind. He confounds mind with spirit or soul, and likens the last to fire caused by the friction of wood, as well as to the growing germ in a seed! In all such discussions, it appears to me, we are bound to have definite ideas of the meanings that ought to be applied to such expressions as body, life, mind, spirit, and soul, which in ignorance of physiology is impossible. It would certainly, therefore, be of great service to the clergy generally if they knew something of this science.

Perhaps no greater error could prevail than that which supposes the senses and instincts to be sufficient for instructing man as to his physical, vital, and intellectual wants. In an early and primitive state of society these might have availed somewhat, but in civilised life the most simple physiological acts—such as

* *Albert N'Yanza*, vol. i. p. 247, *et seq.*

breathing, eating, and drinking—are influenced by the artificial conditions in which he finds himself. Hence it might readily be shown that physiological knowledge is more or less necessary for all the arts and professions of modern times, and that an ignorance of it has entailed a large amount of misery, ill-health, and mortality on mankind.

For example, how little is the important subject of ventilation studied by architects! If you take a walk into the West End of our city, and look at the fine crescents and handsome streets that are being erected there—then go into the houses, look at some of the rooms, and only remember the amount of pure air that is required in respiration—you will be perfectly astonished that they could have been erected. The new University Club in Edinburgh contains one of the most beautiful drawing-rooms in the world. But at night its heated and close atmosphere is too perceptible. A very remarkable instance of want of physiological knowledge is to be found in the history of the present Surgical Hospital. It was built only a few years ago at a large cost, and is now said to be one of the worst ever erected. Epidemic diseases have spread through it, and the result of the operations in some of the wards has been unsatisfactory. This is not so much the fault of the architect as it may be of some surgeon ignorant of physiology, and careless as to abundant access of pure air.

In former days people thought that in the atmosphere there were all sorts of evil spirits, witches, and demons, and they attached dreadful consequences to their influence. Now, they people the air with what they call germs, seeds, or something or other that in their imagination gives rise to epidemics. The miseries that have been brought on the human race by this illusion are remarkable. Think of the horror contained in the one word "quarantine." Suppose yourselves arrived after a long voyage at your destination, and being compelled to remain in the close vessel other fourteen days, because you come from some part of the world where fever prevails. It is not

alleged that there is any disease on board, but simply that you have left a place where an epidemic existed, and it is imagined that you bring some germs or seeds that will produce a pestilence, if you landed without quarantine. Consider the loss to commerce which results from it. Of all diseases which were supposed to be propagated in this way, the plague was the most notorious. But a distinguished French physician in Egypt, Clot Bey, proved that the plague never had been infectious at all. He was permitted by the Viceroy of Egypt to inoculate two or three criminals who had been condemned to death with plague matter. He did so, and proved that the disease was not only not "catching," but could not be inoculated. Nobody ever controverted his views; but the plague is still thought to be contagious. We are ever running into exaggerations. Because some diseases are contagious, we ascribe the same quality to a great many others that are not so, or in regard to which we have no positive proof. It still remains undecided as to whether cholera is contagious or not; and this and many other similar questions can only be determined by physiological knowledge. Hence it is only by spreading this knowledge among the people, and getting them to observe facts, that we can ever settle these disputed subjects.

All the engineers with whom I ever came in contact are decidedly of opinion that the odours arising from putrid matter and animal excreta are deadly, and that it is necessary to convey them to a distance from dwellings at any cost. The result is that at an enormous sacrifice of money we have had the sewage of our towns conveyed into neighbouring rivers, which have become surcharged with this matter. To escape the imaginary evil of smells, they have poisoned various streams and springs, thereby occasioning wide-spread disease from drinking unwholesome water. The consequence is, that an Act of Parliament has recently been passed to prevent the sewage of towns being carried into rivers; and the engineers can do neither one thing nor another. The sewage can not stop where it is, and yet it can not

be taken away. But the people of other countries have settled the question. We have only to cross the Channel and go to Paris, and we find that the whole sewage is conveyed through a great tube to the Forest of Bondy, seven miles off, and there, is converted into a dry earthy mass, which constitutes one of the best kinds of manure. It is sold to agriculturists all over the country, so that the municipality of Paris thus gains £300,000 per annum. Observe the difference between Paris and Edinburgh. We also recently caused a great tube to be constructed in order to carry the sewage a mile out into the Firth of Forth and throw it away. This cost the city something like £100,000. We spend more money in wasting matter than other nations in preserving and obtaining from it an enormous revenue. And yet there is nothing in the world to prevent Edinburgh from imitating Paris, and deriving many thousands of pounds annually from its sewage.

Two years ago I was asked to visit a certain work in the Canongate, in which a man, possessing an acre of ground—through which what is called the "Foul Burn" ran—made an artificial manure. He built two large tanks, into which, by means of sluices, he conducted the stream and allowed it to form a sediment. He then ran off the liquid—repeating this process till both his large tanks were filled with thick mud. He now emptied them over his acre of land, and spread some chloride of lime on the surface to keep down the smell. He then mixed the sediment with a quantity of refuse from breweries, and converted it into a dry powder which he called artificial manure. He made in this way 750 tons of manure in a year, which were sold for 25s. per ton—more than paying all his expenses, and yielding a tolerable profit. It so happened that we then had a very active Inspector. He heard of this manufactory in the Canongate, and immediately cited the manager for creating a dangerous nuisance. I was consulted, and reported that I had inspected the work; that I had visited all the cottages in the neighbourhood, and that there had not been a single case of

illness since it had been erected. I said to the Sheriff that, so far from punishing and fining this man, he should have a statue of gold erected to his honour, for he had solved one of the great problems of the age — the utilisation of town sewage. After a little, the Sheriff asked how many yards this work was from the public road. The manager replied that it opened on the road; so the Sheriff ordered the manufactory to be suppressed, as there was a statute prohibiting such a work being erected within so many yards of a public road. The work was stopped; the 750 tons of manure were no longer made in Edinburgh, and the sewage was again allowed to pass into the Firth of Forth as utterly useless. I was informed that if the great burn at Canonmills could have been utilised instead of the little foul burn, 10,000 tons of artificial manure might have been manufactured, and sold at 25s. per ton. I attribute all this waste to a want of physiological knowledge, because, if magistrates and others were impressed with the great physiological law—viz. that the excreta of man as well as of animals should fertilise the earth instead of poisoning our rivers and seas,*—I think we should manage things very differently.

Many manufacturers have added largely to the mortality of their workmen by an ignorance of physiology. No class of men is more interested in securing the bodily health of those they employ, because it is good and skilled work they want, which cannot be performed if the individual be weak or diseased. Consumption, for example, is common among grinders and polishers of steel, dressers of flax and feathers, cotton-carders, china-scourers and potters, tailors, seamstresses, strawplaiters, lace-makers, silk-workers, and miners. On the other hand, cooks, butchers, tallow-chandlers, and soap-boilers, enjoy to a great degree immunity from the disease. The reason is obvious. In the first class of cases, the inhalation of foreign particles into the

* In Leicester there has been manufactured from town sewage, by what is called the A. B. C. process, manure which has been valued at £3 : 17 : 3 a ton. See "The A. B. C. Sewage Process," &c. London: Elliot Stock, 1868, p. 17.

lungs excites local irritation, which proves injurious to the respiration, and deteriorates the constitution; or the results are occasioned by the combined operations of sedentary employments, impure atmosphere, exhaustive work, or bad food. In the second class of cases, there are good wages, and, as a concomitant, good food, while a constant contact with oil is supposed to offer an additional explanation of the fact. Much of the mischief occasioned would be removed by putting in force regulations which are dictated by physiology.

Bathing, doubtless, within certain limits, is conducive to health; but I have recorded a case of consumption,* that ultimately recovered, but which had proved nearly fatal from a severe inflammation caused by a cold bath. The young lad, with his schoolfellows, went to Portobello, and notwithstanding his evident dislike, his shivering, his emaciated frame and severe cough, was made by his master, probably with the best motives, to go into the sea with the rest. Again, exercise is also beneficial if properly regulated, but to use hard labour both with the body and the mind at the same time is most injurious. Last year an apparently vigorous young medical student, to the astonishment as well as grief of the University, died from fever. Not satisfied with distinguishing himself at examinations, and gaining class prizes, he was recognised as one of the élite of the Athletic Club. Was he really stronger in consequence? His premature death unfortunately proved the contrary.

It has been shown by Dr. E. Smith that the most lamentable ignorance everywhere prevails as to what constitutes a good and sufficient diet for individuals under varied circumstances—especially for soldiers, sailors, labourers, prisoners, and paupers. Young persons at school also are often insufficiently fed at a period when growth requires abundant nourishment. The mistaken prejudices of some parents on this head often lead to serious results. The public ignorance of dietetics was well

* *Principles and Practice of Medicine*, by the Author. 5th edition. Black, Edinburgh. P. 723.

illustrated by a system recommended to reduce obesity, by a Mr. Banting. Had this gentleman been a scientific or a medical man, it is probable that not the slightest attention would have been paid to his suggestions ; but, for no better reason than because he was neither one nor the other, his system has been largely adopted, and the experiment thus presented to us has shown that what proved beneficial to one person has greatly shaken the health of numerous others for whom it was not adapted. The question of temperance in eating, and especially in drinking, is too vast for me even to touch upon, and yet it is one essentially connected with physiology.

The chemists, I need scarcely say, have been for some time directing their attention to physiological problems. Yet it is not too much to say that their exertions would have tended to more correct results had they experimented with physiologists. The views of Liebig as to muscular action and the production of urea had long reigned undisputed, when a physiologist, putting the matter to actual experiment by climbing a mountain, proved it to be erroneous. The subsequent researches of Parkes have left the matter in no doubt, the controversy ending in the words of a celebrated song :—

> "But though Liebig's adherents are making a bustle,
> And in victory's plumes Playfair's trying to rustle,
> Physiology says they've the worst of the tussle,
> For the secret is this—that there's *life* in a muscle."

Much is being said about female education, and all sorts of efforts are made to give women the same opportunities as men for obtaining knowledge of an extended and elevated character. Here physiology would be of the greatest advantage, not only to the comfort but to the happiness and real welfare of society. Consider—1. The effects of fashionable clothing on the young female—the tight lacing, naked shoulders, thin shoes, and other carelessnesses so subversive of health ; 2. The great object of marriage—the production of healthy offspring, and all the foresight, care, and provision required, but too often neglected

through ignorance ; 3. The rearing of children, and the innumerable wants which they possess, which a knowledge of physiology would enable the mother to satisfy ; 4. The preparation of food, which in most families is cared for by women, and on which so much depends ; 5. The proper employment of women, which should be regulated with regard to their constitutions and conformation ; 6. Nursing the sick is one of the most holy occupations of women, and need I point out how much more intelligently this would be done if they possessed physiological knowledge? These, and numerous other points too numerous to mention, render it peculiarly desirable that women should be taught the general doctrines of physiology when young. Doubtless those who regard this study as too difficult and technical for young men will decry it also for women ; yet it so happens that for them nothing is so truly interesting as this science, and when tried they have exhibited especial aptitude for it. I here show you the examination-papers of two school-girls of the Ewart Institution, Newton-Stewart, which contain an amount of information in physiology perfectly astonishing. Seldom have my students given better answers. And yet it is argued by my excellent friend Professor Blackie, that physiology was far too difficult and technical a subject to be studied by the students in Arts of our University !

It is obviously impossible, in an address of this kind, to point out with sufficient completeness how an ignorance of the laws of health, or their mal-application, is constantly inflicting disease, misery, and death on mankind, as well as impeding the judicious efforts of those who philanthropically seek to ameliorate the numerous evils of our social condition. Enough, I hope, has been said to show that physiology is a branch of knowledge intimately associated with our best interests ; and that, as such, it should not only be added to other branches of natural science in the Arts curriculum of Universities, but be studied by all classes of society as a part of their advanced education.