

J. N. Czermak, “Physiology as a common element of education” (Leipzig, 1869)

Esteemed assembly!

Permit me above all to give expression to the inner joy – despite all the pleasant circumstances of my previous sphere of activity in Jena – that accompanies the honorable invitation to assume an honorary *Ordinarius* professorship at this *Hochschule*, which is in the grip of a flowering like no other in Germany.

My joy was redoubled: for on the one hand exactly the *kind* of academic position under offer, due to its lack of extraneous obligations, seemed to me most especially desirable and well suited to the freest exploitation of the calling to research and teaching; --- and on the other hand in no other time or place in the world has such munificence for the care and advancement of my discipline been undertaken and demonstrated as here and now in Leipzig – one may boldly assert it – whereby scholarly communication, stimulation, and advancement in this domain had to have presented themselves in unusual abundance.

Physiology, so recently grown out of its initial subordinate status as medical teaching aide into an autonomous scientific discipline with particular tasks and special methods, has indeed *here* for the first time attained a residence and workplace worthy of its newly-acquired rank, worthy of the significance it has now gained, upon which not only Leipzig and Saxony, but all of Germany can look with justifiable pride and the most serene self-esteem.

Surely no gift of prophecy is needed to foresee that under the leadership of that master to whom was granted the privilege by the magnificent support of an enlightened regime to bring to fruition of his pathbreaking ideas this new scientific model workplace according to a well-thought-through plan , so that the Leipzig Hochschule truly shall and must flourish into a *higher school* for modern physiology.

Given the effectiveness of the new physiological enterprise under the leadership of its intellectual founder, one might have grounds to expect, as I do, just as powerful an influence upon *general* progress in the presentation and solution of physiological problems as upon *local* progress in scientific life and operation of the school. And if the current representation of the specialty at this university is to be labeled *completed*, one might ask which special and *particular* tasks are still left for another teacher to address?

This question has understandably given me much thought, for although I regard it as a duty of friendship and gratitude and reckon it an honor to place my efforts at the disposal of the present leadership of our model physiological institute for its research and teaching aims, just as the most expansive use of its means have been most generously permitted to me, I would wish even so for that autonomy and independence that corresponds to my academic background.

It thus seemed appropriate to me to use the traditional formality of the inaugural lecture as a desirable occasion, when addressing the given topic, “Physiology as a common element of education,” to develop briefly those thoughts and considerations through which I have sought to

be clear to myself about the possibility of a *special* direction, a *particular* aim for my future academic activity, so as to be able to go to work with the sure and uplifting consciousness of having reclaimed a *new page* for the representation of the discipline at this university!

I started from the conviction that physiology in its present direction and form, which it namely assumed since its fortunate application of the principle of conservation of energy—“the highest and most fruitful generalization in all of science” [citing A. Fick]—to the world of living phenomena, is a science which has earned the right to be of utmost interest and serious attention for every thinking person making claim to true general education.

An expansive basis for this conviction, which I made the starting point of my deliberations, is not required, for it is quite enough to recall the tasks, aims, and methods of modern physiological research in order to make visible the infinitely manifold and internal connections of physiology to any conceivable interests, achievements, and problems of humanity, and thus to place in the proper light the worth and significance of physiology as *a common element of education and culture*.

Physiology is known as the science of the particular processes and activities whose totality makes up the life of organisms.

It seeks not only to learn precisely all the individual expressions of life and to establish them according to their specific manifestation, their temporal value, their spatial extent, etc., but also seeks this moreover as the immutable, law-like result of the diverse and complex arrangements and forms of movement of the elementary mass particles from which the constituent organs and tissues are composed, to comprehend and grasp them in their necessity and contingency.

Its highest task and final aim is: *To derive, i.e., to explain logically and experientially all of life with all other natural phenomena from **one and the same** realm of general laws of action.*

Physiology has not always had this direction.

Earlier one regarded rather more the most diverse attainments and activities of organisms as the result of an entirely special force of nature only [found] in living bodies, a force which was to intervene in inert matter, moving and ordering according to goals and intentions, and one called this mysterious, protean, multi-form agent the “life force.” [cf. *vis viva*]

[further remarks on the old vitalist physiology]

In striving for a mechanical explanation of life modern physiology, like every explanatory science, employs two aids in research: *observation* and *experiment*.

Physiological observation consists in the researcher directing his focused attention on the changes and processes which either present themselves during the course of life on and in the organisms of his sensual perception, or which he must first make accessible through intentional intervention in the interior of the living body; the latter for example through optical or acoustical apparatuses like the ophthalmoscope, the laryngeal mirror, the stethoscope, the plessimeter, etc., etc., or directly through cutting instruments, vivisection in the narrow sense.

[more on the various tools: kymograph, cardiograph, etc.]

But sheer observation, however exact and sharp it might be, does not yet suffice *in itself* for conveying the causes and laws of the phenomena which a satisfactory explanation of life should make possible.

Toward this end observation must combine with experiment.

This consists in a regular dissection of the causal conditions of the individual phenomena, and this dissection takes place in that all the conditions from which a phenomenon can be produced, intentionally modified in sequence, and at the same time the results of this modification can be precisely observed.

That condition must then count as a genuine cause of the phenomenon whose isolated variation or elimination the phenomenon itself has correspondingly modified or neutralized. Only if one can intensify and sharpen the experiment into a *measuring* trial in which the quantitatively specified variation of the generating condition is compared with the degree of the generating modification of the phenomenon does the law of the effect reveal itself.

[more on experimental method, and arguments against vivisection, though he firmly favors it]

It is the next task of physiological experiment now to convey with precision the individual organs and tissues of the body whose special function or expression of activity is this or that living phenomenon, and which thereby must contain all the material conditions that feed into attaining the phenomenon.

Thus for example a given nerve turns out to be the exclusive conduction path for the stimulus process initiated by the mental impulse, if the experimenter reveals it through vivisection, then stimulates it electrically or mechanically, then cuts through it and observes no other modification than a connection in the first instance, but in the second instance a paralysis of an individual muscle or muscle group.

... *Physiological* experiment thus always turns on the physical and chemical in the end.

.... In this respect it is precisely man with his bodily and mental character, with all his capacities and activities as individual, as a part of the totality of humankind and the whole of nature, to whom it has become the task of "*realistic foundation and elucidation*," that physiology take on that, so to say, central place in the wider circle of all knowledge and ability of which it would appear so worthy and meaningful as a common educational and cultural element.

Indeed, what other science could stand closer to the general human interest, too, which could be worthier of serious perusal on the part of every thinking, cultured person, than the very one which poses a task whose exact solution *alone* reveals a correct and basic knowledge of life conditions and life expressions, and itself thereby first enables a real insight into the true nature and being of man.

Aside from the direct utility and practical advantage which physiological knowledge bestows for so many aspects of our demanding existence, there is also scarcely any other scientific discipline than physiology which so certainly and irresistibly leads to the kind of conception of the world that makes [us] truly free and unprejudiced, and patiently [leads] against all human errors, against all human frailties and limitation!

It must nonetheless be conceded that physiology is as yet far removed from having solved its task *completely* in the sense of modern contemplation of nature, or even in a single main point; nor on the contrary should one fail to appreciate that the insight now attained into the life expressions of a contingent mechanism of organic structure is profound enough, the experimental method of research is exact enough, in order to be able to vindicate the significance of modern physiology repeatedly emphasized by me.

I now permit myself to proceed without further ado to the development of those thoughts which for me established this thesis with respect to my new academic circle of activity.

My next thought was that physiology forms at present only a teaching tool of the medical school in all the *Hochschulen*, and hence remains inaccessible to all those whose calling has taken them to one of the other faculties.

In considering this regrettable circumstance by which the great part of the university auditors have been excluded from closer acquaintance with the results and methods of physiological research, the conviction had to impose itself further upon me that, along with the narrow disciplinary lectures on general physiology inserted into the curriculum of medical study, there also ought to be the kind [of lectures] which would present this science – to be sure, no less fundamentally – but in generally comprehensible form, i.e., without assumption of any disciplinary knowledge.

I must express here with all resolution that there is no object of physiology known to me, as in the natural sciences overall, that should not be able to be made fully accessible to an educated person of normal powers of comprehension and understanding whose attention is only moderately strained by gifted application of sufficient aids of demonstration and experiment.

In that I have expressly recognized hereby on the one hand the possibility of a thorough and successful generally comprehensible presentation – I intentionally avoid the expression “popularization,” which not without grounds has come somewhat into discredit – of physiology, and on the other I have already just especially stressed and emphasized the significance of physiological knowledge for the advancement of true general education, so it will be apparent to you, my esteemed audience, how I have come to regard it as my particular task – along with my strictly scientific efforts – to be active in the indicated direction and to wrest a new aspect to the representation of the discipline through special consideration of the general educational interests of the entire student body.

My intended enterprise has, so far as I know, never been carried out yet in the scope and manner that I have in mind.

To be sure, individual so-called popular physiology lectures have been held or at times even a comprehensive account about the achievements and progress of physiology has been reported, – this is however not all that is needed and all that I would like to introduce at this *Hochschule*.

My thought is rather more to venture an attempt for once *to treat physiology as a subject that something like the general philosophical programs [sic: Collegia] on logic and physics, psychology and world history, ought to be included as an indispensable element of higher training in the curriculum of every university auditor.*

I am in no way concealing from myself the concerns and difficulties which stand in the way of the intentions and plans that I cherish for this portion of my future academic activity.

As with every innovation that goes beyond the usual cycle of affairs or intrudes into entrenched relations long in place, the matter as such already gives rise to numerous concerns which would be overcome only through genuine success and unambiguous results.

But there are still some estimable specialists of the opinion that it would not be worth the effort, and would be just as worthless as profaning science to want to propagate insights and knowledge in wider circles which could only create confusion and dangerous superficial knowledge and thus should definitely to remain a monopoly of higher education.

But much greater and more serious than these and similar mostly just imaginary concerns are the real difficulties of the enterprise, which in the nature of the subject itself... The scope of the physiological knowledge domain is also so significant that the correct choice and disposition of the materials to be treated seems not less than easy and obvious.

If physiology, namely as a valuable element of higher education like the university has it to offer and provide, can prove itself and become established, then it suffices in my opinion to offer an explanatory overview of living phenomena with more or less rhetorical skill, ex cathedra, but in no way dogmatically.

It lies much more in the particularity of the subject that the processes so diverse and alien and inaccessible to common sense, processes whose knowledge and explanation concern us here, as well as the methods and aids which physiological research applies to the attainment of its aims, must be presented in detail to the *direct view* of the auditors, if those explanatory and ennobling effects, brought to intimate understanding, are to be created and bequeathed in minds, effects which are sure to be expected with thorough study of modern physiology.

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The physiology lectures which I gave over the past three years in Jena's academic "Hall of Roses" and have recently published can give a passing image of the kind of treatment and presentation of physiology I have roughly conceived for the present intended purpose: I must only explicitly note that I regard as necessary a still more special and profound introduction to the subject, a still richer activation of the direct view, than the educational entertainment of the "Rose public" demanded: and thus you see, esteemed audience, the apparently indispensable

demands on demonstration and experimental lecture aids and correspondingly the internal and external difficulties of the entire enterprise accumulate and rise up to almost alarming heights.

Finally I cannot leave unmentioned that a danger for its felicitous implementation lies in the eventual success of the enterprise itself. I mean that with the size of the audience and with its growth, which cannot be avoided, if the form and content of the lectures are to be found suitable to satisfy a genuine need, naturally the ease, partly indeed the very possibility, of demonstrating everything needed in corresponding and adequate fashion, without any really special installations, will diminish, and this could easily happen in such an alarming degree that the indispensable direct view upon which the didactic success rests in large part would become illusory.

From the very beginning the most scrupulous care must thus be taken that all the diverse demonstrations contain a very high degree of transparency and perfection, and that the lecture venue has the proper dimensions and is equipped ad hoc with special apparatuses which are suitable to make the venue from a mere auditorium immediately into a – *sit venia verbo* [pardon the expression] – spectatorium.

I reckon above all the form and arrangement of the seating, then the central placement and intensive lighting of the room, where the lecturer is located and where the experiments are carried out, and finally the easy disposition of all those aids which must always be at hand, because they individually or in some combination are put to use in almost all demonstrations, as for example electrical lines for constant current, mechanical transmitters, gas and water connections, wall surfaces or screens for hanging painted images or for mounting optical projected images, slide apparatuses, and blackout apparatuses, etc., etc.

All these high requirements and difficulties, which I am persuaded on the one hand must be fulfilled, and on the other hand must be overcome before one can introduce physiology as a common element of education in university circles, do not discourage me, however.

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In conclusion I can only further express the desire and hope that it will be granted to me to live up to the expectations which I have excited promptly and in full measure, and to awaken a truly lively sympathy on all sides for my intentions and efforts, and to maintain it over the long term.