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ANTON DOHRN[1]

To speak of Anton Dohrn before zoologists is both easy and difficult. Many, perhaps the greater number, of you have known him personally, some longer and better than I; and all know his work. Of his aims and their attainment he has left us his own graphic recital full of personal charm; and others have paid tribute to his achievements in a manner so incomparable that I can not hope to bring to you anything new. But I have been encouraged in this undertaking by the thought that I do not first need to arouse in you sympathy for his personality. What I have to say will awaken in most of you an answering chord, recalling so many varied reminiscences that my aim will be accomplished, even though my words fail in their expression. So bring back to your mind the image of the beautiful white building with its red loggias, against the dark background of green ilex; picture this building as it stands on the shore of the Bay of Naples. Upon the facade zoologists read with pride the words "Stazione Zoologica," telling each one that here stands a temple of science symbolizing their aims and ambitions. More than two thousand square meters are covered by this building containing more than 150 rooms, in which fifty persons, officials, technicians, artists, fishermen and laboratory servants are continuously engaged in work. At Easter time the visitor to the station will find there as many

[1] Memorial address delivered at the International Zoological Congress, Graz, August 18, 1910, by Dr. Theodor Boveri, professor of zoology and comparative anatomy, Wurzburg. (Translated for SCIENCE.)

as eighty investigators busily occupied, and a tour of inspection from room to room in reality carries him through the whole range of biology. In the course of thirty-six years many embryonic biologists have been attracted here to study for the first time the wonders of marine life. Here investigators have come from every civilized land, because the scientific problems they had in mind could nowhere else be studied to such advantage. How many hours of happy work, how much of the joy attending discovery, has this building seen! The tables of the station have been occupied more than 2,000 times, while the number of scientific experiments either originating or deriving their inspiration here can not be estimated. Add to this total all that the station itself has contributed to scientific work; the help given to zoological investigators by the *Jahresbericht;* the material supplied for museums throughout the world, as well as for teaching purposes, and last but not least recall the fact that this institution since its foundation has served as model and inspiration for the establishment of zoological stations in many different countries. Remembering all this, we can but echo the words of the address delivered at the station's International Jubilee Celebration in 1897:

> We can not imagine what the position of the biological sciences would be at this time had the far-reaching influence of the station been eliminated.

Should we wish to express as briefly as possible what this influence has been we would say that Dohrn's Station first made the study of marine life practical. For a long time occasional soundings had been made by a few persons, and they had revealed the hidden treasure. Similar institutions were established about the same time as Dohrn's by contemporary leaders in the field of zoology, Henri de Lacaze-Duthiers and, in America, Louis Agassiz, not to mention other smaller undertakings. But in making the great treasure available Dohrn was the first, and this marks the importance of his work in comparison with all others. In this we have an objective measure of his work. Each one of us, profiting by the studies made at the Naples Station and conscious of having added another stone to the growing structure of our knowledge, must imagine his own part increased a thousandfold, if he is to measure the entire scientific contribution made possible by Dohrn's creative genius. With this in mind we must realize how immeasurable was the influence he exerted on biology. Not only does time fail me, but I am not in the possession of the facts necessary to follow in detail the course of the newer streams of knowledge arising in the zoological station, and spreading out over the most widely separated fields of biology. I shall direct your attention to only one branch in the wide field of enquiry carried on in the station, namely, that which may be described under the head of causal morphology. Judged by what has been gained in the study of marine organisms and realizing that without the opportunities offered by these stations the results would have been unattainable, the part taken by the oldest and largest of these institutions at one of the most critical moments in the history of our science entitles it to the highest reward.

Anton Dohrn, the man to whom we owe all this, was born December 29, 1840, in Stettin, now almost seventy years ago. When one hears his father's personality described there is no doubt that the son resembled him in outward appearance and inherited from him what was best in his parent's character. The possession of ample means permitted the elder Dohrn to order his life according to his inclinations.

To live life to the full, as Goethe expressed it; to develop all his inherent powers; to take as comprehensive a view as possible of all fields of learning, these were his guiding principles. In the house of this unusually talented musician were heard artistic renderings of the chamber-music of Beethoven and Schubert, while as an accomplished linguist he made finished translations of Spanish dramas. Far and wide he was known as an entomologist, as well as the founder and director of an influential entomological journal published in Stettin. These and other undertakings enlivened an immense correspondence which he carried on with a circle of prominent men, and such relationships were further developed by frequent journeys to Italy, which country of all others gave the greatest pleasure to this man, fascinated by the beauties of nature, antiquities and the charm of Italian life.

In such surroundings, with three equally gifted brothers and a sister, Anton Dohrn grew to manhood, and those who knew him well recognized in him many of the qualities possessed by the father. At seventeen years of age, this precocious youth (who had already passed without difficulty through the gymnasium) published articles in entomological periodicals. We can imagine him on the threshold of the university, full of strength and love of life, abounding in enthusiasm for a multiplicity of interests, developed under the father's influence, and by unusual teachers. The world as Goethe saw it was his confession of faith. Dohrn himself regarded it as an accident that with his traits he should in those times have become a zoologist. The entomological leanings of the father, who had interested his three sons while yet boys in the art of collecting insects, gave the first impulse in this direction, but his real interest was not yet aroused. What could zoology as it was taught in his student years, in the early sixties in Königsberg, Bonn and Berlin, offer to his hungry mind? Disappointed at the time already lost, he had the notion of giving up his studies and becoming a publisher, when the appearance of Darwin's work brought an illuminating ray suddenly into his life. When we consider how many of us have been drawn into biology, from widely separated fields of interest, by the doctrine of descent looming up before our minds, we can easily imagine what an anchor of safety was offered by this vision to a young zoologist of Dohrn's temperament and education, already despairing of his ground. Here was the turning point in the life of one who scientifically was in despair. At one bound zoology took for him its place as the central point of all knowledge. What had appeared to his mind as without continuity, suddenly became most perfectly connected. Like many others of his time and later, he had the feeling that here if anywhere the riddle of our being must find a solution. Without doubt the manner in which the new teachings were presented by Haeckel and Gegenbauer must have had great influence on this revolution of his thought processes. Following the advice of these two men, he matriculated in 1868 at Jena, and it appeared at first as if his life too would find its aim and end in the chair of a professor of zoology, but Dohrn's personality forced itself out from this career and created a new sphere of existence. Later he gave two reasons for breaking away from the academic career. Often when working by the sea he had felt the great need of laboratory facilities. A profitable field of activity in Jena hardly seemed longer possible, as a result of an increasing divergence of his scientific views from those of Gegenbauer and Haeckel. Little as we can doubt the strong influence of these motives,

it seems to me that they were only the expression of an impulse, unconscious perhaps to Dohrn, to bring those powers into play, which as privatdozent, he would be forced to suppress. He longed to create something great all his own, to wander on new and untrodden paths. This desire showed itself in his earlier project to become a publisher, as it was his wish to choose a field of practical activity affording full play for his intellectual talents. When the earlier indifference towards the adopted science had been changed into enthusiasm, this impulse, as a matter of course, chose for its objective, zoology. Beginning with taxonomy, imbued with Darwinian theories and accepting transmutation as a physiological problem, he had already gained a comprehensive view of the needs of his science. He had ever before his eyes the lesson the sea had taught some of his fortunate predecessors, especially as recorded in the brilliant results of Johannes Müller's work. His own experience had often shown him how much more advantageously these marine organisms could be utilized if the experimenter, hurrying from inland to the coast for a short season, found there even a primitive laboratory. The founding of a marine zoological station offered the needed medium for the expression of this strongly felt impulse to develop his great personal powers.

In the winter of 1870, Dohrn went to Naples, hoping to realize his plan, but the negotiations entered into were soon interrupted by war which recalled the young officer to Cassell (on account of an earlier illness he had been transferred to the reserves). In the fall of 1871 Dohrn removed permanently to Naples, and forthwith began the great constructive period of his life. To-day the biologist comes to Naples and sees the Zoological Station standing in the public gardens, of which it is almost an integral part. On going to work he finds not only the material for his experiments, but apparently everything needful for their elaboration, even complicated and specialized equipment being brought to him with business-like promptness. In addition he has easy access to a library of such completeness as nowhere else could be at his disposal—in brief, when the occupany of a Naples table, a veritable "Tischlein deckt dich" allows him to concentrate his thought entirely on his work, he accepts all in its completeness without realizing the indescribable toil and self-sacrifice with which this now perfect institution has been brought into existence. And I too must confess that even though I had known the station in its beginnings and had read and heard much as to its origin, it was first through the manuscripts left by Dohrn in which he speaks of the formative years that it became clear to me what courage, what self-denial, what inexhaustible patience, what an intimate acquaintance with the most varied realms of knowledge, what an art for grasping situations and handling men, had been brought into play in this creation. Dohrn himself, speaking twenty years later of this time, said:

> It now often seems to me as though like a sleep-walker I had safely passed all the pitfalls that lay on either side of my way. Without a model as precedent, with entirely insufficient pecuniary resources, absolutely without business knowledge, in a foreign land, of whose language I knew little or nothing, I signed an agreement with the authorities of the city which of all others in Italy is the most difficult to administer. From the time of the first negotiations in the city hall in Naples, in November, 1870, to the opening of the station in February, 1874, I passed through an Odyssey of wanderings.

Do we hear in these words the approach of that period in life when in retrospection one doubts the power of youth (even one's own) to have accomplished what has been

done and which perhaps one is no longer capable of doing? His own words make us realize the size of the undertaking to which Dohrn had committed himself. No man of experience, upon hearing of the plans, believed them to be practical, and the more intimate the knowledge of the critics, the more were they convinced that this fantastic undertaking would meet with nothing less than failure. But these prophecies left out of the reckoning one thing, which alone action could bring to life, namely, Dohrn's iron will and his unusual abilities.

Within the limits I must set myself in this address, it is impossible to give a picture of the difficulties with which Dohrn had to contend during these years. When, as we dare hope, that which he has written of the drama of these early years at last reaches print, no zoologist will fail to read it. As one example only, we will cite an episode out of many similar ones which might be chosen. In the autumn of 1872, when the building was almost ready for the roof and Dohrn at the time was lingering in Berlin, in order to seek support for his undertaking in the Academy of Science, from the Prussian authorities and from the crown, he suddenly received from Naples a telegram to the effect that the municipal authorities had stopped the building because the height agreed to by contract had been exceeded. This was in truth the case. In consequence of an incorrect level, it became necessary to exceed the prescribed height by a couple of meters, unless the whole structure were to be reduced in size. This infraction of the agreement aroused anew the smouldering fires of suspicion. All the enemies and envious critics, all those whose profits had been interfered with, again rose, and soon the rumor was rife that the building must be razed to the ground. Dohrn hastened immediately to Naples. It was autumn and the season of the heaviest rainfall was imminent. Unless great damage were to be done, the house must at once be put under cover. But notwithstanding every effort, he was unable to obtain more from the municipal authorities than the permission to carry on the work at his own risk. A settlement of the question as to the height could not be reached. Not an instant did Dohrn pause to consider; the precious time must be used to advantage, and the work of building continued. He was also confronted with the problem how to procure funds to pay the indemnity occasioned by the slight excess of height. The straining of every nerve had to be begun again in order that those upon whose favor the success of his enterprise rested might be reconvinced and rewon. This work he had believed to be behind him. But all ears appeared closed. Week after week passed and nothing was attained. Still undisturbed and unaffected by the damage that a deluge of unusual and unprecedented severity had occasioned, he pushed his building operations towards completion. Suddenly a command came from the city authorities that the work must be definitely discontinued and, as if this were not enough, at the same time bad news arrived from Berlin. Du-Bois Raymond, in whom Dohrn had found a friend and sympathizer, wrote him that the circle of intellectuals in Berlin with whom rested the final decisions, were so unfavorably disposed that no aid from the academy and thus no subsidy from the German government could be counted upon. Du-Bois Raymond deeply regretted being obliged to communicate to him anything so adverse to his interests, and hoped that Dohrn would not allow himself to be cast down, but would make every effort to get the necessary help elsewhere. The evening of that same day Dohrn was on his way back to Berlin, and before Du-Bois Raymond could

expect even an answer to his letter Dohrn was before him in person. He begged his well-wisher to tell him what were the dangerous weapons which according to the letter would be directed against him. As Dohrn had suspected, it was, on the one hand, doubt as to his scientific abilities, by which means Professor Peters had prejudiced his Berlin colleagues against the undertaking, and, on the other hand, it was rumored that the Zoological Station was a commercial venture, and as such should not be subsidized by the government. As soon as Dohrn received this information he replied that he had determined nevertheless to get the money he needed in Berlin; and so, as in Naples, a similar personal campaign was carried on, but with better success. From one opposing academician he went to another and soon succeeded in disarming the most hostilely disposed; the others he convinced of the importance of the beginnings he had made, and of the correctness of the chosen ways and means. One of the amusing pronouncements let fall at this time by the veteran Ehrenberg may be cited here. Ehrenberg affirmed that if Dohrn attacked the fauna of Naples with such an armory of equipment and helpers, in five or ten years there would be nothing left there to investigate. This Berlin campaign lasted fourteen days, in which time he was also able to win to the cause a few more valuable patrons to aid in the further development of the station, and through them was enabled to reach the ear of the crown prince.

He next returned rapidly to Naples, where the opposition to his undertaking had reached the highest point. The German consul general received him with the information that he believed the day to be lost. Public opinion demanded the tearing down of the building. This rumor was verified at the office of the municipality. Every means to turn the tide seemed to have been exhausted. Dohrn's article entitled "The Present Position of Zoology and the Establishment of Zoological Stations" had just appeared (translated into Italian) in an important monthly, and this saved the day. This publication Dohrn sent to the most influential of the city authorities without indeed hoping much from it; but in one case at least the seed fell on good ground, namely, with Baron Savarese, at that time the powerful leader of the selectmen. He expressed a wish to make Dohrn's acquaintance and in a conversation that lasted for three hours Dohrn succeeded in winning over for his project this man who was as intelligent as capable, so that Savarese promised to carry the cause to victory in the municipal council despite its enemies. Ten days later he had made his promise good. Almost at the same time the news came from Berlin that the governmental subsidy for the next year was assured. And thus was taken the first step so immensely important for the continued success of the station, in its assurance of the repetition of the grants from the German and Italian governments. In this way were these two, perhaps the greatest crises in the history of the station, safely passed. Trying as were such times, they show us Dohrn in his element. He appeared as a general on the field of battle. Nothing discouraged, intimidated or turned him aside. In every situation he appeared the same; what others believed to be impossible his penetrating insight resolved into a number of difficulties, but all possible to overcome. No trouble was too great for him to take, no step too hard, no smallest possible opportunity was too insignificant for the forwarding of his plans. His letters went in all directions. He quailed before no journey, no matter how difficult. He attended congresses in order to inform

his professional associates of his hopes, and by means of fascinatingly written articles he instructed and interested the educated classes. He visited numberless people and imbued them with the same inspiration by means of his selfless enthusiasm, through his knowledge of the world, his eloquence of speech and power of repartee. Each new patron gained served as the point of approach to other connections, until he at last reached the place where decisive steps must be taken. With astonishing rapidity he familiarized himself with conditions previously foreign to his life. He was inexhaustible in thinking out new methods, but restless as was the working of his imagination and impulsive as was his character from childhood, he soon learned that unremitting self-control which permitted of no undue haste. He knew that situations change, he knew the mutability of public opinion, what human decisions mean, and that they none of them are unchangeable. Patiently he was able to wait, but like the eagle in the air, his eye was upon the object of his desire, and he swooped upon it as soon as it was attainable. And all these traits were held together and crowned by an unusual strength of mind, which, to quote Jacob Burchhart, "alone is able and therefore loves alone to sail through storm."

As you all know, the origin of the Zoological Station rests on two entirely original ideas of Dohrn's; one of which was to connect with the laboratories a public aquarium such as already existed in London, Hamburg and Berlin. His idea was that the income that these other aquaria were paying to the stockholders in this institution should be used for the benefit of science. Dohrn has said, and it has often been repeated, that this idea came to him on the fourth of January, 1870, as he rode in the mail coach from Apolda to Jena. "It came to me," so he writes, "like a revelation, and a limitless horizon of attainable results appeared to my feverishly working fancy." This fundamental idea demanded for its field of operation a large, much-visited city on a seacoast rich in fauna, and this determined the choice of Naples. As it was later shown that the admission to the aquarium would not suffice for the cost of current expenses, Dohrn fixed upon his second chief idea—to secure for the station an enlarged and stable income by renting out to governments and corporations tables for work. And it was chiefly this so-called "table" system which gave an international character to the station. The station is self-supporting, and both ideas have proved to be successful. The subsidies of the German and Italian governments pay for "tables." Dohrn realized, however, that in the beginning this would not be practicable. First of all a large capital had to be secured for the furnishing of the building; and this sum came mainly from Dohrn's father. In the address made by Dohrn in the spring of 1897, as the station was celebrating the twenty-fifth anniversary of the laying of the cornerstone, Dohrn spoke with loving expression of filial reverence, of all that he mentally and materially owed to his father; but one must not think that his father's help came to him without trouble or battling. No one was more firmly convinced than this very father that his son was following a Utopian scheme, was chasing a will-o'-the-wisp, sure to result in a pitiful fiasco. He not only firmly refused every appeal for aid, but a complete break which lasted a long time between these equally hard heads was the consequence. The quiet soothing influence of Dohrn's mother aided much in the solution of these differences of opinion. When the son had succeeded without his father's help, and the latter, against

his will, was forced to acknowledge that he had thoroughly misjudged the character and capabilities of his son; and when letters from Darwin, K. E. von Baer and other notices of the importance of the newly founded Zoological Station left no further room for doubt, only then did he grant the sum which Dohrn would later have inherited. Fortunately, for many years he was able to enjoy the ever-increasing success of this son.

In the year 1873, as the station was nearing completion, a picture was placed beside the other frescoes which adorned the walls in the hall later to become the library, but then planned as part of Dohrn's residence —a picture which as a document of the time will become more and more valuable as the years go on. The painting shows us five young men who had gathered together about Dohrn in Naples. The highly gifted and unusual Nikolas Kleinberg, chosen by his friend as director of the laboratory; next him the English poet and writer, Charles Grant, who, enthusiastically emersing himself in Neapolitan life, became the beloved interpreter for his friends of their new environment; Adolf Hildebrand, the sculptor, to whom the exterior elevation of the building suggested by Dohrn owes its artistic harmony, and in the background of the picture is Hans von Marees, the painter himself. To-day these frescoes attract to the Zoological Station the art connoisseur, almost as much as the biologist. Here we see these friends, joined a little later by the gifted Francis Balfour as in the ruins of Posilippo they sit together over a glass of wine at the end of a full day's work. On one such evening the exuberance of their joy in living found expression by their decision to swim to the Castell Dell'Ovo, a test of strength to which Dohrn alone proved equal. At last in February, 1874, the Zoological Station was ready for a formal opening, although already a number of investigators had commenced their work. Shortly after this Dohrn married Fräulein Marie von Branowska, the daughter of a friend who lived in Italy. She took a very prominent part in the fulfillment of his ideals. Four sons came from this union, the third of whom, Reinhart, is the successor of his father.

With the finishing of the building and aquaria, there commenced for Dohrn the only less difficult task of equipping the station and providing for its maintenance, so as to meet every possible demand of the investigators working there. At this period his broad view and talent for organization, the tact with which he held in check numberless small difficulties, his restless ambitions, are perhaps more worthy than ever of admiration. It was now necessary to attract young scientists as assistants to the new institution, to educate a personnel to carry on the routine and to establish a regular industry of fisheries. The numberless demands of the often inexperienced investigator had to be learned and satisfied. The habitat of the animals, the times of their appearance and of their maturity, had to be determined, not to mention many other details. This early period of the station presents a happy picture, over which now lies the enchantment lent by distance, blotting out some of the unpleasantnesses.

All was ceaseless activity, as at the advent of spring, and the work grew under the hand of its creator. Early experiences had shown that the station could not properly carry out its functions without a small steamer, and the *Johannes Müller* soon began its successful voyages. But now an imperfect knowledge of the fauna and flora of the bay made itself painfully felt, and in order to gradually remedy this defect Dohrn began the publication of "Fauna

and Flora''; to-day an imposing contribution of thirty-three volumes. The desire to have a medium for publishing the briefer records of observation conducted in the station, as well as to give this work publicity, led to the appearance of the *Mitteilungen.* The necessity of procuring for the library all the newest biological literature was the reason for the publication of the *Zoologischen Jahresbericht;* a model of its kind. Soon came countless demands for material for experiment and observation. This led to the development of a new technique for conserving specimens which were supplied to museums in many different countries. The specimens of the wonderful creatures of the sea were most life-like, and the microscopical technique of the Zoological Station was also greatly advanced. The rapidly appearing communications of investigators working there testified to the brilliant way in which the new institute fulfilled the object of its foundation. The head of the station saw without envy how the fruits of his creation even in his own special field of investigation were harvested by others, so numerous were the claims made upon his time from every side, and the greatness of his character is demonstrated by the unselfish way in which Dohrn regarded men of equal strength developing beside him. What he once had confided to well-tried hands, that he now allowed to grow in these same hands and become independent. One name rises to the lips of all here—Lo Bianco. In the porter's lodge of the house in which Dohrn then lived, he had often noticed a boy always usefully busy. Dohrn made use of the fourteen-year-old boy for every kind of small service at the station. In this environment the unusual and very gifted young man grew up to become one of the most important factors in the station, founding and brilliantly directing his own department. Suddenly this powerful figure whose presence can not be dissociated from the Zoological Station, the friend and helper of all working there, has vanished; struck down as by a thunderbolt.

Five years were given over by Dohrn almost entirely to the building and equipping of the Zoological Station. He looked with impatience for the moment when he could return to his own extensive investigations. It is not the wish of this assembly that the importance of Dohrn's scientific achievements should be touched upon in a valedictory; but if it were I, knowing so little of the particulars of Dohrn's special investigations, would refuse the task. As, however, the purpose is to present a character-sketch I can not refrain from attempting to give a picture of the man. When one asks what Dohrn could have meant when he said it was by accident he became a zoologist, I believe we must see in this an expression of the conscious feeling that he was not born a naturalist. The study of his scientific work leads to the conclusion that he did not lack any of the highest attributes of an investigator. He did not, however, possess the elementary desire, the wish, to make observations, to discover new facts known only to the investigator himself. He did not underestimate the value of discoveries, but he was almost indifferent about making them himself. Is it not remarkable that, having opened the shaft leading to the mine of the undiscovered, he did not decide to follow this path? External influences did not determine for him the direction of experiment, but to his own mind problems of a certain kind were presented in theories, which he then tried to prove by known facts. We see that the conceptions he had grasped while in Jena governed the direction of his thought to the end. In his scientific activity he showed himself to be

always the same, possessing a restless imagination which presented in anticipation that which he wished to see accomplished. This was bound up with a passionate energy in carrying out what he believed to be right. But these qualities had one effect, when it was a question of reaching a certain goal, and another, when a scientific problem was to be solved. The conception of creating a Zoological Station of the greatest value to science, and the idea that the esophagus of the ancestors of the vertebrates had first passed through the central nervous system, as mental concepts are perhaps not so very different; but in order that these thoughts should actually become productive of results they require elaboration and different attitudes of mind. In the first case a course of action must be followed. The actual achievement leads to the proposed goal. The question of which one is right or wrong has no significance in this connection, other than the idea as to whether the goal is or is not attainable. In the second case there is the question of proving that the course followed corresponds with the one pictured in the imagination. No road is to be made, but one and only one road is to be found. Nothing can stand in sharper contrast than the two ways of working as expressed in the often unrecognized differences between artistic, in its widest sense, and scientific ability. True, both can be found in equally able men, but even in the greatest it seems impossible for one quality to be combined with the other without loss. Dohrn was undoubtedly more a man of the first type. He was impelled to express something personal, as it were, an image of himself. In most expressive words he once described the Zoological Station as an organized work of art which he wished to create. Can such a man in the usual sense of the word be an investigator? Can he who so often found himself a controller of men and situations become a servant such as nature demands of those before whom she is to lay bare her secrets? Did it lie within the power of man to change annelids into vertebrates, possibly Dohrn had been the one to accomplish even this; but that is quite another question.

I wish to call attention to another quality which influenced his scientific productions, and to characterize this in his own words. He writes:

> Without doubt it was, and is a peculiarity of mine to take up a new idea with an apparent partisan blindness. This conception might appear to others absolutely questionable. My lively powers of imagination and the accompanying need of expressing and giving them play might all too easily produce the impression that I looked neither to the right nor to the left, but as it were, hypnotically controlled, saw only in one direction—before me. But in fact this is not the case, thoughtless as I appear, and carelessly as I may express myself, just so easy is it for me, once this craving for expression is satisfied, and the one-sided conception is followed to its utmost limits, to turn about and to follow in an almost diametrically opposite direction, and, if possible, going even further in overthrowing the first conception than my critics.

These words refer to questions of practical usefulness, and I cite them in order to give an example of the self-analysis used by Dohrn. Does not he who knows Dohrn's work read in it the same characteristics? Is not the irrepressible need for expression which must relieve his intellectual tension revealed by writing, before the carefully weighed deliberation upon the other side can come to expression? But notwithstanding the obvious faults connected with his scientific work, the undeniably great personality of the man must be recognized. Dohrn had none of that pride which wishes to write its name in as many as possible of nature's books; his mind was concentrated on one ideal.

Seldom is the scientific life work of a scholar revealed to us so clearly and divided into periods so dominated by motives as that of Dohrn's The beginning is composed of systematic entomological work, inspired by the father's occupations. Arthropods were, therefore, especially well understood by him. Naturally, as a result of Darwin's influence, a change took place in his scientific thought, and he at once applied to the arthropods his phylogenetic theories. In the monograph on pantopoda, published in 1881, the second period terminates. This work proves the fact that through his colossal undertaking, "Fauna and Flora," Dohrn wished to set a good example in a field that was hardly sympathetic to him at the time. Meanwhile he had reached out to grapple with the most important genealogical problem, viz., that of the origin of vertebrates. As early as 1875 in the much-noticed publication, "The Origin of Vertebrates and the Principle of Functional Change," he had outlined the proposed work. And now followed, with the same end in view, "The Studies upon the Origin of the Vertebrate Body," with which Dohrn's twenty-fifth publication came to a close in 1907; before even the greatest part of the mass of introductory work had been completed.

In all these works he is heart and soul historian. Good-humoredly conversing with Momsen, who at first was not favorably disposed to him, Dohrn affirmed that as a matter of fact fundamentally they were working at the same problems. For the zoologist, he maintained, carries on archeological historical studies, but in epochs much more remote than those of so-called ancient history. Again and again in his writings he makes such comparisons as these. The study of man was in reality covered in his studies of vertebrates. His aim was not to erect family trees, but to get an understanding of their growth. No biological law could, in his opinion, have taken the place of genetic observations. He humorously compared the phylogenetic stages with the ancestral picture gallery of a royal castle. To him the epochs were also comparable with the technical models in a museum showing all steps in the development of a steam engine or dynamo. He was convinced, in fine, that both developments—the phylogeny of man and the history of man—must go back to one basic principle. This he believed, even though at the time he had not advanced beyond certain indefinite premonitions. Characteristic of this is his well-known preference for ontogeny in arriving at phylogenetic conclusions as contrasted with comparative anatomy. He was even convinced that he could correctly explain the significance of specific cases and many a heated battle was waged over these opinions. To-day we may allow these debatable questions to lie quiet, for whether or not we grant Dohrn's theoretical standpoint, a saying of Liebig's is justly applicable to him. "One who works is sure to make discoveries, no matter where he starts." What may have appeared to the author, in his effort to reach the ideal, as possibly only his working materials—the great quantity of facts that he brought to light by his untiring application, and the greater improvement of his methods—gave him an honored position among the students of animal morphology; especially in the most difficult of all fields, namely, that dealing with the genesis of the vertebrate head.

Most of Dohrn's publications possess, aside from their subject matter, great literary charm. If we divide, as does Wilhelm Ostwald, investigators into classicists and romanticists, it will be seen from what has already been said that Dohrn was markedly representative of the romanticist

type. His works are hardly less expressions of his feelings than of his understanding. He does not present in the least objectively his results, but he lets the reader follow step by step his mental processes to the extent that we see reflected in his works with absolute accuracy the intellectual highly cultivated man keen for battle.

There is no doubt that there were times in which Dohrn estimated his scientific activities as far outweighing in value what he had done for biology through the founding of the station. In such moments he treated the criticism of his scientific opinions with rough injustice, but in this he had the precedent of such great predecessors that it is sufficient to mention the fact only in order to avoid an exaggerated attempt to enhance his character; an effort Dohrn himself would have deprecated. To-day when the sound of battle has passed, those who have run counter to him most sharply acknowledge not alone his great love of truth, but accept the fact that those great outbreaks of a passionate temperament were only the shadow-side of a nature which must have been as it was in order to produce along other lines unequaled and imperishable work.

When one sees how directly and without deviation Dohrn followed his own scientific course, the comprehension he showed of all other branches of biology is doubly remarkable. That he should welcome to the station those engaged in all lines of biological work was a part of the nature of the undertaking. Dohrn had an unusually clear insight into the various fields of our science and of the manner in which they were interdependent and yet complementary to one another. Perhaps the most surprising thing about this apparently one-sided morphologist was the large space dedicated by him to the department of physiology. The addition to the first structure opened in 1888 was planned in order to secure more space for this department and the last great extension, a second time doubling the size of the original building, was put by Dohrn almost exclusively at the disposal of physiologists. This new edifice makes the modest older sister laboratory appear almost in the nature of a step-child. He did not have in mind that physiology for which so much is promised in all modern text-books. Physiology is the knowledge of the vital processes and is divided into physio-physics and physio-chemistry. Before his eyes was a physiology as comprehensive as that conceived of by Johannes Müller, and of which Naegeli once said: "In its Holiest of Holies belongs the origin of the organic world." The time that has elapsed since the founding of the great physiological department is still too short to pass judgment upon the results of this attempt to make physiology breathe sea air. Still even now it can be seen that the close contact which Dohrn established between the study of animal life and development and the exact methods of physiology has stimulated all. His capacity to see, beyond his own field of work and his temporary favorite opinions, the real problem of what life represents and to approach this question from different sides filled the station with a spirit free from all pettiness.

Dohrn was an incomparable host to all his guests. How pleasant it was to meet with him in the library, to pass an evening at his house, or better yet, to sail out with him upon the bay to Cape Misenum or Capri or to his well-beloved Ischia. It was a pleasure to see this man in happy communion with nature, to chat with him seriously, or jokingly, to listen to him as he talked. Of him it can truly be said that nothing human was foreign to his interests, thanks to an almost fabulous wealth of ex-

periences stored up in his ever-impressionable soul. He inherited from his father the love and fine appreciation of music; which was dearest to him of all the arts. Once when an intimate colleague said to him that had he means he would found a picture gallery, Dohrn replied, "And I would own an orchestra led by the best of conductors." While a young man the chance whistling of an air from a violin concerto of Mendelssohn, who, by the way, was his god-father, won for him the sympathy, and later the almost irreplaceable help, of Lloyd, the English aquarium expert; and in later years the road to his heart was most easily found by those with whom he could commune through a common musical taste.

It were vain even to wish to describe the powers of attraction exerted by Dohrn over individuals of widely differing personalities. To the test, "Tell me with whom you associate, and I will tell you who you are," Dohrn could confidently have submitted himself. When, in 1902, an intimate friend among foreign zoologists traveling through Germany, asked a German colleague if he often saw Dohrn, the reply was: "We never see Dohrn any more, he associates entirely now with princes, excellencies and millionaires." In this joking exaggeration is hidden a real and at the same time an important side of Dohrn's relations with people, important alike for the station and zoologists. When he began the building of his zoological station and knocked now here, now there at the doors of the well-to-do, asking if they were not inclined to make some offering in the interests of science, he found, with few exceptions, wise councils, but no money. One notable exception was a gift from English scientists led by Darwin, Lyell, Huxley and Lubbock. Nothing better illustrates the position he finally won for himself than the fact that thirty years later not only did the city of Naples again cede to him a most valuable piece of the public garden, for the station's new building, but above all he erected this building with funds placed at his disposal without conditions by rich friends. And so great was the consideration and confidence he enjoyed that without the least difficulty he could have obtained even greater sums, without specifying "the why or wherefore." But at first, as we have already said, his requests for aid brought only disappointment, and it would have gone hard with the station had not the personal impression he so well knew how to make on ministers and ambassadors and leading members of the Berlin Academy and the Reichstag led to a spirit of readiness to grant support; an accomplishment which compels us to marvel when we consider the caution and the typical reaction of inertia such appeals usually evoke. But quite as necessary as material means for the success of this undertaking planned by a German on Italian soil, was the awakening of an Italian sentiment and the moral support of the fatherland. Highly as we may estimate the spontaneous interest in zoology of the German and Italian rulers, it is beyond question that this sympathetic interest was stimulated by Dohrn's personal qualities and by the turn that his creative faculty could give to the methods for carrying on zoological investigations. The gain to the station coming from this powerful protection needs no comment.

When I spoke of Dohrn's social affiliations I had something special in mind: From his earliest years until his death he maintained the closest ties of friendship with men of the highest intellectual standing entirely regardless of material conditions. I mention only those who are dead, and whose names are widely known: one of the most notable zoologists, Thomas H. Huxley; the eminent physicist and founder

of the Zeiss works, Ernst Abbé; the gifted inventor, Werner von Siemens; Robert von Keudell, ambassador, distinguished in mind as in character; the great musician, Joseph Joachim; and the painter, Hans von Mareés, who at last, after long neglect, is receiving recognition, are enough to prove to us what a noble and rich nature Dohrn must have had. Without these mental qualities would it have been conceivable that he could have won and kept for the station such remarkable professional associates at a time when the future of his creation and of these young men was still unknown? And this attachment of his fellow workers is so much the more remarkable as there were times when the attempt to work with Dohrn was no easy task; but even then the essential element of Dohrn's nature shone out through the mist, so that even the simple fisher-folk were able to appreciate it. Underneath the overbearing character of a nature born to command they were able to recognize a kindly personality in whose hands they knew themselves to be secure. With faithful devotion they hung upon their "Signor Dohrn," and whatever he might have demanded of them each and all would have obeyed.

Fragmentary as is the picture, it were incomplete in a most important point should a subject I have just touched upon remain unexpressed; namely, that the shadow-side as well was not lacking in this wonderfully successful life. Already in the beginning of the early seventies the periods of his greatest development of strength were broken by times of such deep nervous depression that all the remarkable qualities which distinguished Dohrn on other days then seemed almost to disappear. He himself attributed the origin of this affliction to his mother's family, but the indescribable fatigues and condition of mental tension under which he lived were sufficient to explain the occurrence even in a very strong constitution, of these periods of complete exhaustion. Much as he enjoyed his life in a foreign land, this exile brought a great deal that was painful. Dohrn's was one of those natures which, while fully conscious of their achievement, look upon that which is finished almost as the work of another, and hence again and again feel impelled to prove their right to live by new deeds accomplished. Thus the latter years of his life were almost a continual torment to this man of action, for his bodily strength could not keep pace with the still active spirit. Yearly, physicians sent the rebellious man northward, over the Alps, for months at a time. And like Albrecht Dürer, who after only a short journey in Italy sighed at parting, "wie wird mich nach der Sonnen frieren; hier bin ich ein Herr, daheim Schmarotzer," so exclaimed Dohrn as he left his life-work behind him.

To linger awhile in the world of his own creation, and to sail once again in his well-beloved boat out upon the blue waters, was his last wish; but before it could be realized, he died suddenly in Munich on the twenty-sixth of September, 1911.

When I undertook the task of speaking to you of Dohrn, I asked myself which one of his qualities was it above all others that gave birth to the wish to honor his memory before an International Zoological Congress. Scientific achievement alone, as far as I know, has never prompted such an honor. If one should say in Dohrn's case it was the influence exerted on collective achievements, the instance might be paralleled by Abbe's improvements on the microscope. Those, although in a different way, were not less far-reaching in their effect on the development of biology, but as a result of this accomplishment it does not follow that a congress of zoologists should

feel prompted to recognize publicly such great services. The answer, I believe, is not hard to find. We honor in Anton Dohrn not only his prodigious achievements, but his marvelous insight that affects us so directly as zoologists. The zoological station was planned and carried on with the comprehensive realization of the importance of that place in the development of our science which it would be called upon to fill. And the more intimately we are acquainted with the early years of its history, the clearer does it become that for such a work a man was necessary in whom special and unusual qualities were combined; sometimes even partially contradictory ones. We feel the unprecedented and peculiar fitness of this personality for the work. As the man who accomplished this achievement undertook it in the service of a great cause, perfectly conscious that he must risk time, strength and health, yes all he had and all he held most dear—his figure takes on for us something of the great and heroic. But even in these immaterial things we find a law of compensation. Whatever a great man by untiring and unselfish devotion puts into his work as the result of the love of his profession, that is reflected in the labor itself. That which Anton Dohrn, impelled by the noblest of creative impulses, has done for all of us now compels us to honor him by an expression of admiration and gratitude that will hallow his memory through many years to come.

No more suitable occasion to express this could offer than the International Congress. In recent years it would hardly be possible to find a man more entitled to be considered as an international personality, and it is not necessary to explain more fully than has been done the peculiar applicability of this term to Dohrn. Those who knew him realize that he neither could nor would deny the race from which he sprung. He had a deep love of his country and he cherished a feeling of loyalty, thankfulness and duty to the land in which his being, physical and spiritual, had its roots. An excessive national pride or conceit was entirely foreign to him. The dispassionate impartiality with which in quieter moments he was able to analyze himself enabled him to compare the defects and advantages of his own with other nations. He was able, as many were not, to sympathize with the feelings of others for their own country. He not only understood, but enjoyed the traits of Italians, as well as of the English and Americans. He understood how to learn something from all, and to many he was bound by ties of intimate friendship; and when it was a question of science only, then all barriers disappeared. Was it not from beginning to end his dominant desire to realize in the Zoological Station not only one of the most favorably conditioned places for work, for all biologists, but above all to create a common center in which the one-sidedness of isolated scientific work could be equalized? How often has he said that the station represented, as it were, a continuous zoological congress. Every one who has worked long or often in Naples must have felt this. Not only have numberless acquaintances and friendships arisen between the investigators of different countries, not only has there been an interchange of views, a discussion of work and of methods, but almost all who have worked in the station have consciously or unconsciously left behind them parting gifts from their scientific possessions which, gradually growing to a store of incalculable value, are put at the disposal of all those who follow and thus insensibly aid in the

ever widening and increasing usefulness of the station.

Of all the many inspirations of Dohrn, undoubtedly one of the happiest was the subsidizing of the station by the introduction of his table-system, thus making the institution international. Only in this way was it possible to keep the organism free from the dry husks of state tutelage, and to give it sufficient flexibility to meet new conditions, at the same time protecting it from the inertia springing from self-satisfaction or the possibility of retrogression by the ever-recurring necessity for meeting these needs.

But we must also take into consideration the reverse side of such fully adjusted reactionary capacities: its vulnerability. And here is the point at which our passive feeling of gratitude can be changed into active assistance. Every biologist, convinced that the Naples station, on account of its position and size, its catholicity of spirit and richness in opportunities for work, and, not least of all, because of its international character, is of inestimable value for our science, may, by openly giving expression to this belief, help to perpetuate the work as planned by its founder. Let us look upon this institution as a legacy from Dohrn which he has confided to the care of each one of us.

Even though we must grant that such a valedictory as this fails in its chief aim, as he in whose honor it is pronounced can not hear it, we must console ourselves with the thought that the men among whom Dohrn lived had not left him in doubt as to the esteem in which they held his work. Few men in our profession have been recipients of such honors as were shown him by princes and governments, by academies and faculties, from the city in which he worked, and from biologists all over the world, as were shown him during the station's jubilee celebration. Even more precious may have been to him the many spontaneous expressions of sincere admiration and grateful devotion. At the last International Congress such marks of appreciation were shown as to move him deeply, and even without all this he had only to reflect to become conscious of the fact that he had given an impulse to biology which could be equaled only by very few, and that his deeds and his name would continue to shine in the history of our science far above, where only the highest summits are visible. We zoologists will take pleasure in the thought that Anton Dohrn belonged to us.

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THE SCIENTIFIC WORK OF MISS N. M. STEVENS

Miss Stevens began her career as an investigator in 1901 at the age of forty years. It is rare for one who starts so late in life to attain in a few years so high a rank amongst the leaders in one's chosen field. In Miss Stevens's case this was made possible by her natural ability and devotion to her work, as well as by the liberality of Bryn Mawr College, which created for her a research professorship. Her investigations lay almost entirely in the field of cytology, and covered not only extensive studies of the germ cells, but a memoir on the life cycle of one of the protozoa, and several papers on the histology of regenerative processes in planarians and hydroids.

Modern cytological work involves an intricacy of detail, the significance of which can be appreciated by the specialist alone; but Miss Stevens had a share in a discovery of importance, and her name will be remembered for this, when the minutiæ of detailed investigations that she carried out have become incorporated in the general body of the subject. In 1906 she found that the male of a beetle (*Tenebrio molitor*) produced two kinds of