WILHELM HOFMEISTER
1824–1877

BRIEF PAPERS

WILHELM HOFMEISTER

FREDRICH WILHELM BENEDICT HOFMEISTER, the son of a proprietor of a music store, publisher, and book seller, was born at Leipzig, May 24, 1824. The early part of his life was spent as a clerk, with nature study as a hobby. Durng later years he was head of Botany Departments, first at the University of Heidelberg and later at the University of Tübingen. He assumed these positions without university preparation and with only experiences as a self-taught student of botany to recommend him. These experiences, and experiments, began shortly after he left school at fifteen years of age, and led to some of the most profound discoveries ever made in the field of botany. Most of his work was accomplished in the face of the necessity of providing for a large and growing family, and with the physical handicap of poor eyesight, for he was very near-sighted. He pursued the study of plants before and after hours of clerical work and at odd times.

Hofmeister's earlier education was obtained in a private school, the later, in the Leipzig Realschule, where the master taught in a manner that made the pupils think for themselves. He left this school at fifteen years of age to face the world. He early showed an inclination to study nature, largely due to the influence of his father, who was also interested in plants and maintained a small but rather varied, systematically arranged garden. At first he was more strongly inclined towards zoology, but finally decided upon botany. His first salaried position was one in a music store at Hamburg, where in his loneliness he took to roaming the fields. All the while he continued self-education by studying languages, music, physics, chemistry, algebra, geography, etc. Remaining a student to the end, ever trying to improve, he learned Greek in his fortieth year.

After two years at Hamburg he returned to Leipzig and entered into business with his father, where he had leisure time to study. Here he spent sixteen years and did most of the work for which he is famous. At nineteen years of age he had started many fundamental studies that placed him in the front rank of botanists. SCHLEIDEN'S Outlines of Scientific Botany awakened his interest in developmental history and microscopic research. He made field trips even outside of Germany.

HOFMEISTER was an excellent teacher for advanced students, rendering excellent service in technique and the preparation of materials, besides being a wonderful incentive to young botanists, and a drawing agency for advanced students. Among these at Heidelberg were: ASKENASY, ENGELMANN, KIENITZ-GERLOFF, N. J. C. MULLER, BOEHM, PFITZER, KRUTITSKY, ROSANOFF, TIMIRIASEV, WOLKOFF, and MILLARDET, and at Tübingen

ZACHARIAS and VON GOEBEL. His quarters were modest. He spent the whole day in the laboratory assisting students. He seemed to be truly indefatigable.

HOFMEISTER was a man of small stature, dark skinned, with vivacious eyes, the quick movements of a southern Frenchman, a very refined character and a kindly humor. He was exceedingly dextrous in the laboratory, near-sightedness assisting in making very good microscopic slides. Poor eyesight was a handicap in other respects, but he was too sensitive about his appearance to wear glasses. This condition frequently got him into humorous positions, as, for instance, greeting every woman he met on the street for fear of appearing to slight some one. His greetings were not mere perfunctory salutes. He was excellent company and possessed a remarkable memory and mind, one that had room for more than the details of his profession. The photograph, plate IX, shows him at the age of 43 years.

HOFMEISTER, in the happy years of a short life, without guiding assistance other than that of his father and occasional visits with botanists, did a monumental work and settled for all time, disputes in regard to certain phases of plant life. His interests and endeavors in plant research were wide and many.

CAMERARIUS in 1695 had shown that sexuality existed in plants but could not explain the fertilization process. KÖLREUTER experimented in crossing plants and demonstrated the presence of inheritance. The details of the process were lacking. In animals LEEUVENHOEK thought the spermatozoa produced the embryo and that the female matured it. SCHLEIDEN thought the tip of the pollen tube became the embryo in a similar manner. He fought stubbornly for this and because of his prestige and gift of argument, really obstructed progress. There were numerous theories of fertilization, of which the above are examples, but when twenty-five years of age, HOFMEISTER settled the question for all time. His technique was so marvelous that in *Oenothera* he could remove the pollen tube from the embryo sac without mutilating either. The publication in 1848 of this work in the *Botanische Zeitung,* entitled "Die Entstehung des Embryo der Phanerogams," is a marvel of direct exposition and is typical of his style. His drawings are numerous, detailed, and exact. This work won him an honorary degree of Ph.D. from the University of Rostock. He afterwards worked on nineteen families of plants. He had seen the egg sac with its egg apparatus and antipodals. His lack of university training was no longer a handicap. The Royal Saxon Society of Science at Leipzig admitted him to membership.

Turning to comparative morphology, HOFMEISTER endeavored to show a continuity through the plant kingdom but seemed to have no thought of the possibility of evolution. He found the function of the spermato-

zoids and archegonia in the liverworts and related it to the other cryptogams and phanerogams, and clearly demonstrated the alternation of generations. JULIUS SACHS gave him full credit for the establishment of the basis of phylogeny throughout the plant kingdom. HOFMEISTER saw and recognized the process of fertilization and the liberation of zygospores in the desmids and diatoms. He noted also many causal things about plant structure; distinguished between axial, leaf, and hair structures, and noted their relations. He recognized inheritance, variability, and the mutation of plants.

The controversy in regard to the origin of the cell was waxing hot, before his call to Heidelberg, with MIRBEL, VON MOHL, SCHLEIDEN, and NÄGELI furnishing most of the commotion. NÄGELI'S concept is the one commonly accepted today, but HOFMEISTER made many contributions to the details. He saw nuclear division in an embryo and thought that one-half of the protoplasm collected around each daughter nucleus. In pollen grains he saw the nuclear membrane, and saw it and the nucleoli disappear before cell division, and possibly the cell plate and chromosomes. He recognized the importance of colloids and their functions in the physical properties of protoplasm, and studied the permeability of protoplasm. He saw that protoplasm was most abundant in young cells and that cell growth preceded cell division, which took place perpendicular to the direction of strongest growth. Many had considered plants as being composed of independent units or cells. HOFMEISTER considered the cells as being parts of a correlated structure. He anticipated and saw plasmodesmen, establishing that plants are made up of united protoplasmic structures. He said cell turgor was due to osmotic pressure of the cell contents and to water absorption.

HOFMEISTER'S experimental physiological work was chiefly on the movement of sap. He noticed that bleeding took place when there was a reduction of evaporation and that it was not confined to woody plants. He found a sap pressure of 212 mm. of mercury with the poppy and 461 with *Digitalis*. He thought that the tension in the parenchymatous cells and the guttation of cell cavities forced soil water into the vessels. He discovered the periodicity of sap movement in vines and the negative pressure in stems. He observed the curvature of stems due to shock and their subsequent straightening out. He thought heliotropism was due to a lack of light on one side which caused greater elongation on that side. The geotropic response of roots he thought to be a passive response to gravity, the one big failure in his observations. He observed that a rise of temperature caused tulip flowers to open and a decrease caused them to close.

In his twenty-third year HOFMEISTER married the very refined daughter of a Leipzig manufacturer, who created for him an extremely happy and beautiful domestic life. His father had built a large house in Reudnitz,

outside of Leipzig, facetiously called by the members of the family and friends, the "Patriarchal Tent," where he and his children's families lived in perfect accord. It was a most happy community in which social relations functioned perfectly and made an ideal setting for Wilhelm's wonderful work. Here he spent sixteen of the happiest and most fruitful years of his life. HOFMEISTER was called to the University of Heidelberg as Professor of Botany in Ordinary, and Director of the Botanical Gardens at the age of thirty-nine. All went well until he moved to Heidelberg, where his wife contracted pulmonary ailments and died a few years later. This was a great blow to him and left him prostrate. Then his youngest daughter also contracted pulmonary ailments and died. This was a further severe shock to him and seriously interfered with his labors. A second daughter died soon afterward. His courage and best powers were gone. At this time dissention appeared in the faculty at Heidelberg. He did his utmost to avoid being drawn into it. On the death of HUGO VON MOHL at TÜBINGEN, he accepted the call to fill his place, but misfortune followed him. Three of his sons had died in infancy, and now the other two, one twenty-one and the other twenty-five, contracted pulmonary troubles, presumably tuberculosis, and were sent to southern France to recuperate. Here they died within a few months. He was unable to attend their funerals since the letter in regard to their condition did not reach him, and the laws of France required burial within twenty-four hours. His grief overwhelmed him. He became morose and dejected, with only an occasional return of his former self. HOFMEISTER was keenly interested in the unity of Germany, and during the Franco-Prussian war seemed to revive, but for only a brief period. With the death of his two sons he saw the passing of his name. He married the daughter of a physician at Lindenau, but there were no children of this marriage. The honor bestowed by the Dutch Society of Science afforded him his last pleasure. He became palsied and lost his speech, an indication of the blows which were to follow. He suffered a stroke of paralysis, from which he recovered enough to resume his lectures for a short time. A second stroke followed, and it was evident that he must retire from his post. Returning to Reudnitz in the fall of 1876, he seemed to revive, but soon suffered another stroke on January 5, from which he failed to recover, dying a week later, on January 12, 1877, in his fifty-third year. Thus closed a brilliant life that under more favorable conditions might have made many more contributions to botanical science.

One must marvel at the immense amount of work of high caliber that HOFMEISTER accomplished in his short life of fifty-three years under adverse conditions. We should especially remember him for explaining the process of fertilization and for laying the foundations of phylogeny.—A. H. LARSON, *University of Minnesota.*