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THE ROLE OF REFUGEES IN THE HISTORY OF AMERICAN SCIENCE[1]

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SINCE the time of the earliest settlements the flight of refugees from Europe has been a most potent factor in the development of American science. These migrations, which resulted from religious persecution, desire to escape imprisonment or military service, curtailment of political liberties, longing for a more congenial social environment and other causes, have come generally in successive waves of disturbance in which all sorts and conditions of men were affected. While the families of peasants and workmen were chiefly involved in these movements, merchants, physicians, scholars, artists and other groups were also concerned.

[1] The biographical notes on the refugee scientists mentioned in the present sketch were culled from various biographical cyclopedias. The new Dictionary of American Biography with its classified index of celebrities according to occupation and place of birth was found to be especially helpful.

The list of European men of science, who from time to time have sought in America refuge from persecution, is a long one and the stories of their adventurous careers would fill a volume of considerable size. In the present paper a few typical illustrations will be cited from the list of scientists who fled to America in the disturbances of the seventeenth, eighteenth and nineteenth cenuries.

The earliest conspicuous example of an American refugee scientist is that of John Winthrop, Jr. (1606–1676), who in 1631, because of the persecution of the Puritans in England under Archbishop Laud, joined his father and other coreligionists in the founding of the Bay Colony in New England. "Laud's hand fell heavily on the English Puritans," writes J. R. Green, the eminent English historian. "Thousands of the best scholars, merchants, lawyers, farmers, were flying

over the Atlantic to seek freedom and purity of religion in the wilderness." The later preeminence of the New England colonies in education, science, literature and industry was one result of this migration, and no one was more instrumental than the younger Winthrop in helping to lay the foundations of this leadership. His scientific work as chemist, prospector, physician and manufacturer of iron, salt, saltpeter and other commodities was of great benefit to the New England colonies. He was the first to take up in a serious scientific manner the exploitation of America's natural resources. He equipped the first chemical laboratory in the English colonies, and his library contained the largest colonial collection of scientific works in the seventeenth century. A considerable fragment[2] of this library is still extant, and the breadth of Winthrop's scientific interests is indicated by the fact that of his remaining books 52 volumes relate to chemistry or alchemy, 33 to medicine, 10 to physics, 9 to astronomy, 8 to mathematics and geometry, 8 to natural history, 3 to navigation and a dozen or more scattered volumes to geography, metallurgy, military science, agriculture and political economy. Winthrop was one of the early members of the Royal Society and his papers and reports before this body are the earliest contributions presented by an American before a scientific association. His scientific correspondents, of whom many documents remain, included Boyle, Glauber, Helmont, Keffler, Oldenburg, Moray, Digby and many other celebrities. Subjects referred to in this correspondence cover nearly the entire range of seventeenth century science.

If Winthrop be taken as a type of refugee scientist of the seventeenth century, Joseph Priestley (1733–1804) may be cited as an outstanding example of the scientific men who fled to America to escape persecution in the eighteenth century. Priestley's outspoken sympathy with the development of liberal politics in France provoked the anger of many Englishmen, and this feeling came to a crisis on July 14, 1791 (just as the second anniversary of the fall of the Bastille was about to be celebrated) when a mob in Birmingham burned his chapel, sacked his house and destroyed his laboratory and manuscripts—the labor of years of scientific research. The discrimination in England against Priestley after this outbreak caused him to emigrate to America in 1794 and to join his sons in the founding of a settlement at Northumberland, Pa., where he spent the remainder of his days. Although Priestley made few discoveries of chemical importance after settling in Northumberland, his scientific and political opinions had a pronounced influence on the development of liberal thought in America in the early nineteenth century. Priestley, however, was too old at the time of his exile to adapt himself readily to American conditions, with some phases of which he was not entirely sympathetic. He was never naturalized, and his disinclination to become a citizen of the United States was a trait peculiar to a number of other refugee scientists who came to America in later life. Priestley's name, however, will always be venerated in America, and his well-preserved home in Northumberland, where many pieces of his scientific apparatus are displayed, is visited annually by hundreds from every state in the Union.

[2] Owned by the Society Library of New York City.

It is in the nineteenth century that the greatest exodus of scientific men from Europe to America took place. Following the French Revolution and the Napoleonic Wars a great liberalizing movement began which gave rise to political uprisings in many of the countries of Europe. The attempts to crush these outbreaks led to persecutions that resulted in the emigration of hundreds of thousands of people from Europe to the United States. A few cases will be cited of exiled scientists who participated in the uprisings in Ireland and Germany which, fluctuating in varying intensity for half a century, reached their culmination in 1848.

One of the first of the Irish refugee scientists was William James Macneven (1763–1841). He was educated in the best schools of Europe and obtained his medical degree at Vienna in 1785. Returning to Ireland, he took up the practice of medicine in Dublin, where he also became active in founding the Order of United Irishmen. He was arrested and imprisoned in 1798 for sedition but was released under banishment in 1802. On July 4, 1805, he landed in New York, where he began the practice of medicine. In 1806 he received the honorary degree of M.D. from Columbia College and the following year began lecturing at the New York College of Physicians and Surgeons, where he was made professor of chemistry in 1810. As a chemist Macneven is best known for his early recognition of the importance of the atomic theory. He published an American edition of Brande's "Manual of Chemistry," and was the author of various papers on the chemical examination of waters and minerals. Macneven was a public-spirited citizen and in 1824 was active in helping to found the New York Atheneum, before which he lectured on applied chemistry. A tall shaft to his memory in St. Paul's churchyard on lower Broadway of New York is passed daily by more people than the monument of any American scientist.

A second Irish refugee scientist was John Patten Emmet (1796–1842), who came to America in 1804 when his father, Thomas Addis Emmet (brother of the Irish patriot Robert Emmet), was banished as a leader of the United Irishmen party. Emmet obtained

his medical and chemical training in New York under Dr. W. J. Macneven, and in 1825 was appointed professor of natural philosophy in the newly established University of Virginia. His title was changed in 1827 to that of professor of chemistry and materia medica. He was an ingenious experimenter and invented apparatus for the study of magnetism and electricity.

A third Irish refugee physician and chemist was Thomas Antisell (1817–1893), who obtained his medical degree at the Royal College of Surgeons in London in 1839. He continued his chemical studies on the continent under Pelouze, Biot, Dumas and Berzelius, and then returning to Dublin took up the practice of medicine. Becoming involved in the activities of the "Young Ireland Party" Antisell was sentenced to imprisonment but avoided this penalty by escaping to America as surgeon on an outgoing vessel. He landed in November, 1848, in New York, where he practiced as a physician, gave lectures at medical schools and quickly became interested in the civic affairs of his new home. His career as traveling student, doctor, chemist, Irish political agitator and patriotic citizen of the United States runs in grooves almost parallel with those of his fellow countryman Macneven of a generation before. Antisell dropped his medical practice in 1854 to become geologist for the Pacific Railroad survey. In 1856 he became an examiner in the U. S. Patent Office but resigned this position on the outbreak of the Civil War to devote his energies as physician and surgeon to the care of sick and wounded soldiers. At the conclusion of the war he was mustered out of service with the rank of lieutenant colonel. From 1866 to 1870 Antisell rendered distinguished service as chemist of the U. S. Department of Agriculture, after which he served until 1877 as technologist of a commission appointed by the Japanese Government for improving the agriculture of that nation. He then returned to his old position in Washington as patent examiner, in which he served until retirement. Antisell was the author of several scientific works. He published in 1852 a "Cyclopedia of the Useful Arts" (a 690-page illustrated handbook of progress and invention in different branches of applied science) and in 1859 a book on the "Manufacture of Photogenic and Hydrocarbon Oils from Coal." He was the most versatile of the three Irish refugee scientists that have been named.

Further consideration of English and Irish refugee scientists must be omitted in order to consider briefly several exiles of German origin, who as a class have contributed more to the upbuilding of science, agriculture and industry in the United States than the expatriates of any other nation. Movements of Mennonites, Moravians and other persecuted religious sects from Germany to Pennsylvania began in the early eighteenth century. These exiles were largely of peasant origin, and not many who could be called scientists were found among their number. A few, however, as Christopher Sower (1693–1758), the printer, and David Tanneberger (1728–1804), the organ builder, were skilled craftsmen and contributed much to the cultural development of the Pennsylvania-German settlements.

A very different type of refugee migration from Germany occurred a century later as a result of the liberalizing movement that was promoted by the reaction against the imperialistic policies of Napoleon. This movement after the downfall of Bonaparte was directed against the infraction of popular liberties by the rulers of Prussia, Bavaria, Hanover and other German kingdoms. An outstanding incident of this development was the protest in 1837 of seven professors of the University of Göttingen—the famous "Göttinger Sieben"—against the tyrannical policies of the King of Hanover. The expulsion of these professors (among whom were the physicist Wilhelm Weber and the two philologists, the brothers Jacob and Wilhelm Grimm) from their positions at the university was a great incentive to the growing demand for a more liberal constitutional form of government in all the German states. While this movement reached its culmination in the unsuccessful revolutions of 1848–49, the exodus of scientists from Germany, because of harsh governmental restrictions, was gathering headway at an earlier date.

George F. List (1789–1846), economist, was banished from Germany because of his liberal political views and came to America in 1825. He was a great advocate of Henry Clay's "American System" of tariff protection for domestic industries. Frederick A. Rauch (1806–1841), educator, psychologist and first president of Marshall College, came to America from Germany as a political refugee in 1831. George Engelmann (1809–1884), botanist, meteorologist and physician, came to St. Louis in 1833 from Germany, where his democratic tendencies had provoked unpleasant opposition. He collected a large herbarium and organized the St. Louis Academy of Sciences in 1856. Ferdinand J. Lindheimer (1801–1879), botanist, came to the United States in 1834, a victim of German political repression. Theodor E. Hilgard (1790–1873), scholar, horticulturist and sociologist, dissatisfied with political conditions in Bavaria, came to America in 1836 with his wife, four sons and five daughters. He became a member of the German colony at Belleville, Ill., where he conducted a farm on scientific principles. Many other German exiles, as F. J. Lindheimer, got their first start in America as members of this colony, who were jokingly called "Latin farmers" because many of them had a greater knowledge of the Latin classics than of agriculture. Hilgard, by his ability as a practical horticulturist, did much to counteract

this term of reproach. He wrote many essays on social and political subjects in which he interpreted the ideals of American democracy to German readers. Hilgard's greatest contributions to scientific developments in the United States, however, were the careers of his two gifted sons. Julius E. Hilgard (1825–1891) became a geodesist and ultimately chief of the U. S. Coast Survey. He was a charter member of the National Academy of Sciences and president of the American Association for the Advancement of Science in 1875. Eugene W. Hilgard (1833–1916) became a geologist and the leading authority of his time in soil science, of which branch of knowledge in many respects he might be called the founder. He occupied a foremost place among the pioneers of American agricultural education and research. Frederick Overman (1803–1852), metallurgist, dissatisfied with the lack of constitutional freedom in Germany, came to the United States in 1842. He anglicized his name and became a loyal citizen of his adopted country. He wrote many works on mineralogy, assaying and metallurgy and became the leading authority in this field in the United States. His productive life was cut short by the accidental inhalation of arsene in his Philadelphia laboratory. His "Treatise on Metallurgy," published after his death, passed through six editions and had a great influence on the development of mineral technology in America.

The German refugee scientists who came to America before 1848, of whom many more could be named, were only forerunners of the great exodus that was to follow. The growing demand for constitutional freedom by university professors, students, writers and leaders of public opinion was taken up in more serious fashion by Carl Schurz, Friedrich Hecker, Gustav Struve, Franz Sigel and other revolutionists whose hastily planned outbreaks in the different German states were speedily crushed in 1848–49 by better trained Government troops. The thousands of participants in these uprisings who escaped capture fled beyond the borders of Germany, the great majority of them, including the leaders above named, finding their way to the United States. They comprised men in all walks of life—educators, physicians, lawyers, scientists, writers, technologists, agriculturists, skilled craftsmen of every description and a goodly number of adventurers. Among them were many of the best-trained intellects of Germany, filled with youthful zeal and enthusiasm for the exercise of their talents in a free land of unlimited opportunities. Their arrival in the United States was most timely, for it was a period of great national expansion. Only a few typical instances can be cited of the large number of forty-eighters and forty-niners who exercised an influence on the development of different branches of pure and applied science in the United States.

Julius Bien (1826–1909), cartographer, came to the United States after participating in the Revolution of '48. He was a skilled lithographer and brought the making of maps for geographical and geological publications to a degree of perfection that had never before been attained. It was said of him that he "did more than any other to create and establish scientific standards in American cartography." Edward Dorsch (1822–1887), physician, botanist, philosopher and poet, was involved in the South German revolution, but escaping capture came to America in 1849. He was a collector of plants and insects and like many other German refugees played a prominent part after his arrival in America in the anti-slavery movement. Rudolf Eickemeyer (1831–1895), inventor, joined the insurgents in the Revolution of '48 and after its collapse came to America, where he arrived in 1850. He took out over 150 patents for inventions in machinery, telephony, dynamo construction, electric lighting and other branches of applied science. His greatest discovery, however, was Charles P. Steinmetz (1865–1923), also a refugee scientist, whom he befriended, took into his service and started on the road of epoch-making research in electrical engineering. Eickemeyer's business was consolidated in 1892 with the General Electric Company. He was an exemplary citizen and took an active part in civic affairs. Henry Flad (1824–1898), engineer and inventor, took part in the Revolution of '48 as captain of a company of army engineers and with the downfall of the liberal movement came to the United States in 1849. Like Schurz, Hecker, Struve, Sigel and thousands of other forty-eighters, he rendered conspicuous service in the Union Army during the Civil War. After the war Flad was assistant engineer to J. B. Eads in the construction of the Mississippi bridge at St. Louis. His numerous inventions related to improvements in water works, hydraulic elevators, air-brakes, cable railways and other technical branches. Frederick A. Genth (1820–1893), the eminent chemist, came to America in the great exodus of '48 with hundreds of other German chemists and technologists, many of whom, while not actual participants in the liberal movement, were carried along in the wake of the migration that followed its downfall. Genth in 1872 became head of the chemical department of the University of Pennsylvania, where he made important contributions to mineral chemistry. He was president of the American Chemical Society in 1880 and held other offices of distinction. Abraham Jacobi (1830–1919), well-known pediatrist, was another participant in the Revolution of '48, for which he suffered imprisonment.

He escaped finally to America, where his work on the diseases of children established his fame as the greatest pediatrist of his time. He was a staunch American, and his love for democracy was so strong that he declined the offer of the chair of pediatrics at the University of Berlin when it was offered him in 1894. John M. Maisch (1831–1893), eminent pharmacist, was forced to leave Germany because of his participation in the Baden Rebellion of 1849. Because of his distinguished work in pharmacy and pharmaceutical chemistry he was made head of the U. S. Army Laboratory in Philadelphia during the Civil War. He was afterwards professor at the Philadelphia College of Pharmacy, in which capacity he became prominent as a teacher, author and editor. Charles T. Mohr (1824–1901), botanist, came of a family eminent in the fields of chemistry and pharmacology. After the collapse of the Revolution of '48 he emigrated to the United States, where he worked in the fields of chemistry and pharmacy. He published nearly a hundred papers on botanical subjects and is best known for his extensive memoir on "Plant Life of Alabama." Charles A. Schott (1826–1901), geodesist, served in the ranks of the revolutionists of '48 but left the same year for the United States. He was connected many years with the U. S. Coast Survey, in which he won recognition in the fields of geodesy and terrestrial magnetism. Joseph Zentmayer (1826–1888), inventor and manufacturer of scientific instruments, was an ardent lover of liberty and took an active part in the Revolution of '48. With the failure of this movement he was forced to leave Germany and came to the United States, where he began the manufacture of microscopes, photographic lenses and other apparatus, the excellence of which led to a wide demand. Zentmayer's shop was for many years a favorite rendezvous of Philadelphia scientists. He was awarded the Elliott Cresson medal of the Franklin Institute in 1874 and was the recipient of other honors.

The mid-century exodus of scientists from Germany continued with diminishing intensity from 1854 to the outbreak of the Civil War, but not all those who emigrated to the United States remained. The aspirations of many were not realized, and the subsidence of political repressions in Germany induced some of the more dissatisfied refugees to return. An interesting case of a German scientist who could not accommodate himself to American ways is that of Johannes Wislicenus (1835–1902), whose father because of religious and political persecutions left Germany with his family in 1853. They lived for a time in Boston, where Johannes worked for three months as assistant in the chemical laboratory of Professor E. N. Horsford at Harvard. The family then moved to New York, where the young chemist had a teaching position at the Mechanics Institute. But American life was unpleasant for the homesick youth. The culture of the new country, with the slavery question to the front, seemed crude, and in 1856 the discontented family recrossed the Atlantic and settled in Switzerland. It was only a few years after his return to Europe that Wislicenus achieved international fame for his work in organic chemistry. His experience as a refugee demonstrated that some scientists, like some trees, do not withstand easily the rigors of transplanting.

The names of the eminent refugees just cited represent only a very incomplete cross-section of the different classes of scientific men who came to America as a result of the political disturbances in Germany in the mid-nineteenth century. Many other names could be mentioned. Moreover, the scientists who find places in biographical dictionaries form only a very small percentage of our total scientific population. To gain a truer picture of the cultural and material benefits gained by the United States, as a result of the 1840–1860 immigration of scientists and technologists, the acquisitions just enumerated would have to be increased at least a thousand fold. This, however, is not made the basis of a plea for the unrestricted reception of European scientists by the United States at the present time. Conditions now are vastly different from those existing ninety years ago. The frontiers now have all been occupied and openings for employment are so few that immigration, once unchecked, has had to be curtailed. The advantages of scientific and technological superiority, once held by the Europeans, no longer exist and foreigners have not the opportunities to make themselves useful that were enjoyed by refugees two and three generations ago. A detailed statistical study of the race, age, occupation, religion and other available data pertaining to refugees who fled to America in previous migrations, with brief accounts of their successes and failures, would no doubt help clarify certain problems concerning the large number of exiles who have been banished from Germany since the adoption of the present national socialistic system.

Our survey of the past shows that the German refugees who came to America in the 1840–1860 period merged with the predominant population of the United States with far greater facility than was the case with some immigrants of a different racial type. Thoughtful men of the '48 and '49 migrations saw the need of amalgamating quickly with the life of the new country, while imparting at the same time a leaven of their own inherited culture. This work of readjustment was much more difficult for refugees who had passed middle age. Venturesome men in their twenties and early thirties proved to be the ones who were most readily assimilated in the operations of the great American melting pot.

That Germany should now repeat on a vastly greater

scale the tyrannical follies of a century ago seems too incredible for belief. Now as before she has impoverished her own intellectual and spiritual resources with the corresponding enrichment of other countries.

According to an editorial statement in *The New York Times* of August 13, 1939, "all told, about 1,700 eminent professors of science and philosophy have been forced to leave Germany and begin life anew in other countries. These 1,700 are the victims of cruelty and blindness unprecedented in the history of thought." It is hoped that in spite of this persecution there still burns in the breasts of German scientists and scholars a goodly portion of the flaming reaction against tyranny that fired the hearts a century ago of the famous "Göttinger Sieben" and of the thousands of noble youths who, although losing their battle at home for intellectual freedom, found what they desired in another land. In view of what these exiles accomplished it can truthfully be said—"They builded better than they knew."

OBITUARY

JACOB ELRY METZGER

JACOB ELRY METZGER, director of the Maryland Agricultural Experiment Station, died of coronary thrombosis on December 25, 1939, at the Good Samaritan Hospital in West Palm Beach, Florida.

Although he had been in poor health for about a month, his condition was not considered serious. However, he decided to spend a month in rest and vacation and on December 19, accompanied by Mrs. Metzger, left for Lake Worth, Florida. Almost immediately upon arrival his condition became so serious that he was taken to the hospital, where death came early on Christmas morning.

Director Metzger was born on a farm near New Enterprise, Bedford County, Pennsylvania, on July 30, 1882. His early scholastic training was secured in the public and normal schools of his home county and in the preparatory department of the Pennsylvania State College. He received the degree of bachelor of science from the latter institution in 1911, and in 1924 was granted the master of arts degree by Johns Hopkins University.

Director Metzger began his career as an educator prior to entering college, when he was a teacher and principal in the public schools of his home county. For a number of years after graduation, his activities were associated with the public schools. Starting with the organization of the agricultural work in the high school at Fergus Falls, Minnesota, he remained in charge of that work until 1914, when he joined the faculty of the Maryland Agricultural College, now the University of Maryland. His first work at that institution was to organize a department of agricultural education and the summer school, of which he was the director for four years. During the same period, he served as supervisor of agriculture in the high schools of Maryland under the State Department of Education.

In 1917, Director Metzger became identified exclusively with the teaching and research of the University of Maryland. At that time he was made head of the department of agronomy and agronomist in the Agricultural Experiment Station, which positions he held until his death. Other positions held by him later included: acting dean of the College of Agriculture during the absence of the dean in 1924–25; assistant director of the Agricultural Experiment Station 1929–37; acting director from 1937 until he was made director in 1939.

During the years of his connection with the University of Maryland, he represented the institution and state in many national capacities, such as membership on the Corn Judging Committee of the International Grain and Hay Show, and as a representative of the United States at the One-Hundredth Anniversary of Natural Nitrates, held at Santiago, Chile, in 1930.

Director Metzger was a fellow of the American Association for the Advancement of Science, and a member of the American Society of Agronomy and of the Academy of Political and Social Sciences. He held membership in the Sigma Phi Sigma social fraternity, and in Phi Kappa Phi, Sigma Xi and Gamma Sigma Delta, honorary fraternities. He was a past president of the Prince George's County Kiwanis Club and a member of Mt. Hermon Lodge of Masons.

Although Director Metzger's special field of activities was farm crops, his wide general interest in agriculture is evident from the subject matter included in the many bulletins and scientific articles prepared by him and his associates. Probably his greatest contribution to Maryland agriculture resulted from his practical grasp of problems in their various phases and his ability to coordinate the work of different departments in the experiment station in such manner as to secure effective solutions. He was very widely known throughout the state and his counsel was sought at agricultural meetings of all kinds.

In 1912, Director Metzger was married to Jane R. Butts, of New Enterprise, Pa., who survives. In addition to his widow, he is survived by a brother Dr. Irvin D. Metzger, of Pittsburgh, Pa., chairman of the State Medical Board, and three sisters, Mrs. Ira