50 YEARS OF CURRENT SCIENCE—GLEANINGS

"SOME MATHEMATICIANS I HAVE MET "*†

[Prof. Born prefaced his remarks by saying that he was not a professional mathematician and was grateful for being asked to talk not a mathematical problem, but on a general subject. He proceeded to classify the many mathematicians he had met as falling under the three generations of teachers, colleagues or friends, and pupils.]

RECALLING his early days at Breslau where he attended courses of lectures on Philosophy, Chemistry, Physics, Astronomy, Economics and Law, he mentioned the profound impression created by his astronomical studies and by the old Observatory of his College, the instruments going back to the times of Wallenstein and his astrologers, the most modern being a meridian instrument of Bessel (about 1800). In Mathematics his teachers were Rosanes from whom was acquired the first clear idea of mathematical infinity and the technique of matrix calculus which stood in such good stead, later on, for the development of quantum mechanics; and London, the father of F. London who is now well known to physicists by his work in collaboration with Heitler on the theory of valency.

And then at Heidelberg with Koenigsberger, the biographer of Jacobi and Helmholtz. Koenigsberger was an Anti-Kant and an Empiricist who even maintained that the formula $(a + b)^2 = a^2 + 2ab + b^2$ could be derived only from experience! The methods of differential geometry were acquired here and it was mentioned how these good old methods came in handy quite recently for the new field theory, when Weierstrass' results on minimal surfaces were suggested to Pryce in connection with his work on the two dimensional electrostatic case.

It was next at Zurich that he met for the first time a brilliant modern mathematician Hurwitz, a friend of Minkowski and Hilbert. Hurwitz, so well known by the "Hurwitz-Courant" of the yellow series of volumes, was a most inspiring lecturer too.

And at last Gottingen! Of whom else at Gottingen should he talk first if not of Hilbert who is, by common consent, the doyen of present-day mathematicians? Prof. Born spoke at length about his distinguished teacher, of his stimulating lectures, his mathematical work, his influence on his students and his personality. He recalled a hiking excursion to an old ruined town

Plesse with Minkowski, Hilbert and Caratheodory during which he mustered sufficient courage to approach Hilbert and ask him why he studied Mathematics. The answer, so characteristic of Hilbert, was that he had chosen this subject because he had a bad memory! Hilbert's lectures in the class-room left the greatest impression on his hearers and had the quality of everlasting stimulation. He would set out to devise in the class-room new and better proofs of theorems, invent new theorems and if unsuccessful return the next day with beautiful results which have been the admiration of the mathematical world. His mathematical activity could be classified into six periods: (1) Numbers, (2) Invariants, (3) Axioms of Geometry, (4) Integral Equations, (5) General Relativity and (6) Mathematical Logic. Hilbert laid the greatest stress on rigour and logical foundations and on the meaning of pure thinking independent of content. He was perhaps not endowed with the gift of physical insight commensurate with his genius in mathematics and he never felt quite happy in his relations with physicists as evidenced by his quarrel with Pringsheim. Talking about his personality Prof. Born called it strange and likened it to a crystal with sharp edges. People did not understand him. His thinking never went the smooth path of everybody's opinion, but was absolutely independent and unconventional. He had a sharp tongue and was not always what one would call a nice fellow, but he was faithful and good to his friends. He took great interest in politics where, as in everything else, he went his own way and liked to shock people by his opinions, which were always well founded. Even when he changed from extreme pacifism in which he believed during the war into a conservative attitude during the socialistic revolution, he had good reasons for doing so.

Talking next about Klein, the contrast between Hilbert and Klein was pointed out. Klein disliked in his lectures rigorous methods and preferred to give the constructive ideas of mathematics. Having undergone a breakdown in health on account of overwork in trying to keep ahead of Poincaré, he assumed the role of an educationist and took great interest in presiding over mathematical societies and in reforming methods of mathematical teaching. A very amusing incident was narrated of how Klein went on discussing, at one of the meetings of the Mathematical Society a Dutch book on "Flacke Krommen" and talked at length about the theory of surfaces until at last it was pointed by one of the audience that "Flacke Krommen" did not mean "Krumme Flachen" but "Ebene Kurven"!

Then came Minkowski who was attached to Hilbert in the most intimate friendship. Minkowski delivered brilliant lectures on Geometry and other topics. His actual original contributions to relativity have perhaps not been so far appreciated properly. It was during the seminars on electrodynamics conducted by Hilbert and Minkowski that the latter was developing his four-dimensional world theory when Einstein's paper appeared and it can be safely said that Minkowski's work was done quite independently. Prof. Born mentioned that his own first paper in Breslau was on relativity, viz., on hyperbolic motion which caught Minkowski's notice who asked the author of the paper to be a lecturer at Göttingen.

Last but not least among the giants of Göttingen was the brilliant Carl Runge, the applied mathematician and spectroscopist, who it was that introduced Prof. Born into modern physics. An important feature of the mathematical life at Göttingen of those days was the Thursday afternoon walk of Klein, Hilbert, Minkowski and Runge. A separation of this company was effected by the sudden death of Minkowski from appendicitis and on this occasion Hilbert delivered his famous memorial speech on Minkowski. In this connection it is interesting to know that in Hilbert's estimation Cantor, Minkowski and Hadamard, three Jews, were among the first order mathematicians.

Minkowski's successor in Göttingen was Landau, well known for his brilliant work on the analytical theory of numbers and many other subjects.

Passing on next to his friends and colleagues, Prof. Born mentioned in the former category the names of E. Schimidt (Berlin) known for his work on integral equations and potential theory, Caratheodory of real variables and variations, Zermelo of Mengenlehre, Herglotz, Max Abraham and others. When talking of Koebe, an incident that happened at Rome when the International Mathematics Congress met there, was narrated of how when looking at the celebrated paintings of Michael Angelo in the Sixtina Chapel, Koebe burst out on the ephemeral nature of works of art of this type as contrasted with his uniformisation theorems which would stand for all time! This was how he acquired his nickname of "Kunstmacen." The other lecturers at Göttingen were Hermann Weyl famous for his group theory, Hecke, Toeplitz, Courant and Emmy Noether, who has died recently in America. At her funeral Weyl said in his commemoration speech, that she is considered as the greatest woman mathematician known in the history of science, greater even than the famous Sonja Kowalewski.

The associations with Planck and Einstein at Berlin in war time were next touched upon. It was unfortunate that Einstein should have got mixed up in politics with his strong tendencies towards pacifism, liberal doctrines and socialism. This led to the unfortunate conflict with Lenard and Stark. Einstein's scientific work could be divided into two periods—the physical and the later mathematical period of which the first seems to be far fruitful.

Talking in general terms, Prof. Born said that as a rule the physicists he had met were more "normal" and therefore less interesting than the mathematicians. An exception, however, was the case of Ehrenfest who was a strange character. He was a true cosmopolitan, born in Vienna, educated partly in Germany, thoroughly acclimatised in Russia, and at last Professor at Leiden in Holland. He was a man of intense feeling with a great capacity for pure and clear thinking. His house was bare without any furniture and a wall of it served as visitor's book whereon could be found the names of all great men who visited him! Freedom from tradition was a passion with him. He got his meals from public kitchens and never sent his children to school for their education. His Russian wife and his eldest daughter both were called Tatjana, but for distinguishing between them his friends used to style them (Tatjana) and (Tatjana)? He died under tragic circumstances having committed suicide by shooting himself with a revolver; this fatal step was the result of a deep depression which overcame him very often when he found difficulties to keep step with the progress of the younger generation of theoretical physicists.

A rapid survey was then made of the foreign mathematicians and theoretical physicists whom he had met. In referring to Niels and Harald Bohr, he spoke of the former's great gift of physical intuition and likened him to a magician, who, though not much of a mathematician, could grasp the physical aspect of a problem immediately. Amongst the Dutch scientists the palm was given to Lorentz, a great leader of scientific activity and the President of the Solvay Congress. Lorentz's lectures at Göttingen were then recalled. Reference was also made to Kramers, Ornstein and Brouwer. Brief mention was made of Poincaré, Hadamard, de Broglie and Brillouin in France, of Levi-Civita and Fermi in Italy, of Frenkel, Alexandrow and Fock in Russia, and of Moore, Birkhoff, Veblen, Wiener, Alexander, van Vleck (senior and junior) in America. Amongst the English mathematicians and physicists he had met, Prof. Born talked about Hardy, Littlewood, Darwin, Fowler and Dirac. About the silent Dirac, Professor at Cambridge, mention was made of the 'unit' invented by his friends viz., 1 Dirac = I word per hour!

In the last category of his pupils, Prof. Born spoke about Pauli, Heisenberg, Jordan, Hund, Dirac, Fermi and v. Neumann whose book on quantum mechanics was considered to go deepest into the subject.

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