CHARLES JORDAN, 1871–1959

By L. Takács

Columbia University

Charles Jordan was born on December 16, 1871 in Budapest, Hungary. His father owned a leather factory and his family was well-to-do. Jordan went to school in Budapest and graduated in 1889. Subsequently he studied at the École Préparatoire Monge in Paris and at the École Polytechnique in Zürich, where he received the degree of "Diplomingenieur in Chemie" in 1893. After spending a year at Owen's College of Victoria University, Manchester, he accepted an appointment at the University of Geneva in 1894, where he remained until 1899. In 1895, at the University of Geneva, he obtained his degree of "Docteur ès Sciences Physiques" by his thesis [1] and subsequently he became "Privat Dozent" in physical chemistry. In 1895 in Geneva he married Marie Blumauer. He returned to Budapest in 1899, and, in the same year, after the birth of their third child, his wife died. During the following years Charles Jordan studied mathematics, astronomy and geophysics at the P. Pázmány University, Budapest. He married Marthe Lavallée in 1900. Of this marriage three more children were born. From 1906 to 1913 he was director of the Institute of Seismology at Budapest. During the First World War he taught mathematics, physics and meteorology at a military academy. From 1920 to 1950 he lectured at the University of Technical and Economic Sciences, Budapest, where, in 1923, he became "Privat Dozent" and, in 1933, professor.

In 1928 he was awarded the J. König prize[1] by the L. Eötvös Mathematical and Physical Society, Budapest. This prize was awarded every two years. In 1947 the Hungarian Academy of Sciences elected him corresponding member. In 1956 he won the Kossuth Prize for his achievement in the field of mathematics. After 59 years of marriage he lost his second wife in July 1959. A few days after his 88th birthday, on December 24, 1959, Professor Charles Jordan died.

He was a Corresponding Member of the Hungarian Academy of Sciences, Honorary President of the J. Bolyai Mathematical Society, Budapest, Honorary Fellow of the Royal Statistical Society, Fellow of the Institute of Mathematical Statistics, Member of the Institut International de Statistique and of the American Statistical Association, Honorary Member of the Society of Hungarian Geophysicists and the Hungarian Meteorological Society. He was also a member of many other mathematical and scientific societies.

Charles Jordan's industrious and fruitful mathematical activity began in the years following 1910. The theories of probability and mathematical statistics

Received July 16, 1960. An invited obituary.

[1] Cf., A. Szücs, "Jelentés az 1928 évi König Gyula jutalomról" (Report on the Julius König prize of 1928), *Matematikai és Fizikai Lapok*, Vol. 35 (1928), pp. 61–69.

have always formed the core of his greatest work. He was particularly interested in the mathematical methods of these disciplines. He is the author of 5 books [13], [37], [38], [66, 76], [88], 83 scientific papers, and several papers on mountaineering. For thirty years he taught at the Technical University of Budapest. He lectured on the theory of probability, mathematical statistics, the calculus of finite differences, and on special topics such as difference equations, the theory of correlation, and the algebra of logic. His profound scholarship and his lucid style made his lectures a source of great inspiration to his students.

He had an extensive knowledge of the history of mathematics and he studied many of the mathematical classics in their original editions, nearly all of which he had in his personal library. His collection consisted of about 5000 volumes of which nearly 1000 were rare copies such as the first printed edition of Lucas dal Burgo Pacioli's "Summa de Arithmetica", published in Venice in 1494. During the Hungarian Revolution, on October 26, 1956, tanks set fire to the house where he lived, and, in the course of a few hours, his whole apartment and library were destroyed. Losing all his wordly possessions representing the patient work of a lifetime is no small matter for a man of 85. But Charles Jordan received the blow with a wisdom and vitality characteristic of him. He was determined to start life anew: while he was in the hospital, recovering from a mild heart attack, which he suffered after the destruction of his home, he set to work correcting the printer's errors in a borrowed copy of his recently published book [88].

He was a man of extraordinary integrity and with a strong sense of justice. He never failed to condemn injustice even when it was dangerous to do so. He was devoted to his large family and they in their turn surrounded him with their affection. His children, grandchildren, and great-grandchildren gathered round him on various occasions such as birthdays and sometimes in later years tried vainly to persuade him to give up his long solitary walks in the Budapest hills. His favourite pastimes were travelling and mountaineering. In the years following 1900, he explored several undiscovered peaks and tracks in the Tátra mountains, and some of them actually bear his name. At the time he published several papers on his mountaineering experiences.

Charles Jordan started his scientific career at the end of the nineteenth century. After publishing seven papers on chemistry, he published his first paper on probability theory in 1904. This paper [8] deals with the applications of probability theory in meteorology, a subject on which he wrote eight more papers in the course of his career [18], [19], [25], [44], [64], [74], [78], [80]. His first major works in mathematics were inspired by his interest in geometrical probability. During the years 1912–1914, together with R. Fiedler, he wrote one book [13] and five papers [12], [14], [15], [16], [17] on π curves, which are closely connected with the closed convex curves. By using polar tangential co-ordinates, they deduced some extremely interesting properties of the π curves. In his paper [21], written in 1920, he dealt with the approximation of a function $f(x)$ for equidistant values of x by orthogonal polynomials according to the principle of least squares. His other papers on this subject are [24], [25], [51], [52], [54], [75]. In

1922 he gave [26] a new proof of the Euler-Maclaurin summation formula by using the same method that Lagrange used to deduce Taylor's formula via integration by parts. In his paper [31], written in 1923, he dealt with the foundations of probability theory. He gave a definition of abstract mathematical probability, and, starting from this definition, he deduced the fundamental theorems. His other papers on this topic are [22], [45] and [50]. In [50] he criticizes the theory of Mises. In 1926 he gave the expansion of a function $f(x)$, defined for $x = 0, 1, 2, \cdots$, into a series of orthogonal polynomials [33], [35]. He showed that

$$f(x) = e^{-m} \frac{m^x}{x!} \sum_{n=0}^{\infty} a_n G_n(x),$$

where

$$G_n(x) = \frac{n!}{m^n} \sum_{i=0}^{n} (-1)^i \frac{m^i}{i!} \binom{x}{n-i}$$

and

$$a_n = \frac{m^n}{n!} \sum_{x=0}^{\infty} G_n(x) f(x).$$

By using this expansion he gave a new asymptotic expression for the Bernoulli distribution.

His book, *Mathematical Statistics*, which appeared in Hungarian [37] and in an extended form in French [38] in 1927, contains a complete theory of mathematical statistics, including Jordan's own results. Maurice d'Ocagne wrote the introduction to the French version and presented it to the Académie des Sciences, Paris.[2]

In his paper [45], written in 1927, and in [61] and [69], he formulated the theorem of general probability as follows: If $A_1, A_2, \cdots, A_n$ are arbitrary events, then the probability that exactly k events occur among them is

$$P_k = \sum_{j=k}^{n} (-1)^{j-k} \binom{j}{k} B_j, \qquad k = 0, 1, \cdots, n,$$

where $B_0 = 1$, and

$$B_j = \sum_{1 \leq i_1 < i_2 < \cdots < i_j \leq n} P\{A_{i_1} A_{i_2} \cdots A_{i_j}\}$$

is the jth binomial moment of the number of events occurring among $A_1, A_2, \cdots, A_n$.

At the International Congress of Mathematicians in Bologna in 1928 he presented a new interpolation formula which has the advantage that no printed

[2] *Comptes Rendus Acad. Sci. Paris.*, Vol. 184 (1927), p. 728. Cf., G. Rados, "Magyar szerzőnek két idegennyelvű művéről" (On two books of a Hungarian author in foreign languages), *Matematikai és Természettudományi Értesitő*, Vol. 58 (1939), pp. 673–676.

differences are necessary [46], [47], [56]. J. Wishart[3] comments on this as follows: "The Jordan formula is certainly a very interesting one, and deserves to take an honoured place beside those others associated by their names with some of the greatest of mathematicians." It is shown in [46] and [47] that, if a table contains the values of $f(u)$ when $u = a, a \pm h, a \pm 2h, \cdots$, then the interpolated value is given by

$$f(a + xh) = \sum_{m=0}^{n-1} C_m(x) \sum_{k=1}^{m+1} B_{mk} I_k + R_{2n}$$

when using a polynomial of degree $2n - 1$. The numbers

$$C_m(x) = (-1)^m \binom{x + m - 1}{2m}$$

and

$$B_{mk} = (-1)^{k+1} \binom{2m + 1}{k + m} \frac{2k - 1}{2m + 1}$$

are given by a table in [46] for $m = 1, 2, 3, 4$ and for $x = 0(0.001)1$. The quantity I_k is obtained by linear interpolation, namely

$$I_k = \frac{x + k - 1}{2k - 1} f(a + kh) + \frac{k - x}{2k - 1} f(a - kh + h),$$

and

$$|R_{2n}| < h^{2n} \left| \binom{n - \frac{1}{2}}{2n} D^{2n} f(a + \xi h) \right|,$$

where $-n + 1 < \xi < n$.

In [54] he continued his investigations on approximation and graduation, according to the principle of least squares, by orthogonal polynomials, (cf. [75]), and he eliminated all the unnecessary matter of his earlier papers. He determined the Newton expansion of the approximating polynomial and also the mean square deviation. To summarize briefly his result on the approximation: Given the observations $y_0, y_1, \cdots, y_{N-1}$ corresponding to $x = 0, 1, \cdots, N - 1$, an approximation by a polynomial $f_n(x)$ of degree n is required such that

$$S_n = \sum_{x=0}^{N-1} [y_x - f_n(x)]^2$$

shall be minimum. He expands the function $f_n(x)$ into a series of orthogonal polynomials,

$$f_n(x) = \sum_{m=0}^{n} a_m U_m(x).$$

---

[3] J. Wishart, A. C. Aitken and G. J. Lidstone, "Interpolation without printed differences: I, II, III," *Math. Gazette*, Vol. 16 (1932), pp. 14–25.

The polynomials $U_m(x)$ of degree m are called orthogonal with respect to $x = 0, 1, \cdots, N - 1$ if

$$\sum_{x=0}^{N-1} U_i(x) U_j(x) = 0, \qquad i \neq j.$$

$U_m(x)$ has the following Newton expansion:

$$U_m(x) = C_m \sum_{\nu=0}^{m} (-1)^{m+\nu} \binom{m+\nu}{m} \binom{N-\nu-1}{m-\nu} \binom{x}{\nu},$$

where C_m is an arbitrary constant, which can be chosen conveniently as

$$C_m = \left[(m+1) \binom{N}{m+1} \right]^{-1}.$$

It turns out that the $a_m (m = 0, 1, \cdots, n)$ which minimize S_φ are independent of the degree n; this is the most important point. The Newton expansion of $f_n(x)$ is given by

$$f_n(x) = \sum_{m=0}^{n} \sum_{\nu=0}^{m} C_{m\nu}\, \Theta_m \binom{x}{\nu},$$

where

$$C_{m\nu} = (-1)^{m+\nu}(2m+1) \binom{m+\nu}{m} \frac{\binom{N-\nu-1}{m-\nu}}{\binom{N+m}{m}}$$

and Θ_m is the orthogonal moment of order m of the observations, i.e.,

$$\Theta_m = \sum_{x=0}^{N-1} U_m(x) y_x = \sum_{\nu=0}^{m} \beta_{m\nu} T_\nu,$$

where

$$T_m = \sum_{x=0}^{N-1} \binom{x}{m} y_x \Big/ \binom{N}{m+1}, \qquad (m = 0, 1, 2, \cdots),$$

and

$$\beta_{m\nu} = (-1)^{m+\nu} \binom{m+\nu}{m} \binom{m}{\nu} \frac{1}{(\nu+1)}.$$

The mean square deviation is

$$\sigma_n^2 = \frac{1}{N} \sum_{x=0}^{N-1} [y_x - f_n(x)]^2 = \frac{1}{N} \sum_{x=0}^{N-1} y_x^2 - \Theta_0^2 - |C_{10}|\, \Theta_1^2 - \cdots - |C_{n0}|\, \Theta_n^2.$$

For $n \leqq 7$ and $N \leqq 100$ ten-decimal tables are published in [54].

In his papers [31], [45], and [60] he gave the correct interpretation of Bayes' theorem, thus clearing up much of the controversy. In [62] he showed that the justifications for Pearson's χ^2 test were all founded on Bayes' theorem. In [27], [32], [34] and [35] he determines "inverse probabilities" by using Bayes' theorem. In [40], [41], [57], [58], [63], and [81] he gives approximating formulas for the multidimensional hypergeometrical and Bernoulli distributions as well as for their inversions. In [28] he deals with the Mointmort-Moivre urn model and in [40], with the generalization of the Eggenberger-Pólya urn model by which he arrived at a general case of the multidimensional hypergeometrical distribution. His papers [42], [43], [44], [64], [65], [71] are concerned with the theory of correlation. He wrote four papers on the conception of expectation [30], [49], [59], [77], and two papers on the theory of errors [29], [72]. In [39] he deals with the Lexis problem.

His book [66] on *Calculus of Finite Differences*,[4] with an introduction by Harry C. Carver, first appeared in 1939 in Hungary and in a second edition [76] in 1947 in New York. It contains many of the author's new results and it throws new light on the work of several classical authors such as Bernoulli, Boole, Ellis, Euler, Fourier, Lagrange, Laplace, and Stirling. In this book he deals with Newton's series, which, in his opinion, should always be preferred to the power series in statistical research, with the theory of Stirling numbers, which he developed in [55], with the Euler polynomials, and with the Bernoulli polynomials, the second order of which was introduced by him [48]. He gives new approximating formulas by the principle of least squares and by the method of moments. Graduation, interpolation and difference equations are also treated in this book. The papers [68], [70], and [89] are concerned also with the applications of the calculus of finite differences.

In 1947 he introduced the notion of "surprisingness" in a mimeographed paper "On statistical inference" which he wrote in connection with a note by M. Fréchet at the International Statistical Conference in Washington, September 16–18, 1947. If the events $A_1, A_2, \cdots, A_s$ occur respectively $k_1, k_2, \cdots, k_s$ times in n trials, then the "surprisingness" of this phenomenon may be measured by the quantity

$$S = 1 - \frac{P_{k_1,k_2,\cdots,k_s}}{P_{m_1,m_2,\cdots,m_s}},$$

where $P_{k_1,k_2,\cdots,k_s}$ is the probability of the system $(k_1, k_2, \cdots, k_s)$ and $P_{m_1,m_2,\cdots,m_s}$ is that of the most probable system $(m_1, m_2, \cdots, m_s)$.

In his paper [73] he deals with the generalization of Simmons' theorem, in [83] with renewal theory, in [85] and [86] with van der Waals equation, and in [84] and [87] with the approximation of observations.

His book [88] *Chapters on the Classical Probability Theory*, which he considered

[4] Cf., A. Szücs, "Charles Jordan: Calculus of Finite Differences," *Matematikai és Fizikai Lapok*, Vol. 46 (1939), pp. 170–172; and G. Rados, "Magyar szerzőnek két idegennyelvű művéről" (On two books of a Hungarian author in foreign languages), *Matematikai és Természettudományi Értesitő*, Vol. 58 (1939), pp. 673–676.

his greatest work, was completed in 1946. The contents of this book summarize the results of his fifty years of research and thirty years of lecturing. Of special interest are the chapters on the historical background to the development of the concept of probability, on the mathematical methods of probability theory, on the probabilities concerning repeated trials, on classical probability problems and on geometrical probabilities. It was a source of great disappointment to him that the publication of the book was delayed for ten years after its completion. The Hungarian Academy of Sciences, whose permission was necessary to publish any scientific work, continually delayed granting its permission. Before the work was finally allowed to appear in print in 1956, the author had to alter his original title, "Probability Theory", to its present form and make a few omissions such as leaving out his paragraph on Mendel's theory of heredity. Thus, although it was the first Hungarian book on probability theory to be written, it was unfortunately not the first one to be published.

The work of Charles Jordan has made a lasting impression on the development of modern probability theory. During his long and productive career he laid the foundations of the school of Hungarian probability theory, and his students, of whom the present author is one, will always feel gratitude for his guidance and inspiration.

CHARLES JORDAN'S PUBLISHED SCIENTIFIC WORKS

Note: C.R. is a notation for *Comptes Rendus Acad. Sci. Paris* throughout this bibliography.

[1] CHARLES JORDAN, *Dédoublement de l'acide butanoloïque 2, et recherches sur les dérivés actifs de cet acide. Étude numérique sur la formule transformée de MM. Thorpe et Rücker, thesis, Geneva* (1895).

[2] A. GUYE AND CH. JORDAN, "Dédoublement de l'acide butane-2-oloïque (α-oxybutyrique)," *C.R.*, Vol. 120 (1895), pp. 562–565.

[3] A. GUYE AND CH. JORDAN, "Dérivés de l'acide α-oxybutirique (1-butanoloïque) actif," *C.R.*, Vol. 120 (1895), pp. 632–635.

[4] A. GUYE AND CH. JORDAN, "Éthers des acides α-oxybutyriques actifs," *C.R.*, Vol. 120 (1895), pp. 1274–1276.

[5] A. GUYE AND CH. JORDAN, "Recherches expérimentales sur les butanol-2-oïques (α-oxybutyrique) actifs," *Bull. de la Société Chimique de Paris*, Ser. 3, Vol. 15 (1896), pp. 474–498.

[6] A. GUYE AND CH. JORDAN, "Formule simplifiée pour calculer les variations de densité des liquides avec la température," *Bull. de la Société Chimique de Paris*, Ser. 3, Vol. 15 (1896), pp. 306–308.

[7] A. GUYE AND CH. JORDAN, "Dispersion rotatoire des corps actifs liquides non polymérisés," *C.R.*, Vol. 122 (1896), pp. 883–886.

[8] JORDAN KÁROLY, "A valószinűségi számitás alkalmazása meteorológiai viszonyainkra" (The application of the theory of probability to our meteorological conditions), *Atmosphaera* (Budapest), Vol. 8 (1904), pp. 41–48.

[9] CHARLES JORDAN, "La propagation des ondes sismiques," *Revue Générale des Sciences Pures et Appliquées*, Vol. 18 (1907), pp. 531–544 and 571–578.

[10] JORDAN KÁROLY, "A Héviz tó fenekének fölmérése," (Charting the basin of the lake of Héviz) *ABalaton Tudományos Tanulmányozásának Eredményei*, (Budapest), Vol 2. Függelék (1908), pp. 77–79.

[11] JORDAN KÁROLY, "A választójogi rendszerekről" (On systems of suffrage), *A Huszadik Század Könyvtára*, (Budapest) No. 34 (1908), 16 pp.

[12] CH. JORDAN AND R. FIEDLER, "Contribution à la géométrie des courbes convexes et de certaines courbes qui en dérivent," *C.R.*, Vol. 154 (1912), pp. 927–930.

[13] CHARLES JORDAN AND RAYMOND FIEDLER, *Contribution à l'Étude des Courbes Convexes Fermées et de Certaines Courbes qui s'y Rattachent*, Hermann et Fils, Paris, 1912.

[14] C. JORDAN AND R. FIEDLER, "Courbes Orbiformes," *Archiv der Mathematik und Physik*, Ser. 3, Vol. 21 (1913), pp. 226–235.

[15] CHARLES JORDAN AND RAYMUND FIEDLER, "On a particular case of closed convex curves," *Tôhoku Math. J.*, Vol. 6 (1914), pp. 44–52.

[16] JORDAN, FIEDLER, "Vermischte Mitteilungen, Zu 449 (Bd. XXI, S. 288) (W. Blaschke)", *Archiv der Mathematik und Physik*, Ser. 3, Vol. 22 (1914), pp. 362–364.

[17] JORDAN KÁROLY AND RAYMOND FIEDLER, "Zárt konvex görbékkel kapcsolatos görbékről" (On curves connected with closed convex curves), *Mathematikai és Physikai Lapok*, Vol. 24 (1915), pp. 207–228.

[18] JORDAN KÁROLY, "A köd," (Fog) *Természettudományi Közlöny*, Vol. 50 Nos. 131–132 (1918), pp. 134–143.

[19] JORDAN KÁROLY, "Várpalotai évi [meteórologiai] jelentés," (An annual [meteorological] report of Várpalota), *Időjárás*, Vol. 23 (1919), pp. 75–81.

[20] JORDAN KÁROLY, "Az arányos választórendszerek birálata," (A critique of the system of proportional representation), *Táltos Könyvtár* (Budapest), Nos. 12–13 (1919), 56 pp.

[21] CHARLES JORDAN, "Sur une série de polynomes dont chaque somme partielle représente la meilleure approximation d'un degré donné suivant la méthode des moindres carrés," *Proc. London Math. Soc.*, Ser. 2, Vol. 20 (1921–22), pp. 297–325.

[22] JORDAN KÁROLY, "A valószinűség a tudományban és az életben," (Probability in science and life), *Természettudományi Közlöny*, Vol. 53, Nos. 775–778 (1921), pp. 337–349.

[23] KARL JORDAN, "Kritik der Proportionalwahlsysteme, "*Zeitschrift für die gesamte Staatswissenschaft*, Vol. 76 (1921), pp. 487–492.

[24] JORDAN KÁROLY, "Észlelések eredményeinek törvénybefoglalása polynomok segélyével," (The approximation of data of observations by polynomials), *Mathematikai és Physikai Lapok*, Vol. 29 (1922), pp. 49–63.

[25] K. JORDAN, "Eine vereinfachte Anwendung der Methode der kleinstein Quadrate," Die Meteorologen-Tagung auf dem Hohen Sonnblick. *Meteorologischen Zeitschrift*, Vol. 39 (1922), pp. 383–384.

[26] CHARLES JORDAN, "On a new demonstration of Maclaurin's or Euler's summation formula," *Tôhoku Math. J.*, Vol. 21 (1922), pp. 244–246.

[27] CHARLES JORDAN, "On the inversion of Bernoulli's theorem," *Philos. Mag.*, Ser. 6, Vol. 45 (1923), pp. 732–735.

[28] CHARLES JORDAN, "On the Montmort-Moivre problem," *Acta Scientiarum Mathematicarum*, (Szeged), Vol. 1 (1922–23), pp. 144–147.

[29] CHARLES JORDAN, "Sur la théorie des erreurs d'observation," *Rendiconti del Circolo Matematico di Palermo*, Vol. 47 (1923), pp. 396–408.

[30] CHARLES JORDAN, "On Daniel Bernoulli's 'moral expectation' and on a new conception of expectation," *Amer. Math. Monthly*, Vol. 31 (1924), pp. 183–190.

[31] CHARLES JORDAN, "On probability," *Proc. Physico-Mathematical Soc. of Japan*, Ser. 3, Vol. 7 (1925), pp. 96–109.

[32] CHARLES JORDAN, "Formules nouvelles pour comparer deux probabilités *a posteriori*," *C.R.*, Vol. 182 (1926), pp. 198–199.

[33] CHARLES JORDAN, "Développements nouveaux pour l'application du théorème de Bernoulli," *C.R.*, Vol. 182 (1926), pp. 303–305.

[34] CHARLES JORDAN, "Sur l'inversion du théorème de Bernoulli," *C.R.*, Vol. 182 (1926), pp. 431–432.

[35] CHARLES JORDAN, Sur la probabilité des épreuves répétées, le théorème de Bernoulli et son inversion," *Bull. de la Société Mathématique de France*, Vol. 54 (1926), pp. 101–137.

[36] CHARLES JORDAN, "Les mathématiques appliquées à la statistique," *Revue de la Société Hongroise de Statistique*, Vol. 4 (1926), pp. 230–238.

[37] JORDAN KÁROLY, *Matematikai Statisztika*, (Mathematical Statistics), Athenaeum, Budapest, 1927.

[38] CHARLES JORDAN, *Statistique Mathématique*, Gauthier-Villars, Paris, 1927.

[39] CHARLES JORDAN, "On Poisson's and Lexis's problem of probability of repeated trials," *Philos. Mag.* Ser. 7, Vol. 3, (1927), pp. 1195–1199.

[40] CHARLES JORDAN, "Sur un cas généralisé de la probabilité des épreuves répétées," *C.R.*, Vol. 184 (1927), pp. 315–317.

[41] CHARLES JORDAN, "Sur un cas généralisé de la probabilité des épreuves répétées, "*Acta Scientiarum Mathematicarum*, (Szeged), Vol. 3 (1927), pp. 193–210.

[42] CHARLES JORDAN, "Les coefficients d'intensité relative de Kőrösy," *Revue de la Société Hongroise de Statistique*, Vol. 5 (1927), pp. 332–345.

[43] JORDAN KÁROLY, "Kőrösy relativintenzitási koefficiensei," (Les coefficients d'intensité relative de Kőrösy), *Magyar Statisztikai Szemle*, Vol. 5 (1927), pp. 1082–1087.

[44] JORDAN KÁROLY, "A korrelációs módszerek alkalmazása a meteorológiában," (Emploi des méthodes de corrélation en météorologie), *Időjárás*, Vol. 31 (1927), pp. 65–70 and 93–94.

[45] JORDAN KÁROLY, "A valószinüségszámitás alapfogalmai," (Les fondements du calcul des probabilités), *Mathematikai és Physikai Lapok*, Vol. 34 (1927), pp. 109–136.

[46] C. JORDAN, "Sur une formule d'interpolation," *Atti del Congresso Internazionale dei Matematici*, Bologna, Vol. 6 (1928), pp. 157–177.

[47] CHARLES JORDAN, "Sur une formule d'interpolation dérivée de la formule d'Everett," *Metron*, Vol. 7, No. 3 (1927–28), pp. 47–51.

[48] CHARLES JORDAN, "Sur des polynomes analogues aux polynomes de Bernoulli et sur des formules de sommation analogues à celle de MacLaurin-Euler," *Acta Scientiarum Mathematicarum*, (Szeged), Vol. 4 (1928–1929), pp. 130–150.

[49] JORDAN KÁROLY, "A matematikai reménységről," (On mathematical expectations), *Középiskolai Matematikai és Fizikai Lapok*, Vol. 6 (1929–30), pp. 37–43.

[50] JORDAN KÁROLY, "Véletlen, valószinüség és természeti törvény," (Chance, probability and the laws of nature), *Athenaeum*, Vol. 15, No. 5–6 (1929), pp. 245–272 and 327–328.

[51] CHARLES JORDAN, "Sur la détermination de la tendance séculaire des grandeurs statistiques par la méthode des moindres carrés," *J. de la Société Hongroise de Statistique*, Vol. 7 (1929), pp. 567–599.

[52] KARL JORDAN, "Berechnung der Trendlinie auf Grund der Theorie der kleinsten Quadrate," *Mitteilungen der ungarischen Landeskommission für Wirtschaftstatistik und Konjukturforschung*, No. 1 (1930), 48 pp.

[53] JORDAN KÁROLY, "Megjegyzés a 'Középiskolai Matematikai és Fizikai Lapok' 598. számú valószinüségszámitási feladatához," (A note on probability problem No. 598 of "Középiskolai Matematikai és Fizikai Lapok"), *Középiskolai Matematikai és Fizikai Lapok*, Vol. 7 (1930–31), pp. 101–104.

[54] CHARLES JORDAN, "Approximation and graduation according to the principle of least squares by orthogonal polynomials," *Ann. Math. Stat.*, Vol. 3 (1932), pp. 257–357.

[55] CHARLES JORDAN, "On Stirling's numbers," *Tôhoku Math. J.*, Vol. 37 (1933), pp. 254–278.

[56] CHARLES JORDAN, "Interpolation without printed differences, in the case of two or three independent variables,' *J. London Math. Soc.*, Vol. 8 (1933), pp. 232–240.

[57] C. JORDAN, "Problema delle prove ripetute a più variabili indipendenti, "*Giornale dell'Istituto Italiano degli Attuari*, Vol. 4 (1933), pp. 351–368.

[58] C. JORDAN, "Inversione della formula di Bernoulli relativa al problema delle prove ripetute a più variabili," *Giornale dell'Istituto Italiano degli Attuari*, Vol. 4 (1933), pp. 505–513.

[59] CHARLES JORDAN, "Sur l'emploi des moyennes géométriques et arithmétiques," *J. Société Hongroise de Statistique*, Vol. 12, (1934), pp. 40–48.

[60] C. JORDAN, "Teoria della perequazione e dell'approssimazione," *Giornale dell'Istituto Italiano degli Attuari*, Vol. 5 (1934), pp. 81–107.

[61] CH. JORDAN, "Le théorème de probabilité de Poincaré, généralisé au cas de plusieurs variables indépendantes," *Acta Scientiarum Mathematicarum*, (Szeged), Vol. 7 (1934–35), pp. 103–111.

[62] CHARLES JORDAN, "On approximation and on test criteria by the χ test and by Bayes' theorem," *J. Société Hongroise de Statistique*, Vol. 15, (1937), pp. 101–128.

[63] CH. JORDAN, "Sur l'approximation d'une fonction à plusieurs variables," *Acta Scientiarum Mathematicarum*, (Szeged), Vol. 8 (1936–37), pp. 205–225.

[64] JORDAN KÁROLY, "A korreláció számitás alkalmazása a meteorológiában," (L'emploi des méthodes de corrélation en météorologie), *Időjárás*, Vol. 41 (1937), pp. 93–110 and 136–140.

[65] CH. JORDAN, "Critique de la corrélation au point de vue des probabilités," in *Acte du colloque consacré à la Théorie des Probabilités*, No. 740 of *Actualités Scientifiques et Industrielles*, Hermann, Paris, 1938, pp. 15–33.

[66] CHARLES JORDAN, *Calculus of Finite Differences*, Budapest, 1939,

[67] JORDAN KÁROLY," Az ismétléses variációkról," (On variations with repetition), *Középiskolai Matematikai és Fizikai Lapok*, Vol. 15 (1938–39), pp. 189–194.

[68] JORDAN KÁROLY, "A differencia-számitás szerepe a statisztikában," (Le rôle du calcul des differences finies dans la statistique), *Magyar Statisztikai Szemle*, Vol. 17 (1939), pp. 1212–1215.

[69] CHARLES JORDAN, "Problèmes de la probabilité des épreuves répétées dans le cas général," *Bull. de la Société Mathématique de France*, Vol. 67 (1939), pp. 223–242.

[70] CHARLES JORDAN, "Le rôle du calcul des différences finies en statistique," *J. Société Hongroise de Statistique*, Vol. 17 (1939), pp. 379–386.

[71] JORDAN KÁROLY, "A Korreláció Számitása," (Sur le calcul de la corrélation), *Magyar Statisztikai Szemle Kiadványai*, No. 1 (1941), 47 pp.

[72] CHARLES JORDAN, "Remarques sur la loi des erreurs," *Acta Scientiarum Mathematicarum*, (Szeged), Vol. 10 (1941–43), pp. 112–133.

[73] CHARLES JORDAN, "Complément au théorème de Simmons sur les probabilités," *Acta Scientiarum Mathematicarum*, (Szeged), Vol. 11 (1946–48), pp. 19–27.

[74] RÓNA ZSIGMOND AND JORDAN KÁROLY, "A légnyomás és hőmérséklet közötti kapcsolat január és julius hónapban," (Corrélation entre la pression et la température en janvier et en juillet), *Időjárás*, Vol. 52 (1948), pp. 157–166 and 240.

[75] CHARLES JORDAN, "Note on approximation and graduation by orthogonal mom-*Hungarica Acta Mathematica*, Vol. 1, No. 4 (1949) pp. 4–9.

[76] CHARLES JORDAN, *Calculus of Finite Differences*, 2nd ed., Chelsea, New York, 1947.

[77] CH. JORDAN, "Sur l'impôt équitable et sur l'utilité marginale de la monnaie," *Economia Internazionale*, Vol. 2 (1949), pp. 206–220.

[78] JORDAN KÁROLY, "Periodikus menetet mutató észlelések megközelitése trigonometrikus függvénnyel," (Approximation, conformément au principe des moindres carrés, des observations présentant une tendance périodique), *Időjárás*, Vol. 53 (1949), pp. 226–231 and 274.

[79] JORDAN KÁROLY, "Elliptikus függvények és alkalmazásuk, (Elliptic functions and their application), *Mérnöki Továbbképző Intézet Kiadványai.Matematika*, No. 5 (1950), 32 pp.

[80] JORDAN KÁROLY, "Megjegyzés az éghajlat fogalmának meghatározásához," (Remarques sur la définition plus complète du climat), *Időjárás*, Vol. 54 (1950), pp. 197–198 and 255.

[81] JORDAN KÁROLY, "Következtetések statisztikai észlelésekből," (Inference from statistical observations), *Magyar Tud. Akad. Mat. és Term. Tud. Oszt. Közl.*, Vol. 1 (1951), pp. 218–227.

[82] JORDAN KÁROLY, "A számolás eredete és a számrendszerek," (L'origine du calcul et des systèmes de nombres), *Középiskolai Matematikai Lapok*, Vol. 3 (1951), pp. 51–61.

[83] JORDAN KÁROLY, "Megújuló sokaságok és az ipari utánpótlás valószinűségszámitási tárgyalása," (Les ensembles statistiques renouvelés et le remplacement industriel), *Matematikai Lapok*, Vol. 2 (1951), pp. 165–189.

[84] JORDAN KÁROLY, "Észlelések törvényszerűségének meghatározása több változó esetén," (Determination of the law in observations in the case of many variables), *A Magyar Tud. Akad. Mat. és Fiz. Oszt. Közl.*, Vol. 3 (1953), pp. 459–466.

[85] JORDAN KÁROLY, "Van der Waals állapotegyenlete," (Sur l'équation d'état de van der Waals), *Magyar Fizikai Folyóirat*, Vol. 1 (1953) pp. 27–32.

[86] CH. JORDAN, "Sur l'équation d'état de van der Waals," *Acta Physica Acad. Sci. Hungaricae*, Vol. 3 (1954), pp. 335–338.

[87] JORDAN KÁROLY, "A valószinűségszámitás néhány új eredményéről," (On some new results in the theory of probability), *A Magyar Tud. Akad. Mat. és Fiz. Oszt. Közl.*, Vol. 5 (1955), pp. 129–135.

[88] JORDAN KÁROLY, *Fejezetek a Klasszikus Valószinüségszámitásból*, (Chapters on the Classical Probability Theory), Akadémiai Kiadó, Budapest, 1956.

[89] JORDAN KÁROLY, "A differenciaszámitás szerepe a demográfiában," (On the use of the calculus of finite differences in demography), *Demográfia*, Vol. 1 (1958), pp. 197–225.

[90] JORDAN KÁROLY, *Logaritmustábla*, (Table of Logarithms), Műszaki Könyvkiadó, Budapest, (to appear).