ADVANCING EUROPEAN PLANT KARYOLOGY: THE 20th-CENTURY CONTRIBUTIONS OF VICTOR GHIMPU

Gallia BUTNARU[1]

Abstract. *The research and teaching activity of Prof. Dr. Victor Ghimpu was highly synchronized with the major scientific trends in leading European centers, notably in France, Germany, the United Kingdom, and Russia. In an era when classical genetics merged with the microscopic analysis of cells and nuclei, Dr. Ghimpu placed Romanian karyology on the global scientific map through pioneering studies on chromosome and satellite structures. However, in countries later trapped behind the Iron Curtain, such as Romania, cytogenetics had to be rediscovered following the destructive period of Lysenkoism (ca. 1948–1964). The turning point for Eastern Europe's return to classical genetics occurred at the landmark International Mendel Memorial Symposium held in Brno in 1965. This event marked the rehabilitation of "Miciurinism" genetics in the region, attempting to recover nearly half a century of lost priorities and stalled progress in karyological research. Lysenkoism was officially abandoned in the USSR and its satellites shortly after 1964. Claiming it lasted until 1988 is factually incorrect; by the late 1950s and 1960s, Romanian agricultural universities were already teaching classical genetics under the guise of 'creative Darwinism' [23], as a masked way to educate students.*

Keywords: karyology; cytogenetic progress; Europe; Romania; Victor Ghimpu's work; 20th century.

DOI [10.56082/annalsarsciagr.2026.1.66](https://doi.org/10.56082/annalsarsciagr.2026.1.66)

[1]Prof. emeritus; dr.h.c. Senior Researcher, University of Life Sciences of Timişoara, Timişoara, România, Department of Genetics, Full member of the Romanian Academy of Scientists; (e-mail: galliab@yahoo.com).

1.Introduction

Karyology, the field that studies the number, morphology, and behaviour of chromosomes in organisms, has played a decisive role in understanding genetic diversity, speciation in plants and animals, as well as genetic disorders [41, 51, 60, 64, 66, 69]. Building upon Rudolf Virchow's (1821-1902) cell theory principle that 'all cells come from pre-existing cells,' Theodor Boveri (1862–1915) and Walter Sutton (1877–1916) conducted cytogenetic studies to develop the chromosome theory of inheritance. In 1902 and 1903, respectively, they independently demonstrated that chromosome behaviour during meiosis explains the physical basis of Mendelian heredity [45].

In 1910, Thomas Hunt Morgan (1866–1945) confirmed this theory by demonstrating the linear arrangement of linked genes on chromosomes [52].

The 20th century was subsequently shaped by groundbreaking advances in cytogenetics. Notably, Nettie Stevens (1861–1912) identified sex chromosomes and described the mechanism of sex determination in 1905 [3], while Jérôme Lejeune (1926–1994) discovered the chromosomal basis of human genetic disorders in 1959 [43, 69].

The structural and functional organization of cellular organelles, elucidated by George Emil Palade (1912-2008), Albert Claude (1898-1983), and Christian de Duve (1917-2013), fundamentally advanced cellular biology, earning them the Nobel Prize in Physiology or Medicine in 1974 [8]. Concurrently, the impact of transposable elements, discovered by Barbara McClintock (1902-1992) in maize in 1950, was later reassessed as a key mechanism for genetic exchange and regulation between chromosomes, leading to her Nobel Prize in 1983 [49, 26, 61]. The discovery of telomeres and telomerase by Elizabeth Blackburn, along with Titia de Lange's subsequent research on telomeric protection, fully elucidated the mechanisms underlying chromosome stability [12, 21].

In Romania, karyology experienced significant development during the second half of the 20th century. This progress was driven by the contributions of prominent geneticists, such as Olga Săvulescu (1914–1969), Natalia Saru (1905–1975), and Maria Neagu (1921–1985), alongside the influential research group at the Timișoara Agronomic Institute (IAT) under the leadership of Prof. Dr. Iulian Drăcea (1922–1980) [23, 67, 65, 29, 57, 58]. The research school at the Timișoara Agronomic Institute was inspired by the cytological studies of V. Ghimpu and later continued by Dr. Maria Neagu and Dr. Gallia Butnaru. Prof. Dr. Iulian Drăcea holds the distinct merit of protecting and supporting this research at a time when genetic and cytogenetic studies were ideologically prohibited during the 1950s and 1960s.

Following decades of sporadic cytogenetic research, the recent emergence of advanced staining and molecular techniques has revitalized the field of karyology [60].

This article traces the key evolutionary stages of plant karyology in Europe and Romania, highlighting the scientific and educational contributions of Prof. Dr. Victor Ghimpu, a pioneer of modern cytological research in the country.

2. Materials and Methods

This study employs a qualitative, retrospective historical-agronomic research design. The primary objective is to reconstruct and analyze the scientific contributions of Victor Ghimpu to the fields of plant cytogenetics. To ensure the rigor of data a multi-methodological approach was implemented, combining archival document analysis, comprehensive literature reviews, and oral history methodologies.

The core foundational data for this research was retrieved from the physical archives preserved at the Department of Genetics within King Mihai I University of Life Sciences from Timisoara. The analyzed primary materials include: Original interwar monographs, scientific bulletins, and laboratory registers authored by Victor Ghimpu between the 1920s and 1950s. Institutional administrative records, course curricula, and historical registers detailing the evolution of agricultural sciences within the university's historiography.

3. Results and Discussions

Key Pioneers in Karyology:

While Walther Flemming (1843–1905) is widely recognized as the 'father' of cytogenetics and karyology, other contemporaries made vital contributions to the field; notably, Wilhelm Waldeyer (1841–1923) and Eduard Strasburger (1844–1912) extensively studied plant cell division throughout the 1870s and 1880s.[13, 28, 44]. Furthermore, Eduard Strasburger coined essential biological terms such as cytoplasm and nucleoplasm. He also established one of the modern laws of plant cytology, demonstrating that 'new cell nuclei can arise only from the division of pre-existing nuclei′ [10].

In the early 1900s, Theodor Boveri (1862–1915) and Walter Sutton (1877–1916) independently proposed the chromosomal theory of inheritance. Their foundational work established that chromosomes serve as the physical vehicles for genetic transmission, linking cellular behavior directly to Mendelian laws. Formally recognized as the Boveri–Sutton chromosome theory, this conceptual breakthrough laid the cornerstone for modern cytogenetics [53, 46, 70, 47, 59]. A highly significant contribution to modern biology was the theory demonstrating that Mendelian laws of inheritance apply to chromosomes at the cellular level across all living organisms [19].

Thomas Hunt Morgan (1866–1945) was educated at the Agricultural and

Mechanical College of Kentucky (renamed the University of Kentucky), developing into a pioneering evolutionary biologist and geneticist. Morgan demonstrated that genes are linearly arranged on chromosomes, providing the physical and mechanical basis of heredity. His groundbreaking work formed the foundation of modern genetics by experimentally proving the chromosome theory of inheritance through the demonstration of genetic linkage and recombination in *Drosophila melanogaster* (L). Furthermore, Morgan significantly advanced Darwinism, famously noting that 'evolutionism could not progress without a correct theory of genetics.' For these discoveries elucidating the role of chromosomes in heredity, he was awarded the Nobel Prize in Physiology or Medicine in 1933. His legacy spurred widespread cytogenetic research, which ultimately drove enormous progress in the study of speciation [29, 27, 9]. In contrast to the static model of the chromosome theory and the fixed, linear arrangement of genes, Barbara McClintock's (1902–1992) observations provided revolutionary - though initially vehemently contested - evidence that genetic elements could change positions within the genome. Her work introduced the concepts of mobile genetic elements (transposons) and the breakage-fusion-bridge cycle. The broader significance of McClintock's discoveries became fully apparent in the 1960s, following François Jacob and Jacques Monod's description of genetic regulation in bacteria - a concept McClintock had already demonstrated in 1951 through the Activator/Dissociation (*Ac/Ds*) system in maize. In recognition of her visionary research, she was awarded the Nobel Prize in Physiology or Medicine in 1983. Additionally, 'The McClintock Prize' was established in 2004 to honor outstanding contributions to plant genetics [26, 25, 50, 7].

Last but not least, Elizabeth Helen Blackburn (b. 1948) discovered telomerase, the enzyme responsible for synthesizing and maintaining telomeres—the protective caps at the ends of chromosomes that play a vital role in preserving genomic integrity. For her pioneering work, she was awarded the Nobel Prize in Physiology or Medicine in 2009, sharing the honour with Carol W. Greider and Jack W. Szostak [12].

The Scientific and Educational Legacy of Victor Ghimpu (1920–1950)

The academic contributions of Romanian agronomist, cytologist, and university professor Dr. Victor Ghimpu (1896–1952) between 1920 and 1950 represent a cornerstone of applied plant cytogenetics in Romania. He distinguished himself as an exceptional karyologist and phytopathologist, focusing on the microscopic analysis of chromosome numbers, morphology, and stability within *Medicago*, *Acacia*, *Hordeum*, and other cultivated angiosperm species [37, 63].

Evaluating his legacy raises the question of whether Victor Ghimpu should be classified primarily as a plant karyologist or a phytopathologist. His major

contributions were balanced almost equally between these two domains: fundamental karyological research (focusing on genetics and chromosome structure) and applied phytopathology (dedicated to crop protection). Ultimately, a fair assessment recognizes him as a leading pioneer and one of the most prominent figures of karyology in Romania.
His research and teaching activities were closely synchronized with contemporary scientific breakthroughs in leading European centres across France, Germany, the United Kingdom, and Russia. In an era when classical genetics was merging with microscopic cell analysis, Dr. Victor Ghimpu placed Romanian research on the international stage through his pioneering studies on plant chromosome structures. His enduring impact on the academic community is reflected by the University of Life Sciences in Timisoara, which honoured his memory by naming the Second National Genetics and Breeding Conference after him in 2025.
His life and scientific achievements are well-documented across major historical and academic publications, including *Noesis: Travaux du Comité Roumain d'Histoire et de Philosophie des Sciences* [1], *Studies and Communications on the History of Science* [2], and the *Encyclopedia of Great Personalities in Romanian History*. He is also featured in the *Dictionary of the Members of the Romanian Academy of Sciences* (now AOSR), an institution where he actively worked. Further biographical details can be found in Iulian Viorel Peștean's *Great Romanian Agronomists* [62]. In addition to his academic roles, Dr. Ghimpu applied his expertise within the Autonomous Directorate of State Monopolies starting in 1936.

Victor Ghimpu's Specific Contributions to Karyology

Victor Ghimpu distinguished himself as an exceptional karyologist, focusing on the microscopic analysis of chromosome morphology, stability, and particularly SAT chromosomes (satellite chromosomes) [54]. As a pioneer in the karyology of economically important agricultural genera, his foundational research was published extensively in France and Romania.
For the genus *Medicago* alone, Ghimpu determined the chromosome numbers for 34% of its 93 species, establishing scientific priority for 27% of the total taxa (Fig. 1) [31]. His datasets were so precise that they were fully integrated into the authoritative *Chromosome Numbers of Flowering Plants* world atlas, edited by Fedorov and compiled by Bolkhovskikh, Grif, Matvejeva, and Zakharyeva [14].

The Chromosome Satellite Theory

During the 1930s, before electron microscopy was introduced to biological laboratories, visualizing secondary constrictions and chromosome satellites-small chromatin masses attached to the main chromosome body by a fine filament-posed a major technical challenge. The microscopic methodology developed by

Victor Ghimpu for his pioneering karyological studies during that decade relied on refining differential chemical fixation and selective nucleic acid staining techniques. Utilizing bright field light microscopy with oil immersion, he achieved magnifications of up to 1,000 to 1,500 times, making his detailed chromosomal observations possible (Fig. 2).

In his visionary 1930 study, *'Satellites des chromosomes dans le règne végétal'*, Victor Ghimpu formulated advanced hypotheses regarding the origin, morphology, and functional role of chromosomal satellites - secondary constrictions critically involved in nucleolus organization. His insights were later confirmed through molecular genetics during the 1960s by the pioneering work of Donald Brown (1931-2023), Ferruccio Ritossa (1936-2014), and Max Birnstiel (1933-2014) [17, 68].

The vital functions of SAT (*Sine Acido Thymonucleinico*) chromosomes in cellular architecture were early recognized by Sergei Navashin (1930, S.G. Navashin, 1857-1930) [56]. Building on these observations, in 1931 Emil Heitz (1892-1965) demonstrated that the Nucleolar Organizer Region (NOR) coordinates the assembly of the nucleolus during telophase, establishing the satellite as a fundamental cytogenetic marker [11]. This chromosomal dynamic was further analyzed in the context of somatic variation by Mikhail Navashin (1896-1973) during his extensive studies in the 1920s and 1930s [55].

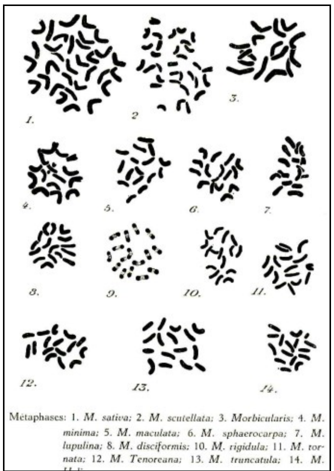

Fig. 1. Variation in number, size, and morphology of *Medicago sativa* (alfalfa) (root cells chromosomes).

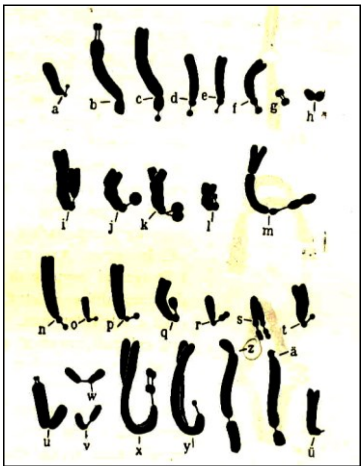

Fig. 2. Morphological variation in number, size, and shape of SAT-chromosomes

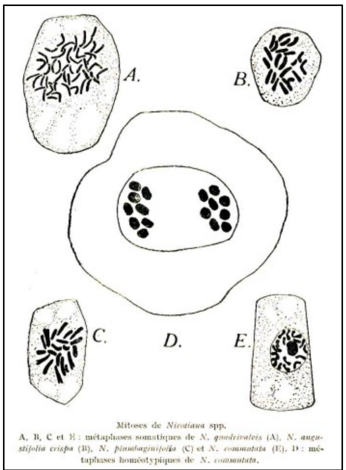

Fig. 3. Mitotic division stages in *Nicotiana* (tobacco) root cells Ghimpu originally pictures

Cytogenetics Applied to Interspecific Hybrids of *Nicotiana*

To fully appreciate the profound impact of Dr. Ghimpu's research, it is essential to contextualize the geopolitical and economic significance of the tobacco monopoly during the 20th century. At the time, state-controlled tobacco monopolies served as central financial pillars for governments worldwide and drove the rise of major transnational corporations. During World War II (1939–1945), tobacco was elevated to a strategic military resource and functioned as a universal currency; cigarettes were classified as essential wartime rations distributed directly to soldiers. Simultaneously, the rapid expansion of smoking among women created an unprecedented economic boom for the industry. In Romania, the Autonomous Directorate of State Monopolies (CAM) stood as the nation's most profitable economic institution [5]. Consequently, the aggressive pursuit of high-yielding, disease-resistant varieties and cost-effective production triggered an explosion of both fundamental and applied cytogenetic research [4, 6]. The demand for more productive varieties and more economical products drove an expansion of fundamental and applied research [33]. In the work ′Recherches cyto-génétiques des Nicotiana résistantes à la mosaïque′ from 1942, Ghimpu explained the genetic mechanisms of the formation of chromosomal aberrations in mitosis (Fig. 3) and, most frequently, in meiosis, the formation of univalents and the incorrect division of bivalents, which leads to the sterility of newly created tobacco hybrids [38].

The 20th-Century European Context: Background to Victor Ghimpu's Karyological Research

While Victor Ghimpu was working at the boundary between cell morphology and agronomy, cytology and genetics across the European continent were undergoing radical transformations, often shaped by different methodological schools. Trained at the Sorbonne, under Alexandre M.A. Guilliermond (1876-1945) and Pierre J-L. Dangeard (1895-1970), Ghimpu pivoted from pure morphology toward applied cytogenetics and hybridization, aligning with the French school's focus on functional cellular analysis. [42, 18, 22].

Furthermore, his intellectual framework was profoundly shaped by the German school of genetics, spearheaded by pioneering figures such as Theodor Boveri (1902), Carl Correns (1900, 1909), and later Otto Renner (1924) [20].

At the time, this tradition was characterized by its highly theoretical and fundamental approach. Crucially, the German school prioritized the developmental 'mechanics' and experimental cytogenetics. This dual focus drove groundbreaking investigations into caryon genetics, non-Mendelian maternal inheritance, and chromosomal dynamics during mitosis and meiosis - areas of inquiry that remained aggressively contested among contemporary biologists [24].

Ghimpu adopted the meticulous German approach to karyotype description, applying this rigorous methodology to the cytogenetic analysis of economically significant crops, most notably tobacco.

He began his teaching career in 1941, at the University of Odessa, and then in 1946 he was Professor, Dean (1949) and Rector (1949) to the Faculty of

Agronomy in Timişoara [48]. As a professor in Timişoara, he published the coursebook *Plant Protection* (1948, 1952, 872 pages), which was structured into three volumes: General Part (focusing extensively on cell pathology and chromosome aberrations), Phytopathology, and Entomology. This work served as a benchmark for both students and practitioners.

Victor Ghimpu published over 190 articles in journals such as *Buletinul tutunului (Tobacco Bulletin)*, *Viața agricolă (Agricultural Life)*, and *Pagini agrare și sociale (Agrarian ans Social Pages)*, alongside numerous brochures and scientific papers. Among the most notable are:

Agricultura pe câmpul internațional, Ed. PAS, București, 1925; (Agriculture in the international field) PAS Publishing House, Bucharets, 2025.

Progresul agriculturii, Ed. PAS, București, 1926 (Agriculture Progress, PAS Publishing Houes, Bucharest, 1926); *Cultura tutunului* (translation after Prianișnikov), Ed. PAS, București, 1927; (*Tobacco cultivation* (translation after Prianișnikov), PAS Publishing Houes, Bucharest, 1927).

Contribution à l'étude caryologique du genre Medicago, 1928 [30];

Contribuții à l'étude de satellites du genre Hordeum, 1928;

Recherches cytogénétiques sur les genres Hordeum, Accacia, Medicago, Vitis et Quercus, 1930 [36];

Satellites des chromosomes dans le règne végétal, Lyon, 1930; Gebeza solurilor [31];

Infinitul mic în patologia vegetală, 'Viața agricolă', nr. 5, București, 1935; *(Little Infinit in Vegetal Pathology), Bacteriozele plantelor cultivate și bacteriile fitopatogene*, Ed. PAS, București, 1935 (Bacterioses of the cultivated plants and phytopathogenous bactaria, PAS Publishing House, Bucharest, 1935) [32]; *Bolile soiei*, 'Viața agricolă', București, 1935 (Soyabean diseases, 'Agricultural Life, Bucharest, 1935) [34];

Seceta – cause, efecte,mijloace de combatere (Drought-causes, effects and means to combat [40];

Egiptul agricol vechi și modern, Ed. PAS, București, 1937 (Old and Modern Agricultural Egypt, PAS Publishing House, Bucharest, 1937;

Cultura tutunului în România, 'Monitorul Oficial', București, 1938 (*Tobacco cultivation in Romania*, Official Gazette", Bucharest, 1939;

Cultura tutunului în SUA, 'Monitorul Oficial', București, 1939 (Tobacco cultivation in the USA "Official Gazette", Buchrest, 1939 [39];

Bolile bacteriene ale plantelor, 'Buletinul cultivării și fermentării tutunului', nr. 1, București, 1939 (Bacterian diseases of the plants, "Tobacco Bulletin for Cultivation and Fermentation" no.1, Bucharest, 1939).

Despre insecta Trips Tabaci, 'Monitorul Oficial', București, 1939 (About Trips Tabaci insect, "Official Gazette", Bucharest 1939);

Încercări pentru prepararea, conservarea și întrebuințarea zemei bordeleze, 'Monitorul Oficial', București, 1939 (Trials for the preparations, preservation and use of Bordeau solution " Official Gazette", Bucharest, 1939);
Contribuții generale asupra fitopatologiei, Ed. PAS, București, 1939 (*General Contributions on Phytopathology*), PAS Publishing House, Bucharest, 1939) ;
Bolile și insectele dăunătoare tutunului, 'Monitorul Oficial', București, 1941(*Diseases and Harmful Insects of the Tobacco*, "Official Gazette", Bucharest, 1941);
Dușmanii noștri din totdeauna, insectele, 'Natura', nr. 11, 12, București, 1941 (Our eternal enemies Insects "Natura" no.11, 12, Bucharest, 1941);
Sur les recherches caryologiques des plantes, Cartea Românească Publishing House, Bucharest, 1941 [35];
Recherches cyto-génétiques des Nicotiana résistants à la mosaïque, 'Monitorul Oficial', București, 1942;
Sur les satellites chromosomiques, Cartea Românească Publishing House, Bucharest, 1943;
Impresii din America, 'Finanțe și industrie', București, 1946 (Impressions from america, "Finance and Industry", Bucharest, 1946);
Protecția plantelor. Îndrumări științifice și practice pentru cunoașterea și combaterea bolilor și insectelor dăunătoare plantelor cultivate, vol. I-III, Editura Centrului Studențesc, Timișoara, 1950 (*Plant Protection.Scientific and Practical Guidelines for Understanding and Combating the diseases and harmful insects of the cultivated plants*, Vol.I-III, Centrul Studențesc Publishing House, Timișoara, 1950).

All of his articles, books, and specialized literature collected over time—indexed by subject—as well as *The Great Agricultural Encyclopedia* (12 volumes, 1928–1943) and *The 20th Century Larousse* (6 volumes, 1928–1933), are housed in the library of the Departments of Genetics and Phytopathology. Additionally, the microscope slide room, which contains the histological and karyological collections prepared by Dr. Maria Neagu and Dr. Gallia Butnaru, preserves several original slides prepared by Victor Ghimpu.
Upon Victor Ghimpu's admission as a corresponding member of the *Romanian Academy of Sciences* (actually AOSR) on December 20, 1936, his status as a scientific authority was firmly established. This event marked the official recognition of his contributions to cytogenetics, validating his laboratory research and his commitment to applied science. He emphasized the paramount importance of cytogenetics and phytopathology laboratories, arguing that they should directly serve Romania's economic and agricultural interests rather than remaining isolated [16].

Victor Ghimpu's work was highly appreciated, earning him the following distinctions:

Member of the Romanian Academy of Sciences;
Member of the Romanian Society of Sciences;
Member of the General Association of Engineers in Romania;
Member of the Odessa Society of Natural Sciences;
Member of the Society for Plant Pathology of Paris.

Figure 4. 1945: The first professors of the newly established Faculty of Agronomy within the Polytechnic School of Timişoara [15].

From left: Prof. dr. Ioan Nanu, Prof. dr. Ioan Vasiliu, Prof. dr. Eugen Prutescu, Dr. Euge Epure, Dr. Gherasim Constantinescu, Dr. George Bujorean, Ing. Gheorghe Bungescu, Dr. Gheorghe Valuță, Dr. Irimie Staicu, Dr. Coriolan Drăgulescu, Dr. Victor Ghimpu, Dr. Alexei S. Potlog.

Conclusions

(1) Victor Ghimpu (1896–1952) was a renowned Romanian agronomist, karyologist, and phytopathologist, who spent a significant part of his university career in Timisoara. He is recognized as a pioneer in plant genetics and crop protection, with the following major contributions:
(2) In *Scientific Research* he is considered the first prominent Romanian karyologist, conducting fundamental studies on chromosome numbers in various plants, such as barley, grapevines, and tobacco.

(3) In *Plant Protection* he chaired the Department of Plant Protection starting in 1947 and was an internationally recognized expert in combating tobacco diseases and pests.
(4) The *Academic Career*: he was a professor at the Faculty of Agronomy in Timisoara from 1946 until 1952. In 1949, he briefly served as rector of the Agronomic Institute of Timisoara (now the "King Michael I" University of Life Sciences). Additionally, he served as Dean of the Faculty of Agriculture and Director of the Department. He was one of 12^{th} professors elected to organize, initiate, and develop educational activities at the newly established Faculty of Agriculture (1945) within the Polytechnic School of Timisoara (Figure 4).
(5) *Recognition*: He was a member of the Academy of Romanian Scientists (AOSR) and a member of prestigious scientific societies in Paris and Odessa. Today, his legacy is honoured through the ′Victor Ghimpu′ National Conference, hosted by the ′King Michael I′ University of Life Sciences in Timisoara (USVT) - an event dedicated to research in agricultural genetics.
(6)As a defining final conclusion, Acad. Radu Codreanu remarked to me in 1985 at the First National Congress of Science and Education of Romania: 'He was a great scientist and cultural figure'.

R E F E R E N C E S

[1] *** Academia Română Institutul Naţional De Cercetări Economice "Costin C. Kiriţescu.
[2] *** Publicistică Economică Românească − 1918-1947.
[3] *** Stevens N. M American biologist and geneticist. History. Britannica Editors, 2026.
[4] *** The Autonomous State Monopolies Administration of the Kingdom of Romania. 2010.
[5] *** The Centre for Economic Information and Documentation. 2024.
[6] *** The history of tobacco business in Romania: from Ciubuc to Superslim, from Phanariots to Smugglers, from Macedonski to Interagro. 31 July, DailyBusiness Editorial Team, pp. 15-16. 2024.
[7] *** The McClintock Prize for Plant Genetics and Genome Studies". Maizegdb.org. 2004.
[8] *** The Nobel Prize in Physiology or Medicine 1974. *nobelprize.org,* 2019
[9] Allen, G.E. ′Thomas Hunt Morgan. The Man and His Science. Princeton University Press. pp. 11–14, p. 24, pp. 46–51, 1978.
[10] Alt, W.K., Sauer P. Biologie an der Universität Bonn. Eine 200-jährige Ideengeschichte. In: Bonner Schriften zur Universitäts- und Wissenschaftsgeschichte. Band 8. V&R unipress, 2016.
[11] Berger, F. ′Emil Heitz′: a true epigenetics pioneer. Nature Reviews Molecular Cell Biology 20(10), pp. 12-16, 2019.
[12] Blackburn E., Epel E. The Telomere Effect: A revolutionary Approach to Living Younger, Healthier, Longer. Lifestyle Pub. pp. 99-105; 138; 307-310, 2017.

[13] Bloodgood, R.A. From central to rudimentary to primary: the history of an underappreciated organelle whose time has come. The primary cilium. Methods Cell Biol. 94, pp. 3-52, 2009.

[14] Bolkhovskki, Z.V., Grif, V.G., Zakharyeva, O.I., Matvejeva, T.C. Chromosome Numbers of Flowering Plants. Ed. Fedorov, An., Acad. Sci. USSR, V.I. Komarov Botanical Institute. Leningrad, pp. 307-310, 1969.

[15] Butnariu, H., Butnaru, G., Sărac, I. A Lived History. Agroprint Ed. p.19, 2015.

[16] Butnaru, G., 1985. Personal communication. Conversation at the First National Congress of Science and Education of Romania, 28 November 1985.

[17] Capocci, M., Santoro, M.G., Hightower, L.E. The life and times of Ferruccio Ritossa. Cell Stress and Chaperones. 19 (5), 599–604, 2014.

[18] Charle, C., Telkes, E. Les Professeurs de la Faculté des sciences de Paris. Dictionnaire biographique (1901-1939), Institut national de recherche pédagogique (Paris) et CNRS Éditions, collection Histoire biographique de l'Enseignement: 270, 1989.

[19] Crow, E.W., Crow J.F. 100 Years Ago: Walter Sutton and the Chromosome Theory of Heredity. Genetics 160 (1), 1–4, 2002.

[20] Darlington, C.D. ′Otto Renner′. 1883-1960. Biographical Memoirs of Fellows of the Royal Society, 7: 206–226, 1961.

[21] De Lange, T. Studies how telomeres protect chromosome ends from the DNA damage response and the role of telomeres in cancer. The Rockefeller University. 2018.

[22] Dhombres, J. Aventures scientifiques. Savants en Poitou-Charentes du XVIe au XXe siècle. Les éditions de l'Actualité Poitou-Charentes (Poitiers): 262 p., 1995.

[23] Dracea, I. Darwinism and genetics (course notes) 1954.

[24] Dubinin, N. P. ′Work of Soviet Biologists: Theoretical Genetics′. Science 105, pp. 109–112, 1947.

[25] Fedoroff, N V. Barbara McClintock, Biographical Memoirs V.68, Washington, DC: National Research Council/The National Academies Press, pp. 211–236, 1995.

[26] Fedoroff, N V. Barbara McClintock. 16 June 1902-2 September 1992. Biographical Memoirs of Fellows of the Royal Society. 40 (1), 1–10, 1994.

[27] Fisher, R. A., De Beer, G R. Thomas Hunt Morgan. 1866–1945. Obituary Notices of Fellows of the Royal Society. 5 (15), 451–466, 1947.

[28] Flemming, W. (1878). "Zur Kenntniss der Zelle und ihrer Theilungs-Erscheinungen" in Schriften des Naturwissenschaftlichen Vereins für Schleswig-Holstein. (Archived from the original) 3, pp. 23–27, 2018.

[29] Gherman, I. Cultura Sfeclei și Industria Zaharului In Romania. Scurt Istoric. Istoricul culturii sfeclei de zahăr şi a industriei zahărului în ţara noastră (Sugarbeet cultivation and Sugar Industry in Romania. History in Brief. History of Sugarbeet cultivation and Sugar Industry in our country)

[30] Ghimpu, V. Contribution à l'étude caryologique du genre Medicago. Compt. Rend. Acad.Sci. Paris 187 (4), 245-247, 1930.

[31] Ghimpu, V. Contribution à l'étude caryologique du genre Medicago. p. 12, 1928.

[32] Ghimpu, V. Fitopatogene", p. 165-174. year XXVI, no. 5, mai 1935

[33] Ghimpu, V. Recherches cyto-génétiques des Nicotiana résistantes à la mosaïque′. 1942.

[34] Ghimpu, V., "Bolile soiei (Soybean diseases)", p. 232-238. year XXVI, no. 6-7, June-July 1935

[35] Ghimpu, V., ”Cromozomii câtorva plante cultivate (Chromosomes of several cultivated plants)”, p. 412-417. year XXIV, no. 7, July 1933.

[36] Ghimpu, V., ”Cromozomii speciilor de lucernă (Chromosomes of the Lucerne species”, p. 475-481. year XXI, no. 19-20, 1-15 October 1930.

[37] Ghimpu, V., ”Geneza solurilor (Soil genesis)”, p. 72-78. year XXII, no. 3-4, 1-15 February 1931.

[38] Ghimpu, V., ”Infinitul mic în patologia vegetală: ultravirusurile (Little Infinite in the Vegetal Pathology; Ultra viruses)

[39] Ghimpu, V., ”Orzurile viitorului (The future barleys)”, p. 154-156. year XVII, no. 5, 1 Marche 1926

[40] Ghimpu, V., ”Seceta – cauze, efecte, mijloace de combatere (Drought- Causes, effects, means for combating)”, p. 3-13. year XXVII, no. 1, January 1936

[41] Gianfranco, V., Ravalli, C., Cremonini, R. The karyotype as a tool to identify plant species: Vicia species belonging to Vicia subgenus. Caryologia 61(3), 300-319, 2014.

[42] Guilliermond, A. The: Cytoplasm of the Plant Cell. Chap. I Historical Sketch - Difficulties in the Study of Cytoplasm. Recommended Method. A New Series of Plant Science Books. Ed. Frans Verdoorn. Volume VI Other cytoplasmic formations. 1941 Waltham, Mass., U.S.A. Publ. the Chronica Botanica Company; https://scispace.com pdf, pp. 1-5, 2025.

[43] Lejeune, J., Gautier, M., Lafourcade, J., Berger, R., Turpin, R. Partial deletion of the short arm of the 5 chromosome: the 5th case of crying cat syndrome. Ann Genet.7, pp. 7–10, 1964.

[44] Leyde, K.O. ′Strasburger′. In: Deutsches Geschlechterbuch Band 207 (56. Allgemeiner Band), C.A. Starke Verlag, Limburg, pp. 227–242, 1998.

[45] Lodish, H., Berk, A., Kaiser, C.A., Krieger, M., Bretscher, A., Ploegh, H., Amon, A., Martin, K.C. Molecular Cell Biology, 8th Edition. New York: W.H. Freeman-Macmillan Learning; Chapter 1, 7–9, 2016.

[46] Maderspacher, F. ′Theodor Boveri′ and the natural experiment. Current Biology. 18 (7), 279-286, 2008.

[47] Manchester, K.L. Overlooked Nobel laureates. Adler Museum Bull. 23 (2), 20–21, 1997.

[48] Marian, T. People who made history: Victor Ghimpu. Revista Lumea Satului, No.19, 1-15, 2007.

[49] McClintock, B. ′The Significance of Responses of the Genome to Challenge′. Science 226 (4676), 792–801, 1984.

[50] McClintock, B. The Significance of Responses of the Genome to Challenge. Science, 226 (4676), 792–801, 1984.

[51] Miller, I. The Power of Karyotype Analysis in Understanding Plant Chromosomes: A New Frontier in Genetic Research. MolecularCloud 22: 52:49, 2025.

[52] Morgan, H.T. – Biographical. NobelPrize.org. Nobel Prize Outreach, 2026.

[53] Moritz, K.B., Sauer, H W. Boveri's contributions to developmental biology - a challenge for today. Int. J. Dev. Biol. 40 (1): 27–47, 1996

[54] Mudra, A., ”Despre provocarea mutaţiunilor (About the Challenge of Mutations)”, p. 445-452. anul XXIV, no. 8, August 1933.

[55] Navaschin, M.S. 1930. Unbalanced somatic chromosomal variation in Crepis. University of California Publications in Agricultural Sciences. Vol. 6. Berkeley, Calif. University of California Press. pp. 95–106, 2010.

[56] Navaschin, S.G. Encyclopedia.com. March 8, 2026.

[57] Neagu, M. ASAS 1967-1975 Crearea unor forme de floarea soarelui cu talie redusă şi cu conţinut sporit de ulei (Creating sunflower shapes with reduced size and increased oil content). (Maria Neagu-Grant Manager)

[58] Neagu, M. Cap. Biometrics; From Selection and semiotechnics of agricultural plants. Editor: A.S. Potlog. Politehnic Institute Timisoara Publishing House. 1953.

[59] Nelson, S.R., Nelson, P.S. Walter Sutton's Chromosome Theory of Heredity: One Hundred Years Later. University of Kansas Medical Centre. Archived from the original. No. 24, 2008.

[60] Patel, N., Medina, R., Johnson, M., Goffinet, B. Karyotypic diversity and cryptic speciation. Bry. Div. Evo. 43 (1):150-163. 2021

[61] Pederson, T.A. Nascent interest amplified. Nat. Rev. Mol. Cell Biol. 24, pp. 453, 2023.

[62] Peștean, I.V. Volume, Great Romanian Agronomists. Pamfilus Publishing House, Iași, pp. 15–16, 2018.

[63] Pestean, V.I. Of Great Romanian Agronomists, 1800-2000. PIM Publishing House, Iasi, pp. 234-235, 2009.

[64] Rodionov, A.V. Changes in Genomes and Karyotypes during Speciation and Progressive Evolution of Plants. Russian Journal of Genetics, Vol 61(11):166-183. 2025.

[65] Saru, N. Contributions to the study of the problem of sugar beet varieties in Romania. Economic Information and Documentation Center. Bucharest, pp. 185-245, 2018.

[66] Saunders, L. Z. ′Virchow's Contributions to Veterinary Medicine: Celebrated Then, Forgotten Now′. Veterinary Pathology, 37 (3), 199–207, 2000.

[67] Săvulescu, T., Săvulescu, O. Bibliographie de travaux scientifiques parus en 1941-1944. BiologieVégétale. Bull. Sect. Sci. Acad. Roum. 24, pp. 30-37, 1941.

[68] Schatz, G., Max L. ′Birnstiel (1933–2014)′. Cell. 160 (1–2), 11–12, 2015.

[69] Van Robays, J. ′John Langdon Down′ (1828 - 1896). Facts Views Vis Obgyn 8, pp. 131–136, 2016.

[70] Volker, W. JMM-past and present. Chromosomes and cancer: Theodor Boveri's predictions 100 years later. J. Mol. Med. 80 (9), pp. 545–548, 2002.