NEW ECONOMY Section

150 YEARS OF ROMANIAN RESEARCH

Anda GHEORGHIU*

Abstract. *Internationally, Romania is rather less known for his achievements in the scientific field. Although it has memorable contributions to the advance of the global science, there are few persons who truly are aware of the great value of science accomplishments generated by Romanians. The motivation of this article lies in the desire to make known to the global academic community some of the most significant scientific discoveries of Romanians.*

Since ancient times, the Romanian principalities (Transylvania, Moldavia, Wallachia) tried to develop a system of knowledge in various fields, such as mathematics, astronomy, engineering mining, milling, medicine. But very few people were truly educated mostly priests, and royal functionaries. Schools of higher education – had existed in the Romanian principalities since the 16th century. The most dynamic and continuing were the "academies" set up in Bucharest (in 1689) and Iasi (in 1707). A program of modernization was adopted after the 1859 Union of the two Romanian Principalities, Wallachia and Moldavia. Universities, commercial, medical and technical schools were established. Many important intellectuals surprised the world with their scientific discoveries.

2016 marks the 150-th anniversary of the founding of the Romanian Academy and 150 years since King Carol I (Hohenzollern Sigmaringen) ascended to the throne of Romanian principalities. A king who had not only military, political and social achievements, but above all, a big role in the advancement of the Romanian culture, technology, infrastructure.

This paper is an attempt to present to the public some of the most important achievements of the Romanian scientist in the 150 years. It is homage to those people who dedicated their lives to the advancement of knowledge, to the world culture, to the evolution of the Romanian society.

Keywords: *science accomplishments, cultural personalities.*

1. Some important cultural personalities of the middle age period

Starting with the 17th century, some encyclopedic spirits arose, such as Nicolae Milescu, Constantin Cantacuzino, Dimitrie Cantemir.

* Faculty of Management, NUSPAS, Bucharest, Faculty of Economic Sciences, Hyperion University, Bucharest, anda.gheorghiu@facultateademanagement.ro

Nicolae Milescu (1636-1708) was a Moldavian author, ambassador and voyager. In 1675, he was named ambassador of the Russian Empire to Beijing, returning in 1678, having as main duty the establishment of permanent trade relations with China.

He wrote "Description of travel in China", a well-known travel journal, divided into three parts:

1) Journey across Siberia from Tobolsk to Nercinsk to the border fort China;

2) Nicolae Spătaru diplomatic mission in China;

3) Description of the first part of the Earth, called Asia, where there is the kingdom of China with all cities and its provinces.

Constantin Cantacuzino (1639-1716) was a nobleman renowned as an outstanding representative of humanism in the Romanian cultural space, focused on history and geography. He studied at the University of Padova. He made a map of Wallachia, together with Ion Comnen. Cantacuzino was the author of a history of Wallachia, in which he tried to fill the gap of knowledge about the early history of the Romanians.

Dimitrie Cantemir (1673-1723) was twice Prince of Moldavia and Counsellor of Tsar Peter the Great and also a prominent historian, writer, musicologist.

He was first elected member of the Romanian Academy in Berlin in 1714. In Cantemir's work, influenced by Renaissance humanism he approached the social-historical development of Moldova at the end of the seventeenth and early eighteenth centuries. His main works (except the fictional ones) are as follows:

- Universae logices institutionis Compendium (Latin);
- Monarchiarum Physica examination (Latin);
- Sistema Mohammedan religiae (Latin);
- The music science book (Kitab-i-Musik, Turkish.). Thanks to this late work, Cantemir went into musical history as the founder of the Turkish secular music.

Very few people know that the first person who has invented the first fountain pen with a barrel made from a large swan quill was a Romanian, Petrache Poenaru (1799-1875). At only 28 years old, he patents the first fountain pen in the world, first in Vienna and then to Paris in 1827. Its tool, with an ink tank, was a precursor of the modern fountain pen, because it not only eliminated the scratches on paper and ink unwanted leaks, but also ensured a steady flow of ink. His system to push the ink was mounted to the top of the pen, by slightly pressing the pipe, which later leads to the invention of the piston. Afterwards, Lewis Edson Waterman invented in

1884 a new model, by producing a safer flow of ink. Poenaru contributed to the advancement of science in Romania, and was a militant for the introduction of the decimal metric system in Wallachia.

2. Cultural personalities of the XIX century

In 19th century, Gheorghe Asachi and Gheorghe Lazăr fathered the national education system. In 1813, Gheorghe Asachi set up an engineering class in Romanian language, where he teaches architecture, art history, geodesy, mathematics. Between 1813 and 1849, Asachi was busy organizing schools in Moldova commissioned by the Metropolitan Veniamin Costache. On March 24, 1818, Gheorghe Lazăr began teaching in the School of mark off engineering and has developed several manuals that generated the scientific and technical vocabulary in Romanian language. After the abolition of the Phanariot ruling (1821), in the Romanian Principates began a period of Cultural Revolution, of European culture integration, mostly related to the French one.

In the second half of the 19th century, there was an undeniable industrial development in Romania, and consequently, the natural sciences and applied research started to evolve.

Two extraordinary political leaders influenced the evolution of education, culture and science in Romania-Prince A. I. Cuza and King Carol I.

Alexandru Ioan Cuza (1820-1873) was Prince of Moldavia, Prince of Wallachia, and later "Domnitor" (Ruler) of the Romanian Principalities. He introduced reforms for modernizing the society, establishing tuition-free, compulsory public education for primary schools. He founded the University of Iasi (1860), the University of Bucharest (1864) and many commercial schools.

Carol I (1839-1916), Prince Karl of Hohenzollern-Sigmaringen reigned for 48 years and had a great contribution for many achievements-Romania gained its independence, obtained international prestige, restored its economy and encouraged culture. At the start of his reign, Romania was just a reunion of two Ottoman provinces, which enjoyed a privileged regime. At death of King Carol I, Romania was a modern, strong, an important economic actor and political actor.

In 2016 Romania celebrates 150 years since King Carol started his glorious reign. Also, we celebrate the foundation of the Romanian Academy. It was founded on 1/13 April 1866. This institution was an encyclopedic society – activating in all domains of the arts, letters, and

sciences, with a great reputation, and empowered with the authority to proclaim academicians (so called "immortals"). As a result was attained one of the most important aims in the program of modernization adopted after the 1859 Union of the two Romanian Principalities, Wallachia and Moldavia, the core of present-day Romania. The excellence of an academician was one and the same with supreme intellectual prestige in modern Romanian society.

The members of the Academy (most of them graduates of Western Europe universities) encouraged scientific, cultural and social progress. They organized research centers in varied areas, trained young scholars and scientists that, later, became at their turn, famous for their achievements as scientists and as university professors; they published works of international significance; they set up and endowed museums and libraries; they proposed solutions to national problems regarding the financial system, technology, medicine or instruction.

On May 3, 1891, King Carol 1st established a university foundation, and a library with the same name. King Carol I donated to the so-called Royal Cultural Foundation “Prince Carol” 200,000 Romanian lei in rent, 5 percent. It was a very generous gesture of a constitutional monarchy with social and cultural openness. Made by French architect Gottereau, the University Foundation building in Bucharest was inaugurated on 14 March 1895. The library was then around 3,400 volumes. In 1911, started the construction of a new building, inaugurated on May 9, 1914. It became a memorable day, because then the old king held his last public speech. In the interwar period, Carol I Foundation has become a leading forum for the political and cultural elite. The second royal foundation, established in 1922 (“Prince Carol” Foundation) was the creation of King Carol II, the crown prince. This institution aimed to educate rural population through the establishment of cultural centres in rural areas and sending of so-called "cultural missions" to enlighten the villagers in all areas, from personal hygiene to national history.

3. 150 years of Romanian research in basic science

In what follows, we will make a foray into the evolution of Romanian science, ranking notable achievements in different scientific fields.

In physics, in the 20th century, many Romanian physicists became worldwide known for their discoveries.

In 1891, C. Miculescu performed an accurate determination of the mechanical equivalent of the calorie (1891) while D. Hurmuzescu revealed

five years later the ionizing effect of radiation X (1896). The team led by H. Hulubei started important research in the field of radioactive isotopes and their applications in geological exploration, in medicine etc. He has also obtained, for the first time in the world, the X-ray spectra of gases (he built a special spectrometer for this purpose). As the first director of the Atomic Physics Institute, Horia Hulubei had a decisive role in commissioning, for the first time in the country, a nuclear reactor (second from Eastern Europe) and a cyclotron – and later he organized scientific research based on these modern tools of study.

Nicholas-Karpen has invented the thermoelectric cell uniform, composed of two electrodes made from gold and platinum, a perpetuum mobile. At the outbreak of the I-st World War, he built the first wireless telegraph in Eastern Europe.

Other important physicists of the last century were: Alexandru Proca, who issued the first meson theory of nuclear forces and the equations of the vectorial mesonic field, Ştefan Procopiu, acknowledged for the first theory of the magnetic moment of the electron (the Bohr-Procopiu magneton), Theodor V. Ionescu – the inventor of a multiple-cavity magnetron in 1935, 3D imaging for cinema/television in 1924, quantum emission in hot plasmas and hot deuterium plasma beams for controlled nuclear fusion in 1969 and Ionel Solomon notorious for the nuclear magnetic resonance theory in solids.

As a curiosity, I mention that, in 1957, was put into operation CIFA – a computer of the Romanian Institute of Physics. It was the first computer made in Romania under the guidance of Victor Toma. Romania was the second country in the former socialist camp, which conducted a computer (after the USSR).

One domain in which Romanians excels is mathematics.

One of the first personalities that stands out in the Romanian culture is Spiru Haret (1851-1912), who was a mathematician, astronomer and educator of Armenian-Romanian origin; he was famous not only for achievements in mathematics, but also for organizing a modern education system in Romania, as a minister of education.

Some important contributions to the domain of mathematics were made by: N. Coculescu, founder of the Astronomical Observatory in Bucharest (celestial mechanics), A. Davidoglu (partial differential equations), Dumitru Pompeiu (partial differential equations, mechanics, Traian Lalescu (integral equations).

Octav Onicescu was Romanian mathematician, initiator of the Romanian school of probability theory. He introduced the concept of

"complete chain links", the most important Romanian contribution to probability theory. He and Gheorghe Mihoc were the originators of the Romanian school of mathematical probability theory and mathematical statistics. Gheorghe Mihoc was Dean of the Faculty of mathematics and physics; between 1963 and 1968, he became the rector of the University of Bucharest. He was the President of the Romanian Academy from 1980 until his death a year later.

After the Second World War, renowned scientists obtained significant results. Among them, there were: G. Moisil (multi-valued logics, partial differential equations), N. Popescu (category theory applications to rings and modules, and number theory, and Stefan Odobleja (considered as the father of cybernetics).

The International Mathematics Olympiad (IOM) is an annual mathematics competition involving pupils from different countries. First International Mathematics Olympiad was held in Romania in 1959, thanks to the efforts of the Mathematical Society from Romania, headed by Academician Nicolae-Victor Teodorescu. In fact, Romania has sheltered the International Olympiad of mathematics five times and also took first place among nations five times (1959, 1978, 1985, 1987, and 1996). Romania will shelter again this competition in 2018.

As a curiosity, a Romanian, Ciprian Manolescu, holds the sole distinction of writing three perfect papers at the International Mathematical Olympiad: Toronto, Canada (1995); Bombay, India (1996); Mar del Plata, Argentina (1997).

Petru Poni and C. I. Istrati, have founded the Romanian school of chemistry. Later, some chemists have had important contributions to the advancement of the industrial chemistry. Nicolae Teclu studied the combustion and realized a light bulb that bears his name. Costin D. Nenitescu developed an original synthesis of indole and headed the local school of the organic chemistry. Christopher I. Simionescu had contributions to the synthesis of macromolecular compounds (polyamide, polyester), developed macromolecular compounds coming from acetylene and derivatives with semi- and photoconductive properties, elaborated the theory of conduction in organic compounds. E. Mavcoschi conducted research on biological membrane permeability, formulated the bio-structural theory, by comparing it with molecular theories of living matter. L. Edeleanu was the first chemist to synthesize amphetamine and also invented the modern method of refining crude oil.

In biology, Dr. Victor Babes, was a promoter of Serotherapy and, along with V. Cornil, author of the first treaty of bacteriology in the world

(1885). Grigore Antipa is, for sure, the most popular biologist, because he totally renovated and installed in 1906 National Museum of Natural History, which is now named after him in his current abode in Bucharest. He was a naturalist, Darwinist biologist, zoologist, and ichthyologist, and ecologist, marine and Romanian professor. He studied the Danube and Black Sea, participating in 1893 in an expedition around this sea. The most significant results were obtained in hydrobiology, he is considered as a forerunner in this field, both in Romanian science and in the world. He has also invented the biological dioramas.

Ion Cantacuzino was a Romanian physician and microbiologist, founder of the Romanian school of experimental immunology and pathology. He conducted a broad research on vaccination and cholera, dysentery and active immunization against typhoid fever, scarlet fever etiology and pathology. Cantacuzino has developed a cholera vaccination method, called "Cantacuzino Method" used even nowadays. He has also introduced in Romania, in 1926, the BCG ("bacillus Calmette-Guerin") with attenuated virulence germs for prophylactic vaccination of newborns against tuberculosis.

D. Danielopolu was a scientist who tackled, among the first in the world, at the middle of the 20th century, a new concept – Biocybernetics. He has also made studies on the neuro-vegetative system, and is the author of classic studies on endemic goitre, rheumatism, angina chest and introduced new methods of treatment.

Probably, the most famous Romanian biologist was George Emil Palade, Nobel Laureate for Medicine in 1974 for contributions to understanding the structure and functional organization of the cell. He discovered and described the system ribosomes and functions of intracellular membranes.

4. 150 years of Romanian research in medicine

The Romanian medical school is renowned because of several world-renowned scientists:

Dr. Gheorghe Marinescu was a Romanian neurologist, professor at the Faculty of Medicine in Bucharest, member of the Romanian Academy, the founder of the Romanian School of Neurology. Marinescu was among the first doctors in the world who applied neuroscience histochemical and electrophysiological methods in scientific research. He had innovative contributions on phenomena like the nutrition reflex chromatolysis,

neuronophagy, retrograde degeneration of axons following section. In 1912, he was elected member of the Academy of Medicine in Paris.

Another celebrity of the Romanian Medicine also was represented by Dr. Constantin I. Parhon, one of the creators of endocrinology and author with M. Goldstein, of the first treaty of Endocrinology (1909). Marius Stefan Milcu (b. August 15, 1903, Craiova – d. December 1, 1997, Bucharest) was a doctor, biologist and anthropologist. He is the author of monographs related to the thymus or epiphysis. He was the organizer of the first program of protection for what was called "endemic goitre".

Ana Aslan was a great physician and one of the first women-doctors recognized internationally as a scientist, having big achievements in gerontology and geriatrics. The drugs she invented – Gerovital H3 and procaine Aslavital – are still used, with maximum results in the prevention and even treatment as combination therapy – in CA-disease senile dementia, Parkinson, Alzheimer. In 1952, she founded the Geriatric Institute of Bucharest, which was the first of its kind in the world and was recognized by the World Health Organization. She highlighted the importance of procaine in improving age-related dystrophic disorders, applying it widely in clinical geriatrics. Numerous international personalities were her patients; the list of VIPs interested in the 'Aslan therapy' is impressive since her 'portfolio' of famous patients comprises: I. B. Tito, Charles de Gaulle, N. Khrushchev, J. F. Kennedy, Indira Gandhi, Imelda Marcos, Marlene Dietrich, Konrad Adenauer, Charlie Chaplin, Kirk Douglas, Salvador Dali, Claudia Cardinale and many others.

5. 150 years of Romanian research in engineering

The engineer Anghel Saligny built the legendary bridge at Cernavoda between 1890 and 1895, then the longest bridge in Europe (3850 m) and the first silos made of reinforced concrete.

Aurel Vlaicu achieves important successes in aviation technology, being a pioneer of aviation, and also an engineer and inventor. In 1909 he built his first plane, Vlaicu I. In 1911 built a second plane, Vlaicu II, which, in 1912, won five awards at Aspern, Austria (one of the competitors was Roland Garros).

Traian Vuia was a Romanian inventor, pioneer of world aviation, who achieved, in 1906, the first lift from the ground of an airplane with the own means of the apparatus.

Henri Coanda designed and piloted, in 1910, the first jet aircraft with jet propulsion in the world. Thus, in October 1910, in Paris, he presented a fantastic airplane without propellers.

G. Constantinescu conducted one of the first reinforced concrete buildings in the country and since 1912 he created a new scientific branch – the Sonics.

Lazar Edeleanu develops, in 1908, the oil refining process with sulphur dioxide, subsequently introduced worldwide.

Hermann Julius Oberth is one of the fathers of Rocketry and astronautics. After receiving a patent for his rocket design, Oberth's first rocket was launched on May 7, 1931, near Berlin, Germany. Oberth became a mentor to a young assistant – Wernher von Braun. Together they worked in rocketry research for both Germany and the United States.

In the late 60s was developed the National Strategy of endowing the economy with computers (1967) and after getting the IRIS license with the help of the French President De Gaulle, in 1957, Romania became the eighth country in the world having a computer. After 1968 was set up an Institute of Computer Technology (ITC), a Computers Factory (Felix) and a factory for integrated circuits in Băneasa. Florin Talpes worked at the ITC, during the period 1983-1990, being a researcher in the laboratory of image processing. He recalls "Romania was at that time one of the best schools of mathematics in the world. There are few areas in which a country manages to build a strong worldwide brand. In mathematics, this brand was built in half century. (...) The spiritual father of computer science school was G. Moisil".

At the start of the second millennium, there was a boom in Romania in the number of computer programmers. Some examples of successful software include RAV (Romanian AntiVirus) which was bought in 2003 by Microsoft for use in their development of Windows Defender or BitDefender.

No wonder that, now, Romania is the third leading country (after India and China) among software exporters. The universities offer annually 3,500 graduates in IT. The outcome of the Romanian school of computing is that, at present, 14,000 IT companies operate at present in the country, and, in 2014, they generated cumulative revenues of 4 billion Euros and provide permanent jobs for 75,500 employees and also high incomes for 17,000 freelancers (“PFAs”). In fact, the IT industry is the largest generator of business and jobs in Romania.

6. 150 years of Romanian research in social sciences

Dionisie Pop Martian (born in 1829 Ponor, Alba – deceased July 2, 1865, Munich) was a statistician and economist, initiator of the protectionist economic school. He was the first director of the Central Office of Statistics of Romania and organized the first modern census in Romania (1860).

Alexandru Dimitrie Xenopol was an academician, historian, philosopher, economist, educator, sociologist and writer. He is the author of the first great synthesis of Romanian history, being a world-renowned philosopher of history. As a scientist, especially for his merits exceptional in the history since 1900, Xenopol became honorary member of the Society of Archaeology in Brussels, then received the same title of Academic Society in Chernivtsi in 1901, was elected member of the International Institute of Sociology (1903), respectively member of the Academy of Moral and Political Sciences in Paris (1914) and vice-president of the Society of Sociology in Paris (1916). During 1888-1893 Alexandru D. Xenopol printed in Iasi its fundamental work, History of Romanians in Dacia Traiana, with six volumes and totaling nearly 4,000 pages.

Nicolae Iorga was a historian, literary critic and documentarian, playwright, poet, memoirist, Prime Minister, professor and academician. It is known worldwide as mediaevalist, byzantinist, Slavicist, art historian and philosopher of history. As stated by George Călinescu, Iorga played in Romanian culture, in the first decades of the twentieth century, "the role of Voltaire".

Nicholas Georgescu-Roegen was a mathematician, statistician, educator and American economist of Romanian origin, the father of bio theory, a theory that presents a revolutionary way to see the economy

Costin Kirițescu was also an admired economist, who wrote works about inflation, currency, monetary problems in the 40's of the 20th century.

Virgil Madgearu was a Romanian economist, sociologist and leftist, prominent member and main theoretician of the Peasant Party. He wrote many papers, among the most famous are:

− *Zur industriellen Entwicklung Rumäniens* (1911) *(The industrial development of Romania);*

− *Notre collaboration technique avec la Société des Nations (Our technical collaboration with the League of Nations)* (1933)*;*

− *La politique extérieure de la Roumanie (The foreign policy of the Romania) 1927-1938* (1939).

Victor Slăvescu was an economist, politician, Finance Minister during 1934-1935, member of the Romanian Academy. Victor's Slăvescu bibliography compiled by Lucian Nastase comprises 512 titles of works, published and unpublished. The most important works are his courses: Object, method and doctrine in science businesses in 1927, Technical Banking – 1929, course on coin, credit, exchange – 1932.

Mihail Manoilescu was a publicist, economic and political thinker, politician from an old aristocratic family. Among other public offices that he held, Manoilescu was Minister of Foreign Affairs of Romania in the summer of 1940, the government Gigurtu. His economic thinking has aroused interest in South America. He died as a political detainee.

Among his studies, I mention:

− *Théorie du protectionisme et de l'echange international (Theory of protectionisme and international exchange) (Paris, 1929);*

− *Le siècle du corporatisme. Doctrine du corporatisme integral et pur (The century of corporatism. Doctrine of corporatism full and pure) (Editions "Payot", Paris, 1934);*

− *La situation économique de la Roumanie en 1929 (The economic situation of Romania in 1929) (1940).*

Anghel Rugină was an American economist of Romanian origin, honorary member of the Romanian Academy (1990). He wrote many studies, like:

− *Geldtypen und Geldordnungen. Fundamente für eine echte allgemeine Geld- und Wirtschaftstheorie (Types of money and money orders. Foundations for a genuine general monetary and economic theory)* (Stuttgart, Germania, 1949);

− *Capitalisme, Socialisme ou Liberalisme Social? Observations critique a Voccasion de la Conference Internationale des Sciences Economiques à Rome (Capitalism, socialism or Social liberalism? Critical observations of Vocation of the International Economics Conference in Rome)* (1956);

− *Principia Oeconomica: New and Old Foundations of Economic Analysis* (1986);

− *Principia Metodologica 1: A Bridge from Economics to all other Natural Sciences. Toward a Methodological Unification of all Sciences* (1989).

Mitiță Constantinescu was a Romanian economist and politician, Governor of the National Bank of Romania. He wrote many works, like: L'évolution de la propriété rurale et la réforme agraire en Roumanie (The evolution of rural property and land reform in Romania), National Culture

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Dimitrie Gusti was a sociologist, philosopher and ethicist, Professor at the Universities of Iasi and Bucharest, Minister of Education (1932-1933), member of the Romanian Academy in 1919 and then president of her (1944-1946), member of several academies, societies and institutes of sociology over borders. He was the founder of the sociological school (monographs) in Bucharest. He developed the monograph method, a method which involves simultaneous approach, multidisciplinary teaching of the subject and manifestations, using teams of specialists in social sciences, doctors, engineers, agronomists, teachers etc. Works: "Egoismus und Altruismus" (Egoism and altruism) (1904), "Die soziologischen Betrehungen in der neuen Ethik" (The sociological foundations of praying in the new ethics) (1908), "Sociologia militans", "La science de la realite sociale" (The science of social reality) (1941).

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