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OPINION

Where does radiology go?

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Where are radiology and medical imaging going in the world? In Europe? In France or in the United Kingdom or in Croatia? In Paris or in London or in Zagreb? In Quartier Latin or in Croydon or in Plitvice? Somewhere else? Why does a given contrast medium that was gold in the last Century become a devil in 2010 [1]? Why has whole body CT, which was a new symbol of non-invasive investigation in 1976, become a new kind of radiation weapon [2,3]? Why should the clinical use of MR imaging that was a luxury in 1980 still be

Docminet Scope

DocMinet died on the fifteenth of January 2010 because of a quickly evolving sarcoma of the gut. We gave him a chance when he had a transient stage of better feeling and we decided to get a diagnosis by CT scanning and biopsy at the Alfort veterinary school and clinic. But we refused to treat him by chemotherapy. After a few days of agony, he died at around noon spontaneously in my arms and I weeped a long time.
This is difficult to live without such a nice fellow. Since springtime is bringing newborn cats, we will go and buy a couple of Docminiminets when they no more need their mother's care. They should be castrated in the fall. By soon our carpets and our chairs will be devastated by their claws. They'll make us angry but, they'll bring live too in a period of the decade when melancholia is daily saddening our moods because of the crisis decreasing our way of life.
IntGence is going to become a kind of scientific journal I'm ready to edit under my unique reviewing. I'm fed up with the medical journals, whether they publish in English or in French languages. They accept to publish boring papers only. I may write unpolitcally correct papers but at least I like them! JFMA.

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strictly limited in Europe in 2010, even in neuroscientific protocols [4]? Why is the radiologist giving up the practice of ultrasound which brought such an exciting thrill in the 1970s [5,6]? Why is the recent disclosure of a Dutch manufacture producing Tc^{99} isotope hurting the immediate future of nuclear medicine [7]? How can our centennial radiology and mature medical imaging face the universal bankruptcy of the economic and financial paradigm based on ultra free market exchanges and solidarity social security programs which are supposed to control the health care expenditures? Shall they be ruined more than one century after irresistible expansion without any plateau or dip? Will the radiologists soon be bankrupted while last year they were the wealthiest of the whole medical world and they are practicing one of the most attractive specialties offered by universities to their best students and residents? Will artificial intelligence and robotics render the human radiologists and medical imagers on the list of unemployed people?

How do we understand where to go? Confucius, the venerable Chinese philosopher who lived in the 5th Century BC which was also that of Pericles and Hippocrates in Europe, and who is inspiring again a new wave of thinkers all over the world [8], answered: « *If you don't know where you're going to, let you know at least where you come from!* ». The memory of the contemporary adult, e.g. the 50-year-old generation, should not have forgotten where the current world is coming from: they were born and have lived during that era and they often themselves have contributed actively to its development. The socio-economical consequences of the second oil shock developed in the Western World while the new Republican President of the USA, Ronald Reagan, started his two 4-year-mandates in 1981. He declared and won the so-called "*Star War*" that led to the collapse of the Soviet Empire and liberated the Eastern-European populations from the iron curtain: thus the year 1989 marked the end of the second Millennium. Meanwhile the third Millennium was born slightly in advance with the new universal political paradigm termed "*Globalization of the economy*", including the booming Asian-Ocean Continent, in the hope of an era of peace and prosperity. However the Gulf War started soon after. Intensive brain-drain politics or spontaneous migration of freer individuals attracted many Europeans and Asians to America at a time when many Eastern Europeans and Africans moved to Western Europe, sometimes permanently. A technological gap arose with the computerization of audiovisual information, establishing the civilization of digital imaging; that was definitely opened by Vice-President Al Gore's "*information highways*" under Democrat Bill Clinton's presidency. The internet provided a new tool feeding a new entity termed the "*Global Village*", recently visited by Thomas L Friedman in his book "*The World is Flat*" [9]. In 1995, the world was almost peaceful and looked prosperous. However, in the 1980s, while the need for stricter economical controls of health care expenditure was invading the national technocracies of the Western World, populations all over the world were facing the eruption of new diseases, headed by AIDS, with the first cases reported in New York and in California in 1981 [10].

The aetiological diagnosis of the actual disease involving the world of radiologists and imagers, like that of other health bodies, is highlighted by such knowledge. But what about the prognosis? To be or not to be? That's an actual question. Nobody can seriously give a credible answer if he/she feels that the 20th Century had been a continuous golden paradise. Who is young enough to be ignorant of the awful periods in the past developing under the auspices of two world wars, killing not only soldiers but also tens of millions of civilians, severe economical depressions bumping capitalist and Marxist ideologies, terrible dictatorships following bloody national revolutions…? Is the period in which we are now living any different from that which our elders experienced during those long episodes? Nobody knows. Who can ignore the history of medical radiology and imaging compared with the respective histories of medicine, surgery and biology from their origins. The thinkers would be blind and sterile if they cannot argue their theses within a global approach of the political, social, economical and financial history of the whole world since the 18th century. On the contrary, with such knowledge, our futures might be directed towards either optimistic or pessimistic scenarios, enabling curative and/or preventive treatments, enabling us to save our discipline from many disastrous effects. *"Man is but a reed, the most feeble thing in nature, but he is a* thinking *reed"*, Blaise Pascal said.

The centennial anniversary in 1995 of the discovery of X-ray by Roentgen recalled the details of the tale. There are several recent books providing richly documented chronologies of events and inventions at the origin of the growth of radiology in diagnostic and therapeutic procedures throughout the 20th century [11,12,13]. However those authors present a patchwork with many gaps relating to national and chauvinistic side effects and impairments. Historical data has

increasingly been available on the websites of our plentiful national and international scientific societies of radiology and medical imaging; however, where the page exists, the content of pages is rarely exhaustive and sometimes lacks objectivity. Reviewing the contents of issues of major journals publishing articles in English since 1995 dedicated to the history of sciences and/or medicine, I could not detect any actual interest in the event that changed the medical practice at least as much as microbiology or biochemistry. Why is that? Does the historical research in radiology and medical imaging have to be undertaken by the radiologists and imagers themselves? The least I can say is that they are not claiming noisily to get that monopoly. A philosophical approach to the birth and early development of radiology remains at an embryonic stage with the first chapters of Gagliardi and McClennan's textbook only [14]. Otha Linton [15], a journalist, is the most active historian of radiology in the USA with monthly contributions to *Academic Radiology* and *Journal of the American College of Radiology* where he features the American "*giants*". In France, Henri Nahum and Philippe Devred concelebrated in 2009 the centennial of the *Société Française de Radiologie* with an impressive poster exhibition and several papers in the *Journal de Radiologie*, but they by-passed the last two decades of the last century. There are no scientific sessions dedicated to the history of radiology and medical imaging in the scientific programs of the major congresses of radiology, including the so-called RSNA and ECR meetings. Except in the UK, where the *Radiology History and Heritage Charitable Trust* was transformed into the *British Society for History of Radiology* in 2006 [16], there is no Society of the History of Radiology and Medical Imaging, either at international or national levels. Antoinette Béclère who founded the *Centre Antoine Béclère* of Paris [17], had expected that the *International Society of Radiology* would achieve this goal using her generous donation made after she met with Professor Dr. Walter Fuchs at ICR'73 in Madrid. A few museums are dedicated to radiology besides those of Würzburg and of Brussels [18,19]. There is a virtual *Radiology Museum* on the American *Radiolopolis* website [20].

From where does medical radiology come? Wilhelm Conrad Roentgen originated a paradigm that is unique in the history of sciences. A single man who was a sober physicist discovered a new "*invisible light*", so called Roentgen Rays or *X-rays*, and evidenced it by photographic procedures. Meanwhile he invented *medical radiology* with the exhibition of the skeleton of his wife's hand. On an educational viewpoint, this is a fabulous example of serendipitous phenomenon evidencing the validity of Pasteur's statement: "*Chance smiles on well-prepared brains*". Wilhelm C Roentgen and his immediate followers had to be expert in three associated technologies - photography, physics and medicine - to obtain a picture of an anatomical volume irradiated by an X-ray beam which had been produced by a glass Crookes tube excited by a power battery. There are useful lessons to be extracted from that history. Roentgen's character was that of a pure scientist, able to invent a new science and a new art on only an academic salary, virtually in his own home. He refused to patent the X-rays in his name or make lucrative joint ventures with commercial companies. He expressed some reluctance to travel to Stockholm to receive the first Nobel Prize ever in physics in 1901. Thus the extemporaneous boom of the radiological industry and business developed without any preliminary constraints superimposed by the principal founder. Phillipp Lenart might have argued on the scientific side against Roentgen's godfathership, but there were no serious controversies between pioneers in radiology like this. Indeed, many inventions such as cinematography and telephone occurred during that productive decade of industrial applications of fundamental scientific discoveries. Roentgen's story is a perfect example of the ethics of our modern concern about *"conflicts of interest"*. The interval between the day of the discovery and the first trials demonstrating the medical interest in radiography was a few weeks. This parameter has to be compared with the scientific discovery of genetics by Gregor Mendel, an isolated monk living in a Czech monastery, which was recognized almost forty years after the publication of his preliminary results in 1865. Last but not least, the first International Congress of Radiology, held in 1900 in Paris under Antoine Béclère's invitation, gave the world the official words still used to-day, *radiology* as a science, *radiographer* as a profession [21].

The year 1895 was rich in innovation, including cinematography (Lumière Brothers), wireless telegraphy (Marconi and Popov), pneumatics (Michelin), ferromagnetism (Pierre Curie), psychoanalysis (Freud), topology (Poincaré), sociology (Durkheim). According to the Ukrainian economist Nikolai Kondratieff (1892-1938), 1895 was also the start of a new 40-60-year-macroeconomic cycle while a severe international economic crisis was developing [22]. His theory is still used by experts to predict waves of prosperity and waves of wars and severe socio-economical troubles, such as the 1929 stock market crisis and the oil shocks. Because radiology

has become a science, an art, an industry and a business, was its centennial growth accelerated or hampered by terrible events? To study the scientific hypothesis of one or several relationships between such cycles or waves and major innovations in radiology and medical imaging reported by radiology's historian authors [11,12,13,21] is interesting because of the similarity between 1929 and 2009 tragedies leading to the collapse of the world economy. Coolidge's X-ray tube was imported in Europe during World War 1. The invention of the first organic iodinated water-soluble contrast medium by Rath and its first application to intravenous pyelography by Swick and von Lichtenberg, in Berlin, Germany, is dated 1928-1929, i.e. during the worst inflationary crisis of the D-Mark in German history. The invention of radiotomography by the Italian Vallebona is almost contemporary. Nuclear medicine developed in 1945 at the Lawrence Laboratory at UC Berkeley because of the need for civilian programs after the atomic bombing of Japan which ended World War 2. Medical ultrasound resulted from a technological transfer from British military submarine research. Hounsfield presented his cranial CT scanner at the XIIth International Congress of Radiology held in the second week of October 1973 in Madrid, Spain; metrizamide, the first non-ionic molecule, was introduced there by Almén as well, both without immediate welcome; these events occurred just when the Yom Kippur war was starting simultaneously in October 1973, followed by the first oil shock. Then BJ McNeil, biophysicist at Harvard University, started her work on cost-effectiveness of diagnostic procedures, published in 1975 [23,24]. MRI and PET respectively coincided with the Iran-Iraq war oil shocks and the Gulf war. While some American radiologists [25,26] are readily applying to their discipline the concept of *disruptive innovation* by Clayton Christensen [27], an economist of the Harvard Business School, European radiologists are still far from creating effective multidisciplinary research in their economic history. Few are as actually skilled in translational radiology as the American radiologist Elias Zehrouni, who is the editor-in-chief of the new journal *Science Translational Medicine* [28], after the years he spent as the director of the *National Institutes of Health* [29].

The historical study of the impact of the economic and/or financial cycles or events is important, not only because of their quantitative and qualitative impacts on the cost of equipment but also of services to patients. The future of human resources working in radiology and medical imaging are highly dependant on a clear understanding of economics [30]. Will our radiologists soon be the first victims of budgeting restrictions, of industrial collapses, of social security program bankruptcies? Would we be ready to join the membership of bare-foot physicians working with portable ultrasound and basic radiography? There are more and more indices demonstrating that radiology and medical imaging are not popular although the public is impressed by the continuous improvement of the technology. The regular press is rich in papers dealing with the lack of MR equipment or with the opening of new units with the most recent apparati. But more and more patients complain because they have no physical connection with their absent radiologists who can easily escape from the ward to the anonymous computed global village. Moreover they are perceived to be wealthy, which is not a fault in itself, but they should not forget that vanity feeds contempt, and jealousy generates hostility. The lack of characters featuring radiologists in the scenarios of the contemporary movies and series is a negative symptom as well; they aren't even "second zombies" manipulating images; producers and directors prefer to show medical images on a videoscreen or viewbox: they don't need to feature an attractive professionally qualified radiologist, such as George Clooney, who is not ready to shut down at the box-office replacing a water soluble coffee by a non-ionic iodinated soup. Humans live in a communicating world where lobbies and lobbying play vital roles to the success or failure of projects, whether they are offensive or defensive. It is unlikely that the radiological lobby, even by injecting big money in media campaigns, can obtain the support of a given general population, while politicians and technocrats are more sensitive to general opinion than to the mood of spoiled corporate representatives.

How do we avoid the depressing scenario by somebody who defines a pessimist as an optimist who has survived? To promote high quality examinations is not a recent argument; one of the greatest names in radiology, the Suede Ole Olsson, wrote in 1990 some lines whose content should not become obsolete [31]: *"In a technical and technological specialty such as diagnostic radiology, there is a risk that all interest will be concentrated on the equipment and performances, and that the patients will be neglected or forgotten. This must never happen. The radiologist and other staff must have the patient at the center of their attention at every moment. Although it is understood that the film, being a translation of the patient, necessarily attracts great interest, this does not excuse paying too little attention to the patient."* Radiologists have to construct a new behaviour, promoting a direct and

mutual dialogue with the patient. Professor Guy Ledoux-Lebard used to say that the radiologist was diagnostically more successful than the referring physician because he/she had time to discuss with the patient in the darkroom; that was at the time of the barium sulphate. The pioneers in ultrasonography had that privilege too, but it seems that this has become a handicap for the younger generations of radiologists, at least in the USA [5,6]. Clinical discussion with the patient should be a prerequisite of any radiological consultation. Even this may not be sufficient in a modern educated society that is nowadays encouraged to complain and/or question treatments and techniques. There is no reason to doubt the quality of the education of the residents in radiology, and of the CME of the imaging practitioners, but their attitude towards patients is in question. In fact radiologists are often seen to be delegating the responsibility of technical aspects to their radiographers without regard to their charisma. I'm amazed by the daily broadcasts on radio and TV of negative comments expressed by women who were submitted for mammography without any medical contact. The feminist speech is full of this kind of criticism.

Have modern radiologists and medical imagers become unable to speak with their patients because they actually have nothing to say? Nothing valuable to say from a medical point of view or even a social one? Because I'm an old radiologist who is experiencing (most often anonymously) personal care from many radiological institutions, I'm afraid I have to answer: *"Yes, indeed!"* During these visits I meet and talk with many patients who complain of the lack of dialogue with a doctor and/or of human welcome. Contemporary doctors in general, as well as modern radiologists in particular, have weakened or lost the humanist values inherited from older clinicians. Do they evoke the ethics hypocritically because they prefer theoretical discussions in confidential auditoria rather than face to face dialogues with patients in the clinical area? Do they become silent because they are afraid of medicolegal issues? Do they hide from the patient's anxiety or aggression? Are they wary of Freudian transference? If those statements are true, then the current increasing socioeconomic trouble will not improve the radiological reputation, at least in the populations of the Western world [32]. On 2 March 2010 the *American College of Radiology* announced its new newsletter *"The Scan": "We are excited about our new free Member benefit* "The Scan," *a patient-centered newsletter to display in your offices and waiting rooms — and judging by the response, so are you! The breezy and informative quarterly newsletter helps you better connect with your patients and highlights the vital role that you serve in providing quality patient care. Personalize it with your own contact information to make it even more relevant. Our newsletter publisher has created a special, low-cost service that makes customizing* "The Scan" *effortless."*

The French writer André Malraux stated that the 21st century has no future if it bans spirituality. Is it logical to associate economy and spirituality in the mind of the radiologists and medical imagers? Descartes and Spinoza at their rescue to improve their capacity to win a contest where they risk losing their prestige if any when their incomes drop or their employments are cancelled? My answer is ***"Yes for sure, this is possible provided that this corporation accepts the increasing importance of cultural topics."*** One of the strongest pillars of radiological principles rests on its fabulous history, not long enough to be boring or sterile when it is told, not too short to avoid mistakes induced by a lack of experience either. But, the "*building*" which does not exist in Europe yet, has to be constructed in a dedicated supranational institution federating the national groups where they exist already or stimulating their creation where they do not. I support the idea of an *Academy of Sciences and Technologies of Medical Imaging* because the creation of a radiological section in the *Academies of Sciences* is a lost cause[1]. Latin and French were the official diplomatic and academic languages in the Ancient World. Nowadays the English language plays that role and the success that European scientific societies like the *European Society of Radiology* is achieving testifies to its need. To speak and write English fluently does not inhibit the major vernacular languages, such as German, Italian, Spanish, Russian and French in Europe because a polyglot always owns a richer intellectual and social capital. Such an academy would exist to edit journals, create and host websites, and facilitate meetings and ventures in which multidisciplinary panels can congregate to cover specific topics, etc. in order to fill the cultural space which has opened between the clinical sciences of life and the fundamental research and their technological applications. This project of a European Academy would not replace the *European Society of Radiology*, or compete with the *International Society of Radiology*, the *RSNA*, the *ARRS*, *et*

1 A preliminary discussion on a project of *Académie Francophone des Sciences et Technologies de l'Imagerie* y or so started in 2009.

al. The radiologists and medical imagers have to demonstrate intellect *and* heart, and that they should not be regarded as among the richest classes of *parvenus*. That is possible through the spirit of their historical heritage.

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