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Thirty years take MRI from the cutting edge to sustainability

Peter A. Rinck

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Thirty years ago, I counted 12 MRI machines worldwide. Once the total had passed 25,000, I gave up counting. Yet I wonder how many MRI systems will be in operation in 30 years time? The highest field strength for human MRI applications 30 years ago was 0.15T. Today it is 7T. And 30 years from now? We will see (or perhaps not).

The development of MRI has been accompanied by paradigm shifts, changes in basic assumptions regarding conventional wisdom. Back in the 1980s, physicists declared that it would be impossible for MRI to compete with the rapid imaging times of CT because of physical and chemical restrictions imposed by T1 and T2 relaxation times. They also claimed that it would be impossible to image the human body with a field strength higher than 0.3T. As we know today, both scientific statements were wrong.

"Clinical MRI is based on subjective perceptions, as are all diagnostic imaging techniques."

For most of my scientific and medical life, from the very beginning of MRI, I subscribed to the view that MRI should be promoted. I always believed MRI to be a clean and clear science, but it is not. Clinical MRI is based on subjective perceptions, as are all diagnostic imaging techniques.

Medicine can be found in the middle ground between art and science. Diagnostic imaging is one of the pillars of modern medicine, but in spite of all the numbers and equations, the clinical part is as much an art as it is a science.

Although accomplished radiologists check numbers and curves, they also trust their eyes and rely on their visual perception, their memory, and their cognitive processes. Medical imaging, and thus MRI, is not just about what is in the pictures, and neither is it simply pattern recognition. A good medical image reader has an excellent training plus a certain innate, intuitive ability to spot minute inconsistencies on an image and understand the medicine behind them.

Scientists involved in MRI, mostly chemists and physicists, always looked down on the physicians, the radiologists. I could understand this attitude. They had developed a technology that the average radiologist would never grasp, let alone develop. Thirty years ago, I was the only physician at Paul Lauterbur's laboratory for the duration of my stay; one young radiologist among chemists and computer scientists.

Chemists and physicists in Europe and the U.S. conducted the science part of the MRI business (until companies' marketing and financial people took over) and made decisions on how the technology would develop. This ultimately, though unintentionally, had a negative impact on the technology. The enduser with sole responsibility for patient outcome is, of course, the radiologist.

MRI is a stable technology; 6% of all imaging studies performed in developed countries involve MRI and 10% involve CT. The most popular systems operate at 1.5T, and in the U.S., these units account for approximately 75% of all clinical MRI installations. Few significant technical changes are expected in the near future. Price pressure has resulted in the cost of MRI equipment remaining static or falling, and the introduction of 1.5T systems with fewer bells and whistles. A brand new, state-of-the-art 1.5T MRI machine can be bought for €600,000 or less.

Profit margins on imaging equipment sales are typically low. Manufacturers aim instead to increase revenues through service and maintenance, though this is more difficult in developing markets. The more basic the equipment, the more feasible it becomes for the hospital's medical physics groups or technical staff to service the machines locally.

The highest field strength available for routine clinical imaging is 3T. Sales of high-field systems have, however, been slow, and U.S. hospitals appear to be retreating from 3T in favor of cheaper 1.5T equipment. Some issues relating to 3T MRI, such as energy deposition and dielectric uniformity, have been improved, but other problems remain. The systems are noisy, expensive to service, and can exacerbate imaging artifacts. In addition, there is no proof that imaging at 3T is diagnostically superior to imaging at 1.5T (or lower field strengths). I have yet to find a single scientific paper of substance proving that the diagnostic outcome of patient examinations at 3T is better than at 1.5T.

Three-T was announced as the solution to clinical MRI, but it is not. Instead, it has added another problem to the healthcare system. The “feel good” factor, where one has done everything technically and financially possible, is higher, but this is still not sufficient. What will happen with the recently introduced 7T machines remains to be seen.

Looking to the future we see the following factors that will influence the sustainability of MR Imaging:

- genuinely proven impact of existing MR techniques and indications;
- rejection of inappropriate and pointless examinations;
- genuinely proven impact of newly developed techniques;
- collapse of the MR market in the rich/"developed" countries;
- lower reimbursement;
- "loose money” (high payments by certain patient groups or insurance companies);
- simpler (lower field) MRI equipment;
- the rise of other "basic" imaging and diagnostic techniques (plain x-ray, ultrasound, blood tests);
- lack of training / users’ lack of understanding of the fundamentals of MRI;
- developers’ failure to understand the necessities of the health system and medicine;
- reduced use of contrast agents;
- reduced interest in MRI (it’s not fashionable any more).

Market Forces

A considerable amount of money has been pumped into diagnostic imaging during the past 25 to 30 years, tax money, insurance money, investors' money. The U.S. Government Accountability Office reported in 2008 that high-tech imaging had grown rapidly from 2000 onwards. The office blamed referring physicians' use of MRI, CT, and PET for a doubling of Medicare's imaging-related costs to $14 billion from 2000 to 2006. The availability of MRI more than tripled between 2000 and 2005, with the number of machines per million people growing from 7.6 to 26.6.

The growth in MRI hardware sales has stagnated over the past few years in countries where the modality has become an established part of medical diagnostics. MRI sales have decreased by 30% to 40%, as have sales of CT systems and nuclear medicine equipment. The oversaturated North American market has been worst hit. Sales of MRI units are still on the increase in some emerging markets, including Eastern Europe, Latin America, and Asia.

New players, such as China and India, are expected to drive demand for diagnostic imaging solutions and, to some extent, the direction of technological development. Both countries offer huge internal sales territories, particularly China. Most parts of China and India are extremely poor and have inadequately developed healthcare systems, making low-cost, high-volume imaging solutions essential. These cheaper machines will rapidly spill over into the Western markets.

Mainstream modality manufacturers increasingly have to decide whether new ideas have any clinical and commercial relevance. R&D work will focus more on clinical relevance, in terms of both applications and patient outcomes, than on new pulse sequences, new coils, and new technical functions.

A huge number of imaging examinations are nonessential and it is futile for patients to have these scans. In the U.S., the number of pointless procedures is, fortunately, falling now. From 2010, MRI reimbursement is lower, which could further affect the number of MRI examinations performed. The price for an MRI examination has already fallen in some European countries, too.

Japanese health authorities pay several times less for MRI than U.S. insurers do. MRI is, nonetheless, widespread in Japan owing to the availability of low-cost MR equipment specifically geared for that market. Cheaper technology operating at lower field strengths could be introduced in the U.S. if healthcare reforms force vendors to make that decision. If this happens, the European market will doubtless follow suit.

Manufacturers are, first and foremost, interested in money. This is their *raison d'être*, the purpose that justifies their existence. There is nothing wrong with this goal, though the motivation to make money has shaped radiologists' arsenal. It was not in manufacturers' interest to develop a handful of general-purpose systems. Competition between different company departments has brought us the clinical 3T MRI equipment and 128-slice CT scanners. We now have a plethora of diagnostic imaging equipment for rich nerds.

MRI is an extremely sophisticated technology, and as such, it is perfect for extracting even subtle diagnoses. CT is cruder, but mentally a lot easier to comprehend. Both modalities will be challenged and overtaken by different technologies from unexpected directions: digital radiography, ultrasound, and *in vitro* laboratory tests.

Aging Population

Healthcare resources are being stretched by the growing proportion of elderly inhabitants in many countries, and no government can afford to support everything. Social security funding is being reduced, owing to reductions in the workforce, and services are facing cutbacks. Governments and/or reimbursement agencies will be unable to fund existing standards of care in the future. Rationing already exists and will increase. Diagnostic imaging services will continue to undergo major changes as we address the rapidly increasing healthcare demands of these aging societies. The escalating chronic disease burden will have to be managed more efficiently. Efficiency and cost-effectiveness will become the key drivers of change, where as reimbursement will increasingly be linked to patient outcomes.

The number of CT, MRI, and nuclear medicine procedures performed will plateau or perhaps even decline. Patients will be managed at home, avoiding hospital admissions, using ultrasound and portable digital radiography. Diagnosis and follow-up will increasingly rely on in vitro diagnostics, building on advances in metabonomics.

Low-Technology Future?

Further technological development is not the be-all and end-all of MRI. Circumstances, politics, manufacturers' decisions, and financial considerations can all change – and will change – MRI, radiology, and medicine.

There are not enough well-trained radiologists and radiographers to operate our increasingly sophisticated MRI systems. Why should we waste time considering the future of MRI if there is no one to run the machines and no one who understands the technology? Without an increase in training, all bright new ideas are useless. A country's health system cannot afford medical disciplines and techniques that are not based on solid human foundations. Teleradiology and computer-assisted diagnosis are merely stopgap solutions. To put it another way, if there are no doctors left who know their craft, then the craft will die. Without the human factor you will have too many mistakes. Technically doable is not necessarily feasible.

"Further technological development is not the be-all and end-all of MRI. Technically doable is not necessarily feasible."

At the RSNA 2009 meeting, congress president Dr. Gary J. Becker openly, and quite distinctly, called for an end to a culture of preventable medical error and waste, and demanded an improvement in the quality of medical imaging.

My prediction is that 10 years from now we will have a mass market of simplified MRI systems. I have always wanted a low- or medium-field MRI machine, something that is small and attractive, reasonably priced, easy to service and maintain, and simple to use. In other words, a diagnostic imaging machine that any trained physician could operate safely and reliably.

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Airport security scanners arouse intense controversy

Peter A. Rinck

PRO ACADEMIA EMRF THE ROUND TABLE FOUNDATION

An entire industry has grown up around airport security, aimed at the estimated two billion passengers taking flights every year. This industry grows explosively. Security already accounts for 35% of the operating costs at European airports, compared with just 8% in 2001. More than 40% of airport employees now are security- related staff. It is a multibillion-euro business, a self-propelled, surefire success [1].

The latest addition is digital whole-body imaging of passengers, and this has been introduced at a number of European and American airports. Three different kinds of scanners are being used, all of which virtually strip-search the subject being imaged:

- active terahertz scanners,
- passive terahertz scanners,
- x-ray scanners.

Both terahertz-wave and x-ray scanners use backscatter techniques. Backscatter is the part of radiation or waves that has a scattering angle higher than 90°. It is scattered backward, as the name suggests, away from the irradiated object.

Terahertz (tHz) radiation is also known as submillimeter radiation or t-rays. The region of the electromagnetic spectrum from 0.1 to 10 tHz is a frontier area for research in physics, chemistry, biology, materials science, and medicine. Terahertz radiation lies in the frequency gap between infrared and microwave radiation and, unlike x-rays, it is nonionizing. What makes these waves so fascinating to scientists is their ability to penetrate materials that are usually opaque to both visible and infrared radiation [2].

The biological effects of terahertz radiation are largely unknown. This form of radiation is not believed to harm DNA or tissues, though this claim has been questioned [3]. In the field of radiation protection, no exposure is considered "justified" unless it produces a positive net benefit [4,5]. As such, the responsible authorities should insist on proper research into the possible biological effects of terahertz radiation. Until that work is done, active terahertz scanners should not be used on humans.

The second class of scanners also uses terahertz radiation, but unlike the active scanners they work in a passive mode and do not emit any radiation. These machines receive natural radiation that emanates from the subject being examined. The concept is similar to medical thermography (in other words, imagination might help). Don't expect to see much.

The third technique, x-ray backscatter scanning, seems to be the most efficient virtual search technique. A pencil-shaped x-ray beam is used to determine the spatial resolution of the final image and backscattered Compton photons are turned into images by large detectors. The machines on the market operate between 50 kVp and 125 kVp, with 1 to 1.5 mm of aluminum filtration [6,7]. Around 25 kVp is sufficient for x-ray mammography.

Standards governing x-ray scanners for security applications are different from those for medical applications. Radiation protection requirements are not as strict as those for diagnostic or therapeutic medical devices.

Radiation protection requirements for airport security purposes are not as strict as those for diagnostic or therapeutic medical devices.

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x-Rays that bounce back – or not?

The new scanners had to be sold to the public as absolutely harmless. "The x-rays do not penetrate the body but bounce off the skin," according to Johns Hopkins physicist Mahadevappa Mahesh, writing in the British Medical Journal [8]. Similar statements could be found in numerous newspaper articles, and even on the website of the American College of Radiology [9].

When the x-ray backscatter devices initially appeared, the message from proponents was that the x-rays would penetrate passengers' clothing, hit the skin, then fly back to the detector, a kind of biological reflection. Hidden guns, explosives, and liquids would be revealed on the x-rays' return journey. The equipment would expose individuals to a negligible x-ray dose and a "miniscule" increase in risk of cancer, according to manufacturers and government agencies.

The x-rays bounce back just as some raindrops bounce back from the surface of the ocean: some do, some don't. White lies remain lies. The question is: Who is accountable for these deliberately incorrect statements and why are they made?

Why these x-rays should be stopped or reflected by the surface of the skin remains an open question. We all know that x-rays penetrate the skin. Even at low doses they can travel through the entire body quite easily, for instance, in the case of infants and children. If you look at x-ray backscatter images, you will see some bones, air-filled spaces, and perhaps breast implants, all of which are behind the skin.

Leon Kaufman, one of the leading medical physicists in the development of clinical MRI equipment in the 1980s, published a short comment on these devices and the way that tens of millions of air passengers will be forced to undergo examinations. He asks whether airport body x-ray scanners are a great public health experiment.

"Contrary to every policy enacted since the effects of radiation were understood, we are engaging in a mass experiment of irradiation of not just adults, but also pregnant women, fetuses, children, women of childbearing age, men who may conceive after exposure – in short, everyone unfortunate enough to have to be in an airport. The results will not be known for 20 years," Kaufman wrote [10]. "Imagine if, as an investigator at [University of California, San Francisco], I had asked my [institutional review board] to allow me to carry out an experiment involving indiscriminate exposure to x-rays of a randomly selected population with no informed consent."

In addition to the x-ray luggage inspection machines that expose passengers and personnel to ionizing radiation [11], there is now an additional source of ionizing radiation at airports.

The U.S. Food and Drug Administration (FDA) does not oppose the detectors. Yet they do seem concerned about radiation doses from medical imaging, having announced their intention to develop and disseminate "patient medical imaging history cards" that will keep track of a patient's accumulated radiation dose.

"The amount of radiation Americans are exposed to from medical imaging has dramatically increased over the past 20 years," said Jeffrey Shuren, M.D., J.D., director of the FDA's Center for Devices and Radiological Health. "The goal of the FDA's initiative is to support the benefits associated with medical imaging while minimizing the risks." [12]

The risk of cancer from a single backscatter check is admittedly low. The cumulative risk of repeated exposure to radiation may, however, be a public health threat, in particular for people working in the airline industry and frequent travelers. The risk of a terrorist attack seems far lower. Even those in favor of checking air passengers with ionizing radiation concede that you are more likely to die from their controls than from a terrorist act.

Manufacturers of this new scanning equipment appear to be aware of the potential problems and have been shifting responsibility upwards. As one vendor has observed: "It should be noted here that this is a risk imposed on members of the public by government and that those who are at risk may not be those who benefit." [13]

A vendor statement:
"It should be noted here that this is a risk imposed on members of the public by government and that those who are at risk may not be those who benefit."

The manufacturers also concede that the radiation penetrates the human body and is not bounced off: "While surely there are misunderstandings as to how x-ray backscatter personnel scanners function, it is true that these scanners utilize ionizing radiation, and that the x-rays emitted from them penetrate skin, as well as clothing." [14]

I foresee class actions. We will see collective lawsuits from flight attendants, pilots, frequent flyers, and operators of airport x-ray machines who will claim that their leukemia or multiple myeloma, or their deformed child, is due to the radiation they were exposed to. They will sue the airport operators, the airlines, and the manufacturers. Let's see whether at this point the machines will be scrapped.

Even if the dose is considered trivial, remember the maxim: Better safe than sorry. I have no idea who is right and what will eventually happen. However, one should minimize risks.

I am also concerned that somebody could be tempted to play with the machines. “Let's try increasing the patient entrance dose a little bit to get a sharper picture.” Who vouches and checks? Will the scanners be totally safe in hands that are not completely trustworthy?

Disclaimer

I have nothing against security controls. I have been through them in many countries. They were all performed by concentration camp-type guards (who regard all passengers as potential enemies and killers) or by friendly professionals.

I am not aware of anybody in Europe or North America who has been killed in the air by a terrorist after airport security controls were tightened following the attack on the World Trade Center in New York. This shows that airport screening is quite sufficient as it is today. No such system will ever be foolproof. However, the principle of proportionality between control and genuine threat was left behind a long time ago.

In 2009, there were 11,493 gun homicides in the U.S. [16], more than 30 per day – more than 100,000 during the last decade. They rarely make the national or even local news. More than 3,000 people in the U.S. are killed by fires at home every year. Working smoke alarms would reduce the likelihood of such fatalities considerably and would be a worthwhile investment. For the price of one airport scanner you could buy 5,000 smoke detectors.

The practice of scanning passengers will satisfy politicians' have-to-do-something urge, despite the futility of this strategy. This just glosses over a problem without dealing with it properly. It is like treating cancer with aspirin.

As far as the usefulness of the checks, consider the views of U.S. lawyer Michael Dorf. “In the end, the best argument for implementing x-ray backscatter scans at airports may appeal more to the emotions than to hardheaded calculations of costs and benefits,” he concludes at the end of a lengthy article on the topic [15]. “Despite statistics showing that air travel is substantially safer than automobile travel, many people are jittery about flying, even without the worry of potential terrorism. Full-body scans would be a way to give millions of travelers some added peace of mind. That is not quite the same thing as making air travel safer, but it is a real benefit nonetheless.”

My thoughts exactly. Peace of mind is most likely to be the only benefit that these machines will have for the general public. The powers that be think differently.

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PS: Comment after publication

Apparently, some people – unknown to me – thought this to be an authoritative text; shortly after its publication, the following lines appeared in Wikipedia's section on airport security with a link to the article:

"There are misunderstandings about how x-ray backscatter scanners function, but they do use ionizing radiation and the x-rays emitted from them penetrate clothing as well as skin. While the risk of cancer from a single backscatter check is probably low, the cumulative risk of repeated exposure to radiation is a threat to public health, especially for people working in the airline industry and frequent travelers."

After some months, this paragraph disappeared; I have no idea who had written it nor who had purged it. Was the deletion based on ignorance, politics, or business interests?

The responsible though anonymous Wikipedia editor stated that "the machines do not see through skin."

So far for Wikipedia.

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Critics line up to pour scorn on impact factor

Peter A. Rinck

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The Guinness Book of Records is published annually and contains a collection of world records of human achievements and extremes in nature. Interestingly, the most consecutive catches from juggling two boomerangs, keeping at least one aloft at all times, is 555; the catcher was a Frenchman. The largest vegetable stew was cooked in Carmagnola in Italy this summer, and weighed 1190 kg.

There are records not listed in the book, and one record holder in the category of radiological journals is the RSNA's Radiology. Its impact factor was 6.3 in 2009, while European Radiology follows further down the scale at 3.6.

The impact factor is calculated by dividing the number of citations of scientific papers in a journal in one year by the total number of articles published in the two previous years. The factor was devised by Eugene Garfield (not the cartoon cat), founder of the Institute for Scientific Information (ISI), which is now part of Thomson Reuters. Impact factors are calculated yearly for those journals indexed in Thomson Reuters' Journal Citation Reports – except that only English-language publications are included in the counting, thus it is an Anglo-American index that is not necessarily representative for countries in continental Europe, Latin America, and Asia. According to themselves, Thomson Reuters is "the world's leading source of intelligent information for businesses and professionals." [1] However, I doubt whether impact factors can be described as "intelligent" information since they are only based on counting articles and citations – not evaluating the quality of contents.

Another popular index, the H-number (or H-index), attempts to measure both the scientific productivity and the apparent scientific impact of a scientist. This index is based on the set of the scientist's most cited papers and the number of citations received. It is named after its inventor, Jorge E. Hirsch.

In 1994, I wrote a Rinckside column entitled "Publish and you might perish anyway." Today I would rephrase it: "Have yourself indexed and you will perish even sooner."

Impact factor and H-number, as well as the five-year impact factor, the Article Influence Score, and the Eigenfactor Score all count among these indexes. Eigenfactor Score sounds very similar to Narcissism Score; i.e., self-love of the author. Don't try to correct me, I know that the given meaning is different.

The general idea of finding out the impact, perhaps even the influence or popularity, of a paper is good. All the advantages are itemized in a recent 10-page article in Radiology [2]. However, even in this review, the last sentence makes the reader ponder:

"Finally, it is essential to simultaneously consider multiple indicators when evaluating the quality of any scientific output and to refer to expert opinion to interpret them."

In many instances, impact factors have grown beyond any control and are abused and misused for drawing inappropriate conclusions about single scientists or institutions.

Although they are considered objective by many people, they are easily manipulated, because what is considered "citable" is largely a matter of negotiation between journals and Thomson Reuters. Editors and publishers of many journals plan and implement strategies to massage their impact factors, often in collaboration with the company producing them [2]. Offering a university position or allocating a research grant based on publications in high-impact journals is like playing roulette; it is plain gambling. It is similar to the attitude of some people who admire paintings not because they like them, but because they are expensive.

"Since everyone has learned to 'play the system,' bibliometrics is discredited as a measure of influence."

Indexing promotes mass production of mediocre papers that cite each other. Good articles published 10 or 20 years earlier are neglected, and preference is given to the latest publications. This goes hand-in-hand with the decline in quality of scientific journals. Most publishers have cut down on copy editors. This does not seem to matter much because, as a publisher once confided to me: “We are not really producing journals for possible readers anymore but to offer authors a platform to publish their papers to bolster their CVs.”

There is no scientific proof that impact factors have any impact on the quality of science. It’s just a mathematical ranking, as are H-factors, serving the admiration and infatuation of some researchers for themselves and to ease the distribution of money by granting agencies and government or EU offices with limited scientific competence.

These numbers are a measure for university presidents and department heads who play the factor game to quantify and prove the elite character of their institutions to politicians and the media. Citation indexes are a kind of tabloid press of scientific life – not reflecting the reality of daily research, but rather providing a picture of who sleeps with whom.

2010 seems to be the year of massive attacks on scientific bibliometrics, statistical citations, and content analysis, especially the impact of published scientific literature. One major accusation against the bureaucratic and commercial use of bibliometrics is its threat to basic research and scientific education and teaching. Basic research and educational papers are hardly ever cited and do not contribute to increasing the impact factor of a journal. In other words, the impact factor mirrors mostly quantity, not quality. Moreover, it doesn’t say anything about the quality of an author. Good review papers are the most cited, but they do not necessarily present scientific novelties.

Earlier this year, Chimia, the journal of the Swiss Chemical Society, published two articles. One bore the title “Bibliometrics as Weapons of Mass Citation,” [3] which says it all and was written by Antoinette Molinié and Geoffrey Bodenhausen. The author of the second, a brief commentary entitled “The Follies of Citation Indices and Academic Ranking Lists,” [4] was Richard Ernst, who received a Nobel Prize in 1991 for his contributions to NMR spectroscopy.

Ernst’s comments on the topic are extremely combative and to the point. He describes bibliometry as a “pestilence.” It’s a one-page article, and even civil servants and politicians could read and understand the contents. Here are two extracts:

“Today, an erroneous conviction prevails that institutions and individuals of ‘value’ can be measured ultimately in terms of a single number that may form part of a competitive ‘ranking list’! Only nobodies and nameless institutions never ever appear in a ranking!

“Let us discredit specifically rating agencies and their managers that have established and regularly publish science citation indices and university ranking lists; agencies that enrich themselves on the account of science quality, and cause more harm than good.”

No doubt Thomson Reuters’ Citation Index is a purely commercial enterprise, collaborating with scientific publishers and editors in ways that create fear and competition. Among other books, I have written a handbook on magnetic resonance in medicine that has been translated into seven languages, and I am writing all these Rinckside columns that are read, discussed, and of course criticized extensively. They have quite an impact on the radiological community and in political circles. The impact factor, however, is zero. It doesn’t bother me. The book sold at least 10,000 copies, perhaps 20,000. No, I didn’t make a lot of money. However, every year the publisher sends me a Christmas card.

"When I have to evaluate and recommend somebody for a position, I don’t care about the impact factors of the journals he or she has published."

When I have to evaluate and recommend somebody for a position, I don’t care about the impact factors of the journals he or she has published in or how many papers I count in the list of publications, and I definitely don’t check the list of citations. I read some of the publications, from the introduction to the conclusion, and I check if there is any teaching material in the list of publications. I don’t count publication in mass circulation journals such as Science, Nature, Nature Biotechnology, Nature for Barbie Dolls, Time Magazine, The Economist, Der Spiegel, or Paris Match, all of which have or could have an impact factor higher than 30.

■ Three years ago, in a protest against the absurd use of impact factors, Folia Phoniatrica et Logopaedica cited all its articles from 2005 and 2006 in a very critical editorial that would have more than doubled its impact factor for 2008. In reaction, Thomson Reuters excluded the journal from the list of those counted for impact factor [5,6].

In February 2010, the Deutsche Forschungsgemeinschaft (German Foundation for Science) published new guidelines to evaluate scientific articles. It stated that no bibliometric information on candidates would be evaluated in decisions concerning "...performance-based funding allocations, postdoctoral qualifications, appointments, or reviewing funding proposals, where increasing importance has been given to numerical indicators such as the H-index and the Impact Factor." [7]

Richard Ernst ended his commentary: "There is indeed an alterative: Very simply, start reading papers instead of merely rating them by counting citations!"

I apologize for the many word-for-word citations in this column. I couldn't have expressed them better – and, don't forget: What counts can't be counted.

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