RINCKSIDE

ISSN 2364-3889

VOLUME 27, 2016

PRO ACADEMIA

EMRF

THE ROUND TABLE
FOUNDATION

RINCKSIDE
ISSN 2364-3889 • Volume 27, 2016

CONTENTS

RINCKSIDE is published by The Round Table Foundation (www.trtf.eu).
It is listed by the German National Library.

Adding fuel to the flames: Gadolinium – the German follow-up

Peter A. Rinck

Last December I wrote a detailed article about gadolinium-based contrast agents [1]. It made the news in the United States and I got several requests for interviews.

I don't give interviews. One never knows how the final printed form will look like. Silence is golden.

In Germany, there was a reaction from an unexpected corner. I don't know if it was my article or the general uproar about contrast agents that made the German Society of Nuclear Medicine move. Although they are not involved in MRI, they jumped on the bandwagon and released a comment to the press in early February [2].

It's headlines and first paragraph read as follows:

“MRI contrast agents may remain in the brain. Nuclear medicine physicians recommend alternative tests for the heart. – The metal gadolinium, a component of contrast agents for imaging diagnostics by magnetic resonance can accumulate in the brain after the examination. So far it is unclear whether the deposits cause health problems. However, the Professional Association of German Nuclear Physicians (BDN) recommends to employ the contrast agents at present only for unavoidable investigations. According to the Association, heart studies can also be performed by myocardial scintigraphy or ultrasound.”

The rest of the press release refers to the latest announcements of the US-American Food and Drug Administration (FDA) concerning gadolinium agents and describes in detail radioisotope imaging of the heart.

Gadolinium is described as highly toxic – however, this is an argument like "electricity is deadly"; it always depends on how it's administered. The high toxicities of technetium and of thallium – both applied for myocardial scintigraphy in nuclear medicine – were ignored. By the way, thallium competes with potassium in the body [3] and, at high dose, used to be a well-known rat poison.

The turf war between nuclear medicine and radiology has returned with official backing and is up to new heights. A lot of money is at stake.

The Deutsche Roentgen Gesellschaft (German Roentgen Society, DRG) reacted slowly on the latest developments, playing their cards close to their chests [3]. They didn't want to hurt anybody, neither the German radiologists, nor the manufacturers. Even not their patients. Unfortunately they missed the boat, because their brothers in nuclear medicine were faster: they smell new business.

The radiologists in Germany have had that business for more than 20 years. Germany has about 2,500 MR systems; 1,500 would be more than enough for the population of the country. The greater Berlin area is said to have the world's highest number of MR studies: Statistically 11% of the population get a scan per year, nearly half of them with contrast enhancement.

Even stubborn financial achievers among the MR entrepreneurs (including not only radiologists) admit that a high percentage of examinations and contrast injections is of no clinical significance. Nuclear physicians know that too.

However, the main point I want to make here concerns the outcome of the press release of the Association of Nuclear Physicians.

Hildegard Kaulen, a science correspondent from the *Frankfurter Allgemeine Zeitung (FAZ)*, considered a serious and reliable daily in Germany, and Anna Kröning, writing for *Die Welt*, a slightly yellower paper, took that release and reeled off two articles [5, 6].

Neither grammar nor facts are emphasized, and the statements of the president of the Nuclear Medicine Association, Dr. Detlef Moka, are stretched around two corners. Admittedly, Moka's generalizing remarks about gadolinium contrast agents were off the scientific grounds and quite daring; but the processed articles in the two dailies mixed facts and opinion in a simplistic way and made sweeping judgments: bad news is good news. [4, 5].

Die Welt:
"During MR examinations metal is deposited in the brain."

Even worse, Frau Kaulen tarted up and re-published her article a month after the printed version as an e-version [7]. Headline and first paragraph now read like this:

"Magnetic resonance therapy contrast agents dangerous for the brain? – The contrast agent gadolinium used in magnetic resonance therapy (MRT) was believed to be harmless although it is toxic. There is now protest against its frequent use."

Frankfurter Allgemeine Zeitung:
"Magnetic resonance therapy contrast agents dangerous for the brain?"

MRI's acronym in German is MRT: magnetic resonance tomography; but that definitely doesn't mean "MR therapy". It's not used for treatment, but it's a diagnostic tool.

Frau Kaulen describes gadolinium as a "contrast agent", it's not – it's an element; she also postulates that gadolinium is taken up and stored in the kidneys. Again, that's her invention. Writing science articles for a newspaper is a difficult task; being simple without being wrong requires talent and a lot of practice ... as well as having sufficient time to research and polish an article. Usually journalists are under time pressure. This might be an excuse for the rather garbled accounts.

Nobody mentions that there are several groups of gadolinium-based contrast agents, cyclic and linear, as well as those excreted by the kidneys only and those excreted by both kidneys and liver. There are safe and unsafe contrast agents and procedures – not only a single defective and wrongly applied compound called "gadolinium".

Inaccuracies – by mistake, by ignorance, or for personal or political reasons – are human. For years I read in both papers mentioned here statements like Calais being a Central European city and Budapest being a place in East Europe. Geography is not a strong side of journalists. History is a rather "rubbery" subject too.

Not only on the editorial pages are facts often fiction, and opinions offered as facts, but also on the front pages. Somewhere one has to draw conclusions from contorted and misconstrued articles and finally to draw a line.

During the last decades I have learned that I cannot trust publications I read in *Nature* or, in the case of medical imaging, *Radiology* or any other "high class" science or medicine journals; that one cannot believe dailies and news magazines; and that Wikipedia articles are deeply suspect and not citable. Still, I had some respect for the science section of certain newspapers and scientific magazines. *FAZ* had a famous science editor, Rainer Flöhl. He could compete with British and US-American science editors. He died recently. When he retired some years ago, it was the end of an epoch in German journalism.

■ A tip for science journalists: Always use two independent sources to check the facts; don't rehash press releases on which you lack the background, and don't add random unconnected information. It shouldn't be "all the free press releases we get we'll print".

■ A tip for press releases: Think twice before you make oafish statements. Remember: Silence is golden.

However, the damage is done. Meanwhile patients get uneasy and scared ("I had four MRIs – am I gadolinium toxic now?"). Even if you know that some journalists are irresponsible and completely unreliable: the doubt, the fear remains. Spreading fear is intentional – it attracts readers. Yet, the formerly good reputation of a "quality" newspaper has suffered severely.

By the way, MR contrast agents applied according to the recommendations are still safer than x-ray contrast agents and radioisotope tracers – not *vice versa*.

References

1. Rinck PA. Gadolinium – will anybody learn from the debacle? Rinckside 2015; 26,9: 23-26.
2. BDN – Berufsverband deutscher Nuklearmediziner. MRT-

Kontrastmittel kann im Gehirn zurückbleiben; Nuklearmediziner empfehlen alternative Untersuchungen fürs Herz. Berlin. 5 February 2016.
3. Rinck PA, Beckmann HO. New aspects of the uptake of thallous ion into myocardial tissue. Eur J Radiol. 1981; 1: 173-177.
4. DRG – Deutsche Röntgengesellschaft. Vorwerk D. Gadoliniumhaltige Kontrastmittel in der Magnetresonanztomographie. Berlin. 15 February 2016. www.drg.de..
5. Kaulen H. Kontrastmittel für das Hirn gefährlich? Frankfurter Allgemeine Zeitung. 17 February 2016. Page N1.
6. Kröning A. Beim MRI lagert sich Metall im Gehirn ab. Die Welt. 8 February 2016.
7. Kaulen H. Kontrastmittel für das Hirn gefährlich? Frankfurter Allgemeine Zeitung | FAZ NET. 18 March 2016.

Rinckside, ISSN 2364-3889
© 2016 by TRTF and Peter A. Rinck • www.rinckside.org
Citation: Rinck PA. Adding fuel to the flames: Gadolinium – the German follow-up. Rinckside 2016; 27,1: 1-3.

Science publishers – the beginning of the end?

Peter A. Rinck

PRO ACADEMIA EMRF THE ROUND TABLE FOUNDATION

Half a year ago I wrote a column about the sad state of scientific journals [1]. I never expected to see such a rapid decline. Something worse than expected happened: Some major science publishers are sleeping with the enemy – if you can't beat them, join them. Wiley and Elsevier are turning into vanity or subsidy publishers: they make the authors pay for the publication of their articles – an incredible loss of face for old and established publishing houses.

During the last twenty years, science publishers created new scientific journals by the dozen, the more, the better. Now they try to get rid of them.

Suddenly, like a bolt out of the blue, long-time editors-in-chief of leading journals are dismissed in a rather derogatory manner.

Suddenly, like a bolt out of the blue, long-time editors-in-chief of leading journals are dismissed in a rather derogatory manner.

Wiley claims to be constantly adapting the journals to changes in the market, to keep up with new developments and to serve authors in the best way they can. There is no mention of the readers, nor of the work of the journals' editors – nor of the quality of the scientific content.

The journal concerned in this case [2] will be part of a new agreement between Wiley and Hindawi Publishing Corporation [3]. This agreement gives Hindawi all publishing activities, including editorial oversight.

Hindawi apparently will have an Editorial Board, but will not have an Editor-in-Chief, which means that there is no scientific and ethical oversight. All established and trustworthy scientific journals have editors, because quality and credibility of scientific papers can only be guaranteed by a sturdy editorial policy, editorial ethics, and a balanced understanding of what can be accepted and what, after thorough peer reviews, is refused for quality or other reasons.

More so, Wiley has difficulties finding the right level of communication, having appalling manners, treating editors and editorial board members as mere underlings, or as one of the renowned scientists on an Editorial Board remarked:

"I was very displeased to see this letter. It reads like one sent by a military commander to his subordinates."

The former editor of another journal who was removed from his position by Elsevier summarized the general situation of the scientific journal market as follows:

"Quality is out, quantity for money making is in. Although this seems to be the present trend, it cannot survive for long. Science and business must be in equilibrium for long term success; when one dominates, the other will suffer."

If Wiley is truly in financial trouble or just tries to avoid it or wants to improve profits, remains unclear to the outsider. However, reading the annual reviews written for investing shareholders revealed to the trained eye of those who can read between the lines that in-house economic measures were announced – which is always a sign of threatening financial problems.

The failure or inability of the universities, the readers, the scientific editors and editorial boards to invest manpower and money into the future of independent science has come to a point where we, the scientists, are left with a hopelessly unreliable publication system.

Science publishers today eschew what doesn't yield the quick payoff. A class system will or has already developed: outstanding and reliable publications; run-of-the-mill publications; and vanity publications.

At the end, there will be a two-class or three-class journal market far worse than it exists today [4].

What's good: there are no more subscription and library fees for these journals. On the other hand, whatever is published in these journals is not physically archived and will be forgotten the next day – because nobody is responsible for archiving.

An interesting side effect of the excessive number of scientific articles in an ever increasing number of journals is that they are lost in the data cloud. Until recently, some authors and publishers believed in the helpful power of the "impact factors", but even they are becoming useless in the selection processes for grants and positions. Whatever is and was published digitally by Wiley, Elsevier and possibly others will be lost. Now the most important publications for scientific authors to be cited in are newspapers, dedicated news magazines and similar publications.

Wiley's and other established publishers' reputation will suffer dramatically; and they will be considered untrustworthy and irresponsible, not only by the editors, collaborators and reviewers, but also by authors. Even past-authors are involved: their articles were published in journals that have been downgraded from a top scientific level to a low-level Internet domain.

However, beyond the animosity we may feel toward these publishers, they are not enemies of science. Science is the gold they live of. We voluntarily deliver and hand over this gold to them. They are not interested in us, they are interested in our donations.

You get what you give. Let's keep the gold for ourselves. Let's publish ourselves and guarantee quality of science. It's not so difficult, but it requires personal dedication and the commitment from universities and other institutions.

References

1. Rinck PA. The calamity of medical and radiological publications. Rinckside 2015; 26,8: 21-22.
2. CMMI – Contrast Media and Molecular Imaging; one of the high-ranking scientific journals in medical imaging and contrast agent and molecular imaging sciences.
3. Hindawi Publishing Corporation is a subsidy publisher of research journals founded in 1997, based in Cairo, Egypt. Its profit margins are higher than those of the established publishers. More information about Hindawi can be found at https://scholarlyoa.com/?s=hindawi.
4. Butler D. Investigating journals: The dark side of publishing. The explosion in open-access publishing has fuelled the rise of questionable operators. Nature 2013; 495: 433-435.

Rinckside, ISSN 2364-3889
© 2016 by TRTF and Peter A. Rinck • www.rinckside.org
Citation: Rinck PA. Science publishers – the beginning of the end? Rinckside 2016; 27,2: 5-6.

Datarrhea – the great data revolution

Peter A. Rinck

PRO ACADEMIA EMRF THE ROUND TABLE FOUNDATION

Many opinion makers in medical imaging have accepted as gospel that the future of imaging medicine is digital and that one has to collect all kinds of data available to process or re-process it. They try to sell the concept in numerous lectures and papers, such as “images are more than pictures, they are data” – an amazing though late realization and the astonishing title of a 15-page publication in the February edition of Radiology [1]. It's written in the flowery journalistic style of a feature page article with a long list of non-fitting references.

All over the media we find data mines, data lakes, or data clouds; none of them assume a definite form or contents, they all are slightly mystic and mysterious. Let's try to demystify this foggy datarrhea: is there any applicable clinical connection, any applicable diagnostic relation to radiology?

Three major points struck me:

- Hardly any reference is made to publications and results that were published before 2000;
- hardly any medical doctor with clinical background is involved; and
- there is strong commercial pressure and support of data exploitation of diagnostic imaging data.

■ The daily clinical reality in radiology looks like this: A large majority of cases seen are easy and straightforward: they are either negative or positive and, if positive, the pathology is clearly visible and easily described. One always should get the patient's history and results of clinical examinations; in a minority of cases laboratory, histological and perhaps even genetic tests will be necessary – and the cooperation and exchange between a number of medical disciplines to establish a hopefully solid diagnosis and treatment.

Medical care, diagnostics as well as therapy, does not consist of data algorithms, and medicine is not a science. You cannot build up a virtual reality based on supposedly “precise” data, which most likely contain contaminated data, data errors, and simply wrong data.

I have already stressed earlier that some twenty years ago we had a wave of research into “diagnostic data”, at that time also described as “electronic contrast agents” or “fingerprints”. After many years of work and research only few medically relevant applications emerged [2]. Some features were incorporated into digital image processing. However, most the manipulated data did not lead to reliable additional information about already observed pathologies. Why doesn't anybody involved in the new data hype learn the basics and read the papers published in the thirty years before the turn of the millennium? Most answers can be found there – or in good textbooks.

The data nerds not only live in an ivory tower with a very limited knowledge and view of medical reality; they are also quite confused about their own new discipline. Some want processed personal image data in comparison with, e.g., genetic data, some want bulk personal data collection, including metadata such as patient's name and birth date (most likely to sell them to insurance companies or other institutions interested in them), and some are simply vague and fuzzy about what the outcome of their data milking should and will be.

Data offer supposedly simple solutions to complex problems – however, one has to find fitting problems [3].

Turning this into a new “science” called “radiomics” or “radiogenomics” overshoots the mark. If you give a crippled horse a new name, it still remains a crippled horse and won't run faster. On the other hand, interdisciplinary collaboration of specialists has been going on for a long time – but you need specialists in their field, not data collectors and administrators.

One has the feeling that a lot of people either do not know what they are doing and parrot what others are preaching or believe that they have found something they can make money of: We do not know what all these data mean … but we got it, lakes of it. As I wrote earlier: When you reinvent the wheel, always consider the flat tire problem.

By sheer coincidence I had an exchange about this topic with Dr. Mikhail A. Lyubchak, a radiologist in Odessa. He told me:

"The existing overwhelming obsession for quantification of every aspect of diagnostic imaging sometimes takes bizarre forms. Biomedical imaging researchers often have a physics or IT background and vague understanding of the true concept of diagnostic radiology. This research is being blindly but fully supported by financially driven decision makers, who from time to time try create a new paradigms of medical imaging based on computer-aided diagnosis (that's what I feel most of the quantification is meant for), with a diminishing role for diagnostic radiologists.

“And somehow it seems likely that in this financially driven system of coordinates, where quantification means everything, no one would pay too much attention to reproducibility of MR imaging techniques and associated problems. Needless to say that results of such magnificent innovations could turn out to be surprising.”

Perhaps it might be useful to create less data.

Nobody seems to make a real effort to find out what exactly could be done with the data. Collecting, processing and manipulating personal data will lead to Kafkaesque and secretive administrative institutions. However, in the end, I don't say that we don't need the Great Data Lake and data mining. It is fitting to say that it provides pleasing and lucrative employment to many thousands, gives them a kind of importance and responsibility and, thus, adds to the stability of our societies.

This seems also to be the opinion of Jeffrey R. Immelt, chairman and CEO of General Electric, who gave the New Horizons Lecture at the annual meeting of the RSNA in November 2015:

“The biggest technical theme in the world today is the merger between machines and data. If you think you’re an industrial company, you’re really a data company.” He advocated “precision medicine” and radiogenomics and the merging of the disciplines of radiology and pathology.

Industry, in this case the health industry, depends on the creation of pseudo novelties to survive because at present there seem to be no real innovations or inventions. We will see if more or less random data mining will be more akin to a temporary gold rush.

What will remain at the end? Will data turn out a fertile soil – or fruitless endeavor? Are data really the last truth? Are data really the last truth? Or is real knowledge power and the data cloud the refuse dump [4] ?

Perhaps it might be useful to create less data.

References

1. Gillies RJ, Kinahan PE, Hricak H. Radiomics: images are more than pictures, they are data. Radiology. 2016; 278: 563-577.
2. Rinck PA. MR fingerprinting returns to radiology – and hopefully disappears again. Rinckside 2015; 26,5: 13-14.
3. Rinck PA. Medical philosophy: Cartesian versus confusion. Rinckside 2004; 15,3: 7-9.
4. Rinck PA. Beyond the basics: Is knowledge power? Rinckside 1992; 3,2: 3-5.

Rinckside, ISSN 2364-3889
© 2016 by TRTF and Peter A. Rinck • www.rinckside.org
Citation: Rinck PA. Datarrhea – the great data revolution. Rinckside 2016; 27,3: 7-8.

Smartphones don't upgrade your brain

Peter A. Rinck

PRO ACADEMIA EMRF THE ROUND TABLE FOUNDATION

"Culture? Zeitgeist? Here today, gone tomorrow. Seasons are coming and going. Life goes on, progress cannot be restrained. Only fools attempt it ... Some stays, some disappears." Primo Levi. Il Sistema Periodico. Turin: Giulio Einaudi Editore; 1975.

All traits of life are affected by such changes, including medicine. Today we are watching and exposed to an explosive change of our cultures, occidental and oriental – only few are exempt. The transformation of many societies all over the world into smartphone cultures has materialized at an astounding pace during the last decade. They are a must. Not owning such a device excludes a person from a lot of possible contacts; not having a smartphone is even considered by many people a social stigma.

I wrote this in 2012: "Smartphones are toys, or perhaps ersatz-shrines one prays to and that can respond, giving contentment and comfort" [1, 2].

The mass hypnosis and addiction to smartphones and similar devices has multiple facets. Some are well known, such as security risks and patient privacy [3]. Others are not easily perceived and hardly discussed, sometimes considered taboo topics.

Smartphones and computers in general change values that have an impact on human relations. Also, this influences the relationship and interaction between doctors and patients. We have to be aware of it, adapt to this new situation, and react if necessary. How, for instance, does one deal with patients, their relatives, and colleagues who are enslaved by their smartphones?

The addiction to smartphones is wanted and enforced.

The addiction is wanted and enforced. Dedicated software and platforms are specially designed to create habit-forming routines. A good overview is given in a book on how to develop applications to trap people by Nir Eyal: *Hooked: How to Build Habit-Forming Product* [4].

The best known example is Facebook. It creates a "persistent routine" or behavioral loop based on a fear of missing out. Eyal writes: "Feelings of boredom, loneliness, frustration, confusion, and indecisiveness often instigate a slight pain or irritation and prompt an almost instantaneous and often mindless action to quell the negative sensation ... Gradually, these bonds cement into a habit as users turn to your product when experiencing certain internal triggers."

Social networks dissolve this disquiet for a short period of time like a tranquilizing or pain-relieving drug. Slot-machine psychology is applied to create pervasive connectivity. The user is part of the crowd, recognized, connected – and checking permanently if it's still true. The number of "likes" and "friends" reinforce the ego, most likely by a small dopamine release as a reward. Thousands of apps, but also "serious" programs such as Wikipedia or online blogs play this game with the users. Newspapers and politicians push smartphones and apps, novelties make the front pages.

Smartphone or Facebook addicts can be stalked and interrupted incessantly and everywhere. They are dependent and under permanent surveillance by the crowd. They rely on finding answers and solutions to questions and problems of their daily life on their smartphone and, after a while, lose their ability to critically deduce and interpret their external conditions. They "outsource" part of their brain to the handy devices.

The amount of scientific research and literature about the side effects of smartphones and apps is steadily growing.

A number of surveys show the average U.S. citizen spends three hours a day on mobile devices; the younger the population the more time is devoted: up to 10 hours a day. However, people rarely use smartphones as telephones, to simply talk to somebody else. Nearly 50% of the 18 to 29 year olds said they used their phones to avoid others around them [5].

School teachers and professors observe that students often avoid eye contact and have trouble listening and talking to teachers: "It is as though they all have some signs of suffering from Asperger's syndrome" [6]. Wherever you go in this world, you can watch people stumbling down the streets or sitting in subway trains staring blankly at their little screens. It is like a mass hypnosis.

The brain adapts to this kind of altered utilization. Certain tracts and regions are "downgraded" because they are little used. This "experience-dependent plasticity" is particularly pronounced in children and adolescents, in the first two decades of life, during which the brain matures. Instead of freeing humans from certain tasks with the help of smartphones, they can become dependent on them. Instead of developing complex neural connectivities in their brains, more simple though robust ones are formed.

Psychologists dealing with smartphone-dependent patients stress that smartphone addicts, in particular teens, but also adults, are living just for the present; they have hardly any mental relations to the past, nor to the future. Their powers of reason and judgment are feeble and in many cases they cannot establish a general perspective. Often, they are devoid of empathy. Their self is replaced by their selfie.

Do we have to change our ways to explain a medical examination to this group of people? Do they interpret our words and explanations differently than others? Can we get their undivided attention when necessary? If they are relatives of a patient, do they care?

At present, dealing with smartphone addicts is mostly based upon improvisation. Those hooked usually don't understand they are caught in a vicious circle.

Homo sapiens, perhaps. Phono sapiens, rather not – only phony sapiens?

References

1. Rinck PA. Are smartphones changing behavior in medical practice? Rinckside. 2011; 22(12): 23-24.
2. Rinck P. Smartphones and tablets – the sequel. Rinckside. 2012; 23(1): 1-2.
3. Ridley EL. Radiologists must be aware, vigilant with mobile devices. AuntMinnie Europe. 2 March 2016. Accessed 19 July 2016.
4. Eyal N with Hoover R. Hooked:How to build habit-forming products. London: Portfolio Penguin; 2014.
5. Weisberg J. We are hopelessly hooked. The New York Review of Books. 2016;63 (3):6-9.
6. Turkle S. Reclaiming conversation: The power of talk in a digital age. New York: Penguin; 2016.

Rinckside, ISSN 2364-3889
© 2016 by TRTF and Peter A. Rinck • www.rinckside.org
Citation: Rinck PA. Smartphones don’t upgrade your brain. Rinckside 2016; 27,4; 9-10.

Newspeak in radiology

Peter A. Rinck

PRO ACADEMIA EMRF THE ROUND TABLE FOUNDATION

Recently I talked with a colleague about radiology reports, a topic that every so often returns, in particular when new residents start reporting or new colleagues arrive from other hospitals. We went into generalities: Should the end of a report be called "conclusion," "impression," or "summary"? Also, in English, many radiologists "read" images, but shouldn't it be "interpret" images?

Soon we went off the beaten track, from the language in radiology reports to language in medical imaging in general. Do we all speak a common language – not only the radiologists in one country but those all over Europe? Do we communicate among ourselves and with our colleagues in such a way that everybody gets the same message?

Do we all speak a common language? Does everybody get the same message?

When a German radiologist talks about a *policlinic* and a U.K. or French colleague refers to a *polyclinic*, do they mean the same thing? They might think so, but in reality they don't. They all work in different health systems. In most cases, a German policlinic is an outpatient department usually serving one discipline, e.g., lung diseases, surgery, or dentistry; the U.K. polyclinic, on the other hand, offers a variety of disciplines. The Greek origin of "poli" is polis (the town), while that of "poly" is polys (various).

Policlinic is an old term, coined in the 19th century. However, increasingly for a number of years, novel terms are creeping into medical imaging. Radiologists are faced with a language that sometimes reminds one of the newspeak described by George Orwell in his novel 1984 [1]. Language can fast turn into ideology … selling messages and concepts cloaked in idealistic-sounding words that originally have a different meaning. They are turned into politically correct terms.

Other examples I have discussed previously, for instance the story of the four "P's." The four P's stand for "predictive, personalized, preemptive, and participatory" – P4 medicine [2]. There is even a fifth "P": precise or precision [3]. It is claimed that the *new* radiology derives from the new directions in biomedical science. The P-approaches all should have profound effects on the delivery of healthcare globally and transform the practice of medicine, particularly radiology.

These epithets sound good, suggesting the energy, dynamism, and steadfastness of those who preach them. On the other hand, they are an accusation against the majority of radiologists and other physicians; the adjectives imply their skills and aims are not predictive, personalized, preemptive, participatory, nor precise. They are, at best, mediocre doctors.

"Personalized" and "precision" medicine mean the destruction of what's left of individual privacy – all medical data become public, even when *pro forma* secrecy statements are given to the individual. They include data processing and collection beyond any reason, except – perhaps – to categorize people and assign them to different possible disease classes. It could easily develop into a new form of discrimination based on possible or existing diseases.

In a letter to D.W. Bowser dated 20 March 1880, Mark Twain wrote the following about adjectives:

"When you catch an adjective, kill it. No, I don't mean utterly, but kill most of them – then the rest will be valuable. They weaken when they are close together; they give strength when they are wide apart. An adjective habit, or a wordy, diffuse, flowery habit, once fastened upon a person, is as hard to get rid of as any other vice."

As far as language goes, we also find new nomenclature coined by some ignoramuses that is plainly wrong. My favorite example is the term for diagnosis and therapy in a single approach, combining treatment of a disease with the analysis of its cause in a single strategy – the famous one-stop shop, a medical dream.

The routinely-used U.S.-American term for it takes the first part of the second word and the second part of the first word and puts them together: "Tera-nostics." It would be a dream technology, but the term, as is, constitutes a nightmare for me.

"Tera" comes under the category of metric prefixes: kilo, mega, giga, tera (10^{12}); "-nostic" is closely related to Homer's famous epic poem, the Odyssey, about the travels of the Greek hero Ὀδυσσεύς – Odysseus, Ulysses in Latin and English. The poem mainly centers on him and his journey home after the fall of Troy. The journey home is called "νόστος" (nostos) – the return in Greek. Nostos is – by the way – also a core issue of Zionism and part of the word "nostalgia."

θεραπέια (therapeia), however, is the therapy, the care, the healing. It's written with a theta at the beginning. διάγνωσις (diagnosis) is the differentiation, the scrutiny, the analytical determination. Its root is γνῶσις (gnosis), the cognition, the realization. The suffix "ics" in the properly spelled "theragnostics" pertains to or denotes a body of facts, knowledge, or principles.

Theragnostics allows simultaneous targeted diagnostic imaging and targeted treatment. But why not simply talk about "*in-vivo* targeting"? Better correct and specific than incorrect and complicated. And this term is idiot proof. As discussed earlier, similar considerations hold for "molecular imaging" [4].

Trust is an often forgotten facet of good communications. I don't trust a person who tries to sell me a new scientific result in teranostics. He is using a wrong term – does he really know anything about the topic he talks about?

■ From fact to fiction and from information to light entertainment: This language group is the specialty of public relations departments or companies. They invent slogans like "Imagination at work." Company slogans should be catchy and positive – and not challenge twists of words: "Imagine it works." Another company has just changed its name: from health *care* to health i*neers*, a strange semantic aberration. Some days ago I was greeted by somebody working for this company; wearing a grin like the Cheshire cat he said: "Hi. *Hell is near.*"

References

1. Orwell, G. 1984. London: Secker and Warburg, 1949.
2. Rinck PA. Weltfremd is of no value to your patients. Rinckside. 2011; 22(1): 1-2.
3. Rinck PA. Datarrhea – the great data revolution. Rinckside. 2016; 27(3): 7-8.
4. Rinck PA. What's molecular in molecular imaging? Rinckside. 2013; 24(3): 5-6.

Rinckside, ISSN 2364-3889
© 2016 by TRTF and Peter A. Rinck • www.rinckside.org
Citation: Rinck PA. Newspeak in radiology. Rinckside 2016; 27,5; 11-12.

MR safety update: Why we may not need a 20-Tesla MRI machine

Peter A. Rinck

PRO ACADEMIA EMRF THE ROUND TABLE FOUNDATION

Fresh and perhaps exciting research might be presented on stage at the upcoming ESMRMB's European Magnetic Resonance meeting in Vienna, but some problems concerning MR research and applications will be discussed in the back rooms. Among them is the field strength question.

When I started working with one of the whole-body MRI prototypes in Germany in the early 1980s, some 36 years ago, I sat down to find out more about possible side effects of MR examinations and wrote an overview of the risks and dangers [1]. A year later I was sitting on the board of a commission of the German Federal Health Agency, dealing with the same topic and giving recommendations for Germany [2]. The research results collected and used stretched over a whole century, beginning in the late 1800s. Much of the evidence was contradictory, while some got straight to the point and was reproducible.

Safety limits for magnetic fields and electromagnetic radiation were set. The same happened in other European countries and in North America. Exposure limits were put with wide safety margins to stay on the safe side. During the following decades these limits were slowly raised because no severe of lasting side effects upon the human organism were seen – except for projectile damage caused by negligence and auditory damage by the noise at high field.

Thomas F. Budinger of the Lawrence Berkeley National Laboratory in Berkeley was deeply involved in basic research of MRI risks since the 1980s. In 1998, he wrote in an article entitled “MR safety: past, present, and future from a historical perspective”:

“Contemporary experiments and theories on health effects demonstrate that currently MR imaging is practiced in a safe manner. Technological capabilities and medical science objectives, however, will lead to procedures that will challenge the thresholds of physiological effects. Thus progress in this field will require continual surveillance and better definitions of guidelines which at present are considered prudent but too restrictive.” [3]

Progress in this field will require continual surveillance and better definitions of guidelines.

Early days of 10T dreams

Thirty years ago, Budinger was contemplating the “Dekatesla Project” together with the late Paul C. Lauterbur and Gerald M. Pohost – a 10-Tesla whole-body machine that was never built, for numerous reasons. Now, at the age of 84, he proposes doubling the field strength. Budinger and a number of noted co-authors, mostly between their mid-50s and mid-80s, are established scientists with a proven ethical background who know what they are doing. They published a review of research opportunities and possible biophysical and physiological effects of magnetic resonance equipment operating at 20 T [4]. The list of authors reads like an excerpt from the *Who's Who* of basic and applied biomedical MR research. The article is an example of a well written review paper.

There are always new prospects and possible “added values” to them. Today it is, for instance, sodium MRI and phosphorus MRS at 7 T, and more scientific schemes exist for 20 T.

However, the mere idea of ultra-high field MRI is debatable; there will be problems and risks beyond heat deposition and deafening noise, both to laboratory animals and humans. Although there are some new results, in general there is a paucity of data on the physiological impact of MRI at high and ultra-high fields.

In a 2007 article Thomas A. Houpt and his collaborators wrote:

“Rats, for instance, find entry into a 14.1 T magnet aversive … After their first climb into 14.1 T, most rats refused to re-enter the magnet or climb past the 2 T field line … Detection and avoidance requires the vestibular apparatus of the inner ear, because labyrinthectomized rats readily traversed the magnet. The inner ear is a novel site for magnetic field transduction in mammals, but perturbation of the vestibular apparatus would be consistent with human reports of vertigo and nausea around high strength MRI machines.” [5]

Already in 1988 a group at the General Electric Corporate Research and Development Center described in an abstract sensations of vertigo, nausea, and metallic taste in a group of volunteers. There was statistically significant evidence for field-dependent effects that were greater at 4 T than at 1.5 T. In addition, they found magnetic phosphenes caused by motion of the eyes within the static field. The results were published in a full paper in 1992 and considered proof that there is a sufficiently wide margin of safety for the exposure of patients to the static fields of conventional magnetic resonance scanners operated at 1.5 to 2 T and below [6].

At 7 Tesla, one third of the severely ill patients enrolled in a clinical study complained about vertigo and nausea caused by the equipment [7]. It seems not advisable to prescribe histamine-blockers such as diphenhydramine to preventively mitigate the strength of vertigo and nausea at ultra-high static magnetic fields, although this procedure has been proposed to "pave the way to even higher field strength" [8] – but rather to refer patients to side-effect free 1.5 Tesla machines.

Ignoring uncomfortable news

However, people tend to look the other way and ignore uncomfortable news. Machines operating at higher field strengths became available in the research and clinical market.

More than 20 years later, scientific publications and two PhD theses from the Netherlands throw new light on hazards of ultra-high field magnetic resonance equipment operating at fields higher than 2 T. These and other articles describe some reversible decline in cognitive function as well as symptoms of nystagmus, vertigo, postural instability, nausea, and metallic taste in employees working with MRI at fields of 3 T and, at a higher degree, at 7 T [9, 10, 11]. Even if these effects are not considered to be deleterious, one cannot expect that employees and patients accept getting sick and dizzy in or close to an ultra-high field MR machine.

There are a number of additional aspects that have to be taken into account, among them volume and shear forces on diamagnetic tissues. As Budinger and coauthors stress in their paper about the 20 T project these might become a main limiting factor in ultra-high field imaging:

“Shear forces between tissue and fat or tissue and bone might be sensed but not be uncomfortable. But the susceptibility differences between iron-loaded tissues and adjacent tissues such as the cerebral cortex and other tissues will need evaluation. The importance of these differences will need to be ascertained before human subject exposures to ultrahigh fields and high-field gradients.” [4]

It is also still unknown what happens to magneto-biomaterials in the human brain at high/ultra-high fields and what their function is – whether they are, e.g., bioreceptors or biosensors.

Impact of EU regulations

In July 2016, the European Commission's Directive on electromagnetic fields (EMF) came into force. At present, this directive addresses only short-term effects, not yet possible long-term effects [12].

MRI equipment is excluded from the regulations of this directive. However, if MRI machines operating at 3 T or higher have a negative impact on the health of people working with these machines or on patients, regulatory measures, including exposure thresholds, will have to be re-evaluated and it can be expected that the conditional derogation for MRI equipment from the requirement will be revoked.

Such a step might also negatively affect clinical MRI at 1.5 T and lower fields.

Science is always a progress report; however, perhaps one should rather focus on topics that promise no harm to animals and humans but rather some clearly positive outcome. As I see it, all examinations above 2 T should be considered experimental and not clinical, and patients should be informed, in writing, about possible side-effects. The gadolinium disaster has shown us that being reckless of danger can end in the mutilation and death of patients [13]. We should never forget this.

A detailed overview of the state of research in MRI safety can be found in the European Magnetic Resonance Forum's (EMRF) e-textbook [14].

Industry and taxpayer-sponsored researchers who try to push unproven ideas into the imaging health care market may act unethically and against the benefit of patients and delivery of appropriate medical care to the general public. According to Budinger's review article [4], it might take quite some time until the “all clear” can (or cannot) be sounded for introducing research or even clinical machines in the ultra-high field range of MRI.

There is a lot of food for thought: Aren't there better projects, e.g., working at low field and developing a patient-friendly easy-to-handle MR machine for 95% or more of all clinical examinations, for the price of a medium-sized car? Taxpayers’ money should go into such projects.

References

1. Rinck PA. Risiken und Gefahren der NMR-Tomographie. Dtsch Med Wschr 1983; 108: 992-994.
2. Bundesgesundheitsamt (der Bundesrepublik Deutschland) et al.: Empfehlungen zur Vermeidung gesundheitlicher Risiken verursacht durch magnetische und hochfrequente elektromagnetische Felder bei der NMR-Tomographie und In-vivo-NMR-Spektroskopie. Bundesgesundheitsblatt 1984; 27: 92-96.
3. Budinger TF. MR safety: past, present, and future from a historical perspective. Magn Reson Imaging Clin N Am. 1998; 6: 701-714.
4. Budinger TF, Bird MD, Frydman L, et al. Toward 20 T magnetic resonance for human brain studies: opportunities for discovery and neuroscience rationale. MAGMA 2016; 29: 617-639.
5. Houpt TA, Cassell JA, Riccardi C, DenBleyker MD, Hood A, Smith JC. Rats avoid high magnetic fields: Dependence on an intact vestibular system. Physiology & Behavior 2007; 92: 741-747.
6. Schenck JF, Dumoulin CL, Redington RW, Kressel HY, Elliott RT, McDougall IL. Human exposure to 4.0-Tesla magnetic fields in a whole-body scanner. Med Phys. 1992; 19: 1089-1098.
7. Springer E, Dymerska B, Cardoso PL, Robinson SD, Weisstanner C, Wiest R, Schmitt B, Trattnig S. Comparison of routine brain imaging at 3 T and 7 T. Invest Radiol. 2016; 51: 469-482.
8. Thormann M, Amthauer H, Adolf D, Wollrab A, Ricke J, Speck O. Efficacy of diphenhydramine in the prevention of vertigo and nausea at 7 T MRI. Eur J Radiol. 2013; 82: 768-772.
9. Roberts DC, Marcelli V, Gillen JS, Carey JP, Della Santina CC, Zee DS. MRI magnetic field stimulates rotational sensors of the brain. Curr Biol 2011; 21: 1635-1640.
10. van Nierop LEV, Slottje P, Zandvort MJV, De Vocht F, Kromhout H. Effects of magnetic stray fields from a 7 Tesla MRI scanner on neurocognition: a double-blind randomised crossover study. Occup Environ Med 2012; 69: 761-768. and: van Nierop LE. The magnetized brain. Working mechanisms for the effect of MRI-related magnetic fields on cognition, postural stability, and oculomotor function. Thesis, Utrecht University. 2015.
11. Schaap K, Portengen L, Kromhout H. Exposure to MRI-related magnetic fields and vertigo in MRI workers. Occup Environ Med. 2016; 73: 161-166. and: Schaap K. Working with MRI: An investigation of occupational exposure to strong static magnetic fields and associated symptoms. Thesis, Utrecht University. 2015.
12. European Commission, Directorate-General, for Employment, Social Affairs and Inclusion, Unit B3. Non-binding guide to good practice for implementing Directive 2013/35/EU, Electromagnetic Fields, Volume 1: Practical Guide. Brussels: European Union, 2015.
13. Rinck PA. Gadolinium – will anybody learn from the debacle? Rinckside 2015; 26,9: 23-26.
14. Rinck PA. Chapter Eighteen: Safety of Patients and Personnel. In: Magnetic Resonance in Medicine. The Basic Textbook of the European Magnetic Resonance Forum. 9th edition; 2016. E-version 9.8.

Rinckside, ISSN 2364-3889
© 2016 by TRTF and Peter A. Rinck • www.rinckside.org
Citation: Rinck PA. MR safety update: Why we may not need a 20-Tesla MRI machine. Rinckside 2016; 27,6; 13-15.

Debacles mar “Big Science” and fMRI research

Peter A. Rinck

PRO ACADEMIA EMRF THE ROUND TABLE FOUNDATION

Washington, 1989: “Now, Therefore, I, George Bush, President of the United States of America, do hereby proclaim the decade beginning January 1, 1990, as the Decade of the Brain.” Twenty-four years later: “Last year, I launched the BRAIN Initiative [a twelve year program] to help unlock the mysteries of the brain, to improve our treatment of conditions like Alzheimer’s and autism and to deepen our understanding of how we think, learn and remember.“ US-President Barack Obama.

Neuroscience is a wide field of brain and spine studies that evolved from the sciences of neuroanatomy and neurophysiology. Nowadays the discipline encompasses subdisciplines far outside the boundaries of the exact sciences and of medicine.

With the US-initiatives and those proposed and implemented elsewhere in the world, there came “Big Science” devoted to neuroscience research: a hundred million here, a hundred million there – or, in a European program, one billion over ten years. Altogether, many billions of euros or US-dollars were promised to subsidize projects heavily relying on fMRI research, among them the US-American Human Connectome Project and the European Human Brain Project.

The ten-year European project started in 2013, but was already interrupted in 2015 for reasons described without overenthusiastic detail by the project leaders and by those responsible in the European Commission – but told fully in a paper in the Scientific American: “Two years in, a $1- billion-plus effort to simulate the human brain is in disarray. Was it poor management, or is something fundamentally wrong with Big Science?”[1]. Those in the know in Europe remained silent.

In a report about the US Connectome project, one finds the following statement, hidden in a box outside the running text: “What is needed to get past the current impasse is a method that selectively separates global signal from global noise. Though no such method is yet available, we offer several observations about global fMRI fluctuations [2].”

The history of MRI is a story of successes but also a story of empty promises.

The history of MRI is a story of successes but also a story of empty promises. Certain events have implications and consequences that only slowly unfold over the years.

BOLD imaging and its applications have developed into more than a disappointment – it might become an utter fiasco. Many results are based upon obscure metadata. I have described some reasons and low points in my last column about fMRI: “Functional charlatans” [3]. I don't want to stray off here into the multifaceted picture of BOLD imaging and fMRI; on the other hand, I want to stress that there are numerous serious, genuine, and critical scientists in imaging neuroscience.

However, not only these scientists are upset, the educated and critical public is also getting annoyed, as Manfred Schneider describes their reactions to fMRI and Big Science in the science pages of the Swiss paper *Neue Zürcher Zeitung*:

“Numerous neuroscience institutes were founded, immense amounts of money were mobilized, the western societies got into a neuroscience frenzy. Thousands of subjects were placed in functional magnetic resonance equipment, where they had to endure movies, pornographic pictures, poems, while the researchers at their terminals observed the oxygen metabolism in their brain cells, converted the thrown out data into little pictures and tried to delude the world into believing that they are watching the brain thinking, feeling, acting. By now such studies have lapsed into a kind of oddball science. Meanwhile, no linguist can talk any more about synonyms without telling the confused zeitgeist that the words cake and pie are “synomynously” stored directly next to each other in the left temporal lobe [4].”

More and more researchers admit that acquisition and processing techniques of BOLD data lack the required meticulousness and thus the biased results and conclusions are scientifically irrelevant. Even the inventor of BOLD fMRI, Seiji Ogawa was among the harshest critics. Twenty-two years after his first description in 1990 [5], he published a 19-page review paper where he, in a roundabout way, discusses and disputes his technique [6].

Several thousand papers on fMRI appear every year, Kim and Ogawa mention 3,000 [6], PubMed's numbers stretch between 42,000 and nearly 170,000 since 1990, depending on the search terms one uses. Meanwhile it has become clear that many of these papers, apparently a majority, rest on shaky foundations. Some scientists read Seong-Gi Kim's and Seiji Ogawa's review as a farewell to BOLD imaging, but this conclusion seems too drastic and far-reaching. However, the publication alludes to the intricacy of the scientific background: “The BOLD effect in fMRI is very complex, and this is still an area of intense research.”

The authors also observe in their concluding remarks: “Dynamic properties and magnitudes of BOLD functional responses are dependent on many physiological parameters as well as baseline conditions. In patients with neurovascular disorders, the BOLD response could be sluggish, or even decreased relative to baseline. This should not be interpreted simply as a decrease in neural activity, because neurovascular coupling may be hampered … Resting-state fMRI studies are widely performed, but its physiological source needs to be systematically investigated.”

At the end, the critical reader's conclusion is: BOLD and fMRI should stay in the hands of genuine scientists. Clinical and psychological or commercial applications should be limited to trained and principled researchers.

Today, the concepts of fMRI rely on a great many hypotheses, calculations, and simulations; however, practical proof to establish the validity of these models lags behind. Twenty-six years after Ogawa's original publication, everything is still “*panta rhei* – everything is in flux”: definitely no hope for a trip to Stockholm, but rather “back to the drawing board”.

A number of scientists had hinted at the threatening problems, among them Christoph Segebarth [7] and Nikos Logothetis [8]. Here is but one more example published by a Swedish group in spring 2016: “We found that the most common software packages for fMRI analysis (SPM, FSL, AFNI) can result in false-positive rates of up to 70%. These results question the validity of some 40,000 fMRI studies and may have a large impact on the interpretation of neuroimaging results [9]."

Definitely, “Biostatistics for Radiologists” is not sufficient to perform fMRI and to apply statistical processing to the results. On the other hand, fMRI is not in the hands of radiologists – fortunately, in this case.

Functional MRI seemed one of the most promising research techniques for and beyond neuroimaging: the true study of brain organization. Now we fear the waste of hundred of millions euros of research grants and the shattered remains of thousands of scientific papers. Since nobody really feels responsible or in charge it will be difficult to minimize the repercussions of this debacle.

References

1. Theil S. Why the human brain project went wrong – and how to fix it. Scientific American 2015; 313. 1 October 2015.
2. Glasser MF, Smith SM, Marcus DS, et al. The Human Connectome Project’s neuroimaging approach. Nature Neuroscience 2016; 19: 1175-1187.
3. Rinck PA. Functional charlatans. Rinckside 2015; 26,4: 9-11.
4. Schneider M. Geld für Science-Fiction –- die Hirnforschungshysterie. Neue Zürcher Zeitung 24 May 2013; pg. 23.
5. Ogawa S, Lee TM, Kay AR, Tank DW. Brain magnetic resonance imaging with contrast dependent on blood oxygenation. Proc Natl Acad Sci USA 1990; 87: 9868-9872.
6. Kim S-G, Ogawa S. Biophysical and physiological origins of blood oxygenation level-dependent fMRI signals. Journal of Cerebral Blood Flow & Metabolism 2012; 32: 1188-1206.
7. Segebarth C, Belle V, Delon C, Massarelli R, Decety J, Le Bas JF, Décorps M, Benabid AL. Functional MRI of the human brain: predominance of signals from extracerebral veins. Neuroreport. 1994, 21;5: 813-816.
8. Logothetis NK. What we can do and what we cannot do with fMRI. Nature. 2008; 453 (7197): 869-878.
9. Eklund A, Nichols TE, Knutsson H. Cluster failure: Why fMRI inferences for spatial extent have inflated false-positive rates. PNAS 2016; 113, 28: 7900-7905.

Rinckside, ISSN 2364-3889
© 2016 by TRTF and Peter A. Rinck • www.rinckside.org
Citation: Rinck PA. Debacles mar “Big Science” and fMRI. Rinckside 2016; 27,7; 17-18.

PRO ACADEMIA EMRF THE ROUND TABLE FOUNDATION