

“Breakthrough” and other Swearwords

Science misbehaving in the Media

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From malapropism to eggcorn

A **malapropism** is the misuse of a word for another resembling it, as in “He abseiled the channel” or “Cross the blabbing brook.” The name comes from the fictional character Mrs Malaprop in Sheridan’s play **The Rivals**. The Reverend William Spooner gave us **spoonerisms**, to which he was prone; an exchange of the first letters of two words, as in “Your mad banners,” and “He dealt me a blushing crow”. A similar linguistic quirk is the “**eggcorn**,” a term coined by Geoffrey Pullum in 2003 to describe the substitution of a phrase or syllable for a similar sounding one (“eggcorn” rather than “acorn;” “old-timer’s” instead of “Alzheimer’s” disease).

Editors know all of these, but we need a new word; one to describe scientific words or terms which are appropriated then misused out of their scientific context, often for political or religious reasons. “**Decimate**” is long lost to us. Originally meaning one in ten, its vague similarity to “**desecrate**” and “**devastate**” now sees it used universally to suggest huge-scale destruction.

The same goes for “**induction**” and “**deduction**.” Induction is the mental process lying at the heart of science, that of deriving a general principle from particular instances: the “Aha!” moment. “Deduction” is almost the opposite, describing the process by which a general rule is applied to a particular instance.

Used correctly, these two words elegantly and concisely distinguish the inductive process of science from the deductive process of technology, but they are rarely used correctly. That is a pity, because it makes it harder to explain to non-scientists exactly what science and technology are, what they do, how they are related and how they differ. Too often science is seen as a collection of facts, while technology is vaguely seen as machines, all of which misses the philosophical interest of what goes on in the minds of people who practise either.

Was CP Snow right?

2009 is the 50th anniversary of CP Snow’s famous “**Two Cultures**,” in which he lamented the division between those who practise the sciences and those in the humanities. Perhaps he was right, but not just in describing the inability of one lot to talk to the other. Each group deals with its own disciplines very differently, and those in science are generally poor at it. I don’t just mean talking about their research, I mean describing the mental processes involved in research; getting and testing ideas, isolating variables, establishing a control condition, separating cause and effect, distinguishing between ideas that come through plodding work and those that arrive as sudden inspiration.

People in the arts community readily discuss the creative processes that produce art, music and literature, but we in the scientific community seldom discuss our discipline in such a way. If we did, induction and deduction might have remained generally meaningful terms. We might find it easier to show what ‘scientifically validated’ means, to reveal more clearly the difference between science and pseudoscience, and even encourage students to see the creativity and intellectual stimulation inherent in a scientific or technological career.

Theory” and **“hypothesis”** are similarly confused, so that many believe a theory to be tentative and unsupported speculation. This has proved greatly to science’s disadvantage in the anti-evolution crusades that surface periodically in the law courts of the USA. Evolution is there dismissed by creationists as “only a theory.” Now a hypothesis may be only speculation, but there is nothing “only” about a theory! It is a powerful explanatory construct based on repeated experiments that confirm its reliability and allow us to make confident predictions using it.

“Proof,” another confused word, means one thing to a lawyer, another to a detective and something else to a mathematician. To the public it implies irrefutability, but there is no place for that in science. Many scientific philosophers have shown that, in the words of Bertrand Russell, science’s “...method is one which is logically incapable of arriving at a complete and final demonstration” of proof.

The word is a useful shorthand, but when misapplied it can look damning, as when the media claim that scientists “admit they cannot prove” global warming, the safety of GM foods and inoculations or any of the important scientific advances of today. These are hot media topics, with politicians and others demanding that scientists “prove” global warming exists before we take steps to rein it in. It is a nonsensical demand, not because they are not entitled to question whether global warming occurs, but in asking of science what it cannot give; absolute proof. The trouble is that people who don’t know how science works see lack of proof as evidence of disproof. It isn’t, of course, but it is hard to make that clear if the scientific process is not understood.

Confusion of concept through misuse of terminology is widespread in science and now beyond. Quite apart from ludicrous waffling about things such as “crystal energy,” “purifying the blood,” “magnetic healing power” and similar nonsense that the more extreme alternative health brigade spouts in the hope of sounding scientific, physicists have seen **“quantum”** hijacked so that it no longer describes something tiny but something very big (a quantum leap). Chemists have fared even worse at the hands of the gardening fraternity who have hijacked **“organic”** and **“inorganic”** to describe methods of cultivation rather than branches of chemistry, and even given new meaning to chemistry itself. It is perplexing for a scientist to hear media gardeners advocate the use of sulphur, bluestone and sulphate of potash while also boasting that their organic garden is free from chemicals.

What’s in a name?

I am a zoologist, so I am easily irritated by inaccurate names bestowed on animals in the media. That practice partly reflects our history. European settlers faced with our hitherto unknown marsupial fauna interpreted it in terms of animals familiar to them. I have done a tally, and the earliest European descriptions of kangaroos and wallabies compared them at various times to cats, greyhounds, hares, rats, civets, apes, meerkats, squirrels, deer, jerboa and goats - possibly even more.

Zoological confusion more than 200 years ago is understandable, but it is extraordinary that it should persist today. Despite the unique nature of marsupials (nearly half our more than 300 native mammal species) they are still regularly described as marsupial wolves, Tasmanian tigers, kangaroo rats, marsupial moles, koala bears, native cats, marsupial mice and so on.

If you protest that these are unique animals with their own names of thylacine, koala, dunnart and quoll, you are told that it is by these pseudo-European names that people know the animals and using other names in the media would be confusing, and so ignorance and inaccuracy are jointly invoked as reasons to persist with both into perpetuity, but the practice makes it harder for Australians to understand the unique qualities of their native animals and preserves the European notion that colonial animals are inferior versions of their own. It even impacts negatively on many species which, already at risk, are endangered further, as few people support appeals to save “mice” and “rats” of any kind, while calling thylacines “wolves” and “tigers” in Tasmania justified their extinction at the hands of sheep farmers only seventy years ago.

Bugs and more

When it comes to the misuse of the name “**bugs,**” the impact is more likely to be on our own species. The term “bug” is now so ubiquitous that in the media it can mean a bacterium, computer fault, virus, stomach upset, irritating behavior, fungus, contagious illness and any kind of invertebrate. That’s a real problem when discussing microbes. Typing “flesh-eating bug” into Google brings up 76,000 hits, most of them media stories. On the day I tried, the first five were all Australian, each identifying a different organism, with some using “superbug” for an angle scary enough for the microbe’s identity not to matter.

People blame the media for this kind of scaremongering, but the blame lies elsewhere. The Oxford Illustrated Companion to Medicine, discussing ‘superbug’ and other scare stories, concludes that “There is a tendency to blame the media for these scares, however most of those listed ... have their origin in reports in the scientific media”⁽¹⁾.

The use of “bugs” for microbes, whether bacteria or viruses, is ubiquitous in Australian media reports, even those written by specialist reporters. Again, why does it matter? Most reported “superbugs” are bacteria, but if popular science calls everything a bug, the distinction between bacteria and viruses seems irrelevant. It isn’t. Very few people can tell you whether an infectious disease is caused by a virus or a bacterium, but bacteria respond to antibiotics; viruses don’t. The worldwide overuse of antibiotics, often for viral complaints, has allowed many bacteria to evolve resistance to them, becoming “super-bacteria” with few controls. It is a serious problem, exacerbated by using antibiotics for viral complaints.

By 1998, the UK government, concerned that over-prescription of antibiotics by doctors was encouraging drug-resistant diseases, published five guidelines⁽²⁾. Two specified prescribing antibiotics for bacterial infections only and not for viral infections against which they are ineffective. You wouldn’t think a government would need to tell doctors that. These guidelines carefully referred to viruses and bacteria, avoiding ambiguous terms like bug and superbug. By contrast the House of Lords, on discovering that more than 15% of patients had been incorrectly prescribed antibiotics for viral illnesses, lamented the rise of “superbugs” and the British Medical Association promptly elected to debate the problem of “superbugs” at its annual conference. Remember, that is the doctors talking.

The problem of doctors wrongly prescribing antibiotics for viruses has reached very serious levels, leading to a number of eminent microbiologists warning that we are in danger of losing our only line of defence against many dangerous bacterial infections because the over-frequent use of antibiotics for the wrong reasons has produced bacteria resistant to them. Last year the UK government was concerned enough to launch a public campaign against misusing antibiotics for colds. Antibiotics must be prescribed by doctors, so it is essential that they understand how bacteria evolve their defences.

It is rudimentary evolutionary stuff, but religion again means that science loses in consulting rooms as well as law courts. In 2005 the Finkelstein Institute surveyed 1500 American doctors ⁽³⁾. Most Jewish and Catholic doctors viewed the overtly anti-evolutionary dogma of intelligent design as religious pseudo-science, but 63% of Protestant doctors saw it as legitimate scientific speculation. Amazingly, only 59% of them accepted evolution.

If a significant proportion of doctors lump viruses and bacteria together as “bugs,” treat viruses with antibiotics that don’t affect them, denying the evolutionary process that then allows bacteria to evolve drug resistance, we have a problem. No wonder that the general population is confused and adds to the problem by demanding antibiotics for viral colds and flu and self-medicating through the internet. Try typing “buy antibiotics online” into your search engine. I got one third of a million hits, offering a vast range of antibiotics; no prescription needed, no questions asked.

A similar confusion is being ruthlessly exploited at present in Australia by the deceptively named Australian Vaccination Network, a group that advocates non-vaccination of children against terrible diseases such as whooping-cough, measles and diphtheria. There is nothing evidence-based in their campaign, and their criticisms of vaccination have been comprehensively refuted, but just as creationists have exploited poor understanding of the mechanics of evolution, the anti-vaccination brigade is doing the same regarding our immune systems’ ways of dealing with infectious microbes, both bacterial and viral.

The word “bug” fares no better zoologically, being used for a huge range of animals. Even in a recent edition of *Cosmos* magazine, a story about insects as human food ⁽⁴⁾ described 10 kinds of insect as bugs, although only one, a cicada, gets close, and this was an entomological article in a leading science journal.

A few racial problems

Another troubling misuse of science-speak is “**The Human Race.**” Humans are not a race but a species or, if you like, a single-race species, for science is discovering that different races don’t exist within it. Race is an old concept, but by the 20th Century there were thought to be 4 or 5 human races; Europeans, Africans, Asians and those linked to indigenous Australians. The unraveling human genome changed all that. Compared with animals, in which “race” effectively means “subspecies,” humans prove remarkably similar, with genetic variations occurring largely within supposed racial groups rather than across them ⁽⁵⁾.

Two hundred years ago, phrenologists thought bumps on the skull revealed aspects of personality and character, and European phrenologists found reasons to declare their own race superior. Nazi Germany attempted to promote a master Aryan race through eugenics and extermination. The USA and South Africa introduced racial segregation and apartheid.

The misapplication of these pseudosciences led UNESCO, as long ago as 1950 ⁽⁶⁾, to state that science had shown humans to be a species, that cultural rather than genetic factors accounted for much of the observed variation, and that the “layperson use of the term ‘race’” should be dropped altogether in favour of “ethnic groups.” That was sixty years ago, and DNA studies make it look pretty prescient now.

But rather than drop the term “race” as meaningless, people heap more meanings on it, compounding its ambiguity. In the media “race” can now mean ethnic type, nationality, religion, skin colour or cultural identification. “Racial vilification law” defendants are as diverse as holocaust deniers, apartheid supporters, religious bigots, opponents of immigration and more. A recent absurdity was an Irish woman’s use of racial vilification laws to prosecute her neighbour for calling her a leprechaun. Sensibly the case was dismissed as “political correctness gone mad.”

Why does this matter? If we are to counteract ethnic, religious and other forms of discrimination, or merely want to discuss them, surely we need to identify their root causes clearly and use precise terms - not pseudoscientific labels - to describe them. They have different causes needing different solutions.

If I hate Jews or Muslims, I am not racist but a bigot. If I fear foreigners, I’m not racist but a xenophobe. Calling someone a leprechaun is not racist, but politically incorrect. What does racism mean if there are no human races? We need a much more precise rewording of racial vilification laws. Scientists can’t do that, but at least they could abandon unscientific references to “the human race,” and so could those who write about science in the media.

We saw recently how this can trouble debate at high levels. A US senator, calling President Obama a liar, was immediately branded racist, the derogatory label being enough to require no elaboration of argument or permit any defence. The term “male chauvinist pig” was similarly used to silence critics of feminism and, in the USA of the 1950s, the label “communist” could be invoked to rob dissident voices of their credibility, no matter what their arguments might be. Last month, when dangerous terrorists were given lengthy prison sentences for preparing to bomb hundreds of people, protesters immediately and predictably accused the judge of being an anti-Muslim racist. Last week a Queensland multi-millionaire complained that the government was racist for denying Chinese corporations open access to purchase Australian resources.

When we allow pejorative adjectives like this power in proportion to their ambiguity, such linguistic dishonesty will always be effective, but those of us in science should take special care to protest when scientific terminology, with precise meanings, is distorted and misused in such ways

Even the name of science has been hijacked to give beliefs such as **Creation Science**, **Divine Science**, **Scientology**, **Religious Science**, **Science of Mind** and **Christian Science** an aura of evidence-based credibility belied by their beliefs and practices. Science avoids the metaphysical and requires, above all, that hypotheses must be tested experimentally and, if results and belief conflict, it is the belief that must give way. With religions, cults and dogma the reverse is true, and nothing based on such an approach should include science in its name.

The clichés of science reporting

So, we need a new word, to describe this linguistic piracy, but while we grapple with the problems of new words in the media, it is often old words that are at fault; so old that they are now clichés. You don’t often come across “**methinks**” in everyday language. My dictionary describes it as “archaic,” but that doesn’t faze writers of letters to the editor. For some reason methinks crops up there quite often; one of the clichés peculiar to that particular venue, along with “It never ceases to amaze me...”

Some professions are particularly given to clichés. Politicians use them a lot in media interviews. Perhaps talking about “shifting deck chairs on the Titanic,” “putting Dracula in charge of the blood bank,” “backflips” and “the bottom line at the end of the day” allows the mouth to keep going in a stressful interview while the mind tries to think up something sensible.

But clichés also abound in professions whose practitioners should know better. Journalists' and editors' supposed command of popular writing should make them alert to clichés and wary of them, but that is not so. In the media, any rural town exposed to calamity suddenly becomes a “close-knit community.” No political scandal erupts without a journalist tacking “-gate” onto the end of it. Cancer victims inevitably die “after a long battle with cancer.”

In science stories, the standout, teeth-clenching cliché is “**breakthrough**.” If that isn't used story, the chances are that “**cutting-edge**” or “**groundbreaking**” will be. I recently ran a quick check of science media releases on *Eurekalert*, perhaps the most widely used electronic site for posting such things. In 5229 releases, “breakthrough” appeared 2206 times, “cutting-edge” 1127 times and, although “groundbreaking” came in third, it still featured 783 times. Google *Eurekalert* and try it yourself.

Protesting against such sloppy journalism is more than just pedantry. Clichés like these distort science reporting in quite serious ways.

Crying Wolf

Calling all research a “breakthrough” is counter-productive. It devalues the currency of effective communication. Editors who receive dozens of these releases each day are rightly suspicious of them when they describe routine research as a “breakthrough.” Some that I know bin such releases on the spot.

Muddying the Waters

Occasionally science comes up with something exceptional; a real breakthrough if you like, but if everything else has been given that title, how do you recognise the big stuff among the trivial in media stories? Extreme descriptions should be reserved for extreme achievements.

Lazy Writing

Dropping into clichés makes a science story much less interesting and informative than it might be. A story should be just that; a story, and if it describes something important, the writer should have the skills to make clear why it is so. Evading doing so by describing a discovery or advance as a “breakthrough” tells the reader little about the significance of the science involved.

Dodgy Science

“Breakthrough” suits the clichéd image of the Hollywood scientist; beaver away in geeky solitude until a Eureka moment produces an amazing discovery that will change the world, but that is not how most science happens. The steady accumulation of knowledge in incremental steps; false leads or tentative findings that may be contradicted by other studies – these are far more likely, and journalists would do well to try to convey why such studies are significant, or potentially so, rather than label them all quickly (and mostly wrongly) as some kind of instant transformational discovery. It would also help dispel popular misconceptions about how scientists work.

Why do journalists do this? First, apart from a cliché being an easy way out for a lazy writer, the science value and news value of a story may be measured differently. A clue lies in how some media release sites evaluate the 'relevance' of their stories. The search algorithm seems programmed to give greater weight to words like "breakthrough" and "cutting-edge," and stories larded with such hyperbolic descriptions are hoisted well above others that avoid such terms and concentrate instead on well crafted descriptions of the science involved.

Second, with the declining number of science journalists, media releases prepared by PR employees too often find their way into the media scarcely changed. PR agents are seldom concerned with describing science accurately. Their job is to get their employing institution's name into the media. If that can be done by puffing up commonplace research that might struggle to rate a mention without being called a "breakthrough," so be it.

Framing science stories

Writing a serviceable and honest science story without these silly terms is not especially hard, and even unimaginative journalists who understand their craft can take refuge in a number of frames or angles that are well understood. This is not an exhaustive list, but frames often seen in science stories include these:

- a news event is made out of a study's release;
- it highlights the biggest, most expensive, first.....;
- it is part of cyclical events;
- it is attached to a hard news peg;
- it reflects current media agenda of 'important' issues;

- it emphasises the paradoxical, ironic, quirky etc;
- it highlights differences, controversy (esp. expert);
- it is a human interest story or has that context;
- it revolves around well-known personalities.

The first group is good for scientists. Research discoveries provide, by definition, new information. Cyclical events can be planned for, allowing release of pertinent research results. That is why there are so many national days and weeks designated – Alzheimers awareness week, Threatened Species Day, Mental Health Week and many more; each providing a peg on which to hang stories on that topic.

The second group can be more troublesome. Scientists working in obscure areas can be dismayed to find themselves portrayed as wild-eyed eccentrics, pursuing something nobody else cares about – the old Hollywood scientist cliché - while others can be interviewed only to find themselves intercut on air with someone who disagrees vehemently with what they have to say.

Frames in the third group are double-edged swords. Discovering a treatment that cures sick children, is a human-interest story and the media will love you, but if the treatment develops serious side effects, that is human interest as well, but it won't be nearly such fun. And well-known personalities are great if they play your game, but if they go feral, it can be dreadful. I once had to chair a public lecture by a Nobel

prizewinner who had spent all day in the Barossa Valley. His reputation had filled the hall, but his delivery emptied it.

Dissident Voices

To me, the most difficult part of writing science stories is not making hard science comprehensible, it is what to do with the dissident voice. Journalists should be even-handed in their reporting, but if the great weight of scientific opinion supports some proposition, should a lone dissenter be given equal time? Must health reports on swine flu or whooping cough vaccination campaigns include the view of the unscientific anti-vaccination network just because they demand equal time? At what point does offering differing points of view subvert carefully acquired, important knowledge?

It is not always an easy call. A few years ago, two Australians defied deeply entrenched medical orthodoxy to claim that stomach ulcers were caused by bacteria, and not acidity. Their dissenting voices proved right, and they got the Nobel Prize, but what does that tell us about airing the views of Climate Change deniers, GM food protesters, nanotechnology scaremongers and stem-cell technology opponents?

It is why science sets such store by peer-review and reputable scientific publications. Anyone who has recently authored peer-reviewed publications in a relevant field is deemed to be a reputable voice, dissident or not, but try to explain what all that means to most members of the public, and see how you get on. It is, I fear, another area, and now a very important one, where we as scientists have failed to make clear to non-scientists how we do our work and which parts of it can be relied upon. That, in a world faced with growing problems that demand scientific and technological solutions on the grand scale, has been a very great omission on our part.

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