Omics *in silico* and other trends in biomedical research: Impact on how and what we write

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Abstract
Medical writers and communicators write about biomedical research. It follows that the latest trends in this field translate to new trends in medical writing. This article provides a peek into the latest breakthroughs and developments in biomedical research that can impact what and how we write.

Introduction
As medical and scientific communicators, we write about breakthroughs and innovations in biomedical research. The latest trends in these fields translate to new trends in how we communicate. We have to continuously hone our skills, broaden our vocabulary, and expand our knowledge base. In this article, I share a collection of my favourite trends. Terms written in ***bold italics*** are defined in the glossary in Table 1.

The brave new world of omics
In the era of ***omics*** (genomics, transcriptomics, proteomics, metabolomics)[1] the term *biotechnology* seems inane and inadequate when applied to what is currently going on in biomedical research. Biology has come a long, long way since the start of the human genome project. Last year, an infant with a rare disease was admitted, diagnosed, treated, and discharged within 36 hours – after his whole genome was sequenced in record time of 19.5 hours.[2]

Let's take a look at some of the cutting-edge research coming out of the omic realm, topics that some of us may already be writing about.

> To keep up with new trends, we have to continuously hone our skills, broaden our vocabulary, and expand our knowledge base.

Synthetic biology
Systems biology, move over to give space for ***synthetic biology***.[3] A recent feature in *The Economist* states "life runs not on software and hardware but in all-ware… [making] it highly resistant to human reprogramming".[4] But it can be hacked. By combining biology and engineering, synthetic biology enables us to hack, redesign, even create life. With the development of the ***CRISPR/Cas9 technology***, gene editing has never been easier, cheaper, and faster.

Medicine is benefiting from synthetic biology, starting with finding cures for genetic diseases to regrowing or repairing damaged tissues and organs using 3D printers.

On an industrial scale, synthetic biology requires a high amount of resources that go beyond test tubes. This is where biology meets artificial intelligence. Biological experiments can now be automated, as gene editing becomes a digital rather than laboratory activity. This year, Swiss scientists created the first computer-generated genome of an organism,[5] a bacterium created ***in silico***.

Do-it-yourself biology
Another side of the omics revolution is do-it-yourself biology (***DIYbio***).[1] The DIYbio movement literally originated like start up tech companies, in biological laboratories set up in garages and kitchens of biohackers and bio-innovators. Activities range from home micro-breweries to "CRISPRing" marijuana, to culturing fluorescent bacteria for artistic purposes, to the more ominous threats of bioterrorism. Naturally, there are also concerns about the lack of checks and balances and ethical considerations.[1]

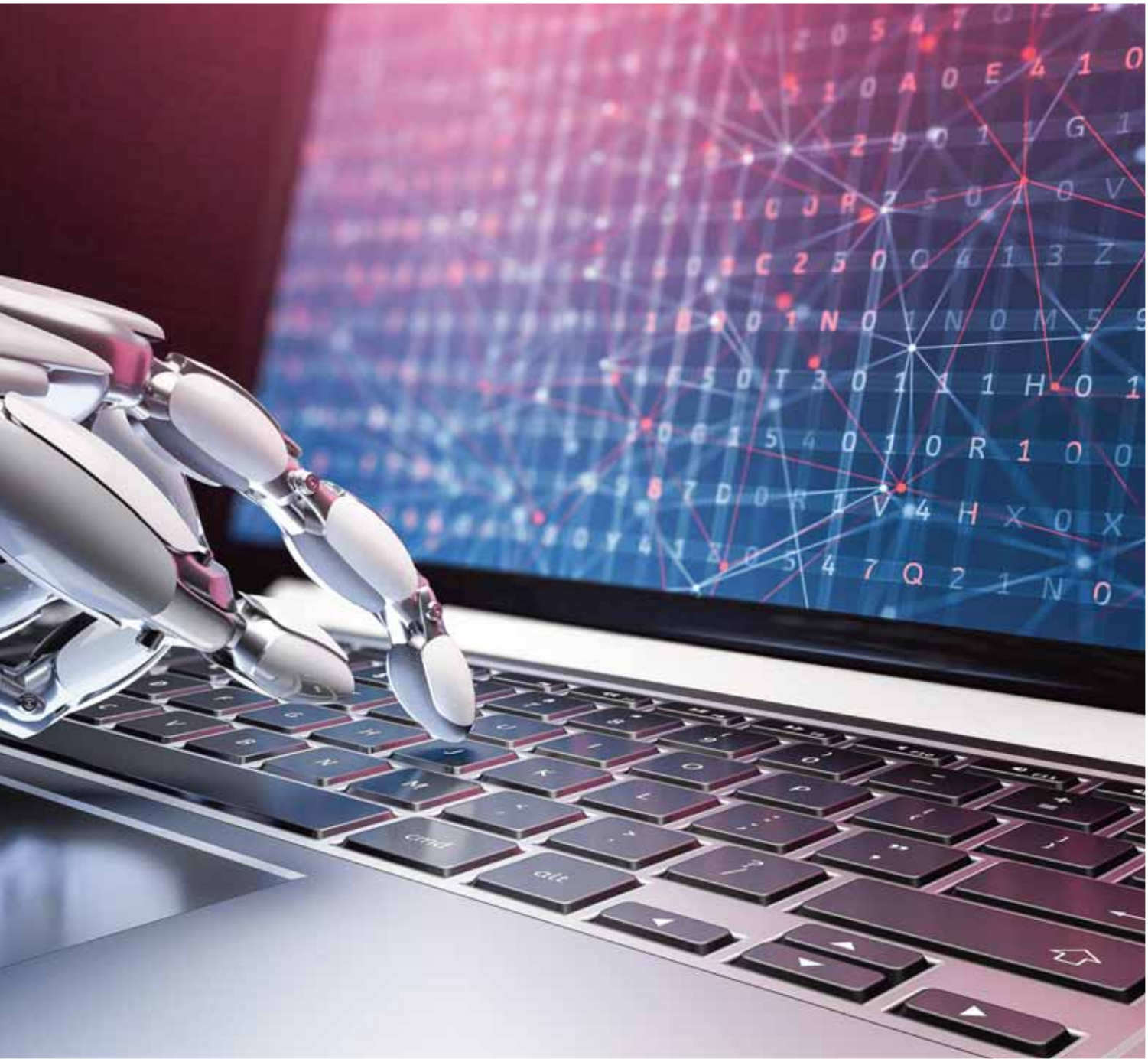
Vaccines and viral misinformation
Vaccines are not new. Till a few years ago, it was such a low-profile therapeutic area as the burden of many infectious diseases have declined to the brink of eradication. In recent months however, vaccines have become the focus of controversy and hype in all forms of media and thus deserve mention here.

Viral misinformation
What used to be a trend towards ***vaccine hesitancy*** has become an all-out anti-vaccination (anti-vax) movement.

Anti-vax is likened to a digitally spread disease. This type of "viral misinformation" is the biggest pandemic risk we are facing today, according to a *Nature* article, and it is spread by a "digitally-enabled emotional contagion."[6] It is sad that this misinformation overshadowed recent achievements in vaccine development, such as the first malaria vaccine made available this year.[7]

Health agencies are trying their best to reverse this trend. But the battle is being fought mainly on social media. I would like to pay tribute to advocacy groups fighting the good fight, trying different public outreach strategies to counteract anti-vax thinking. Children's book writer Andrew Murray ("Buddy & Elvis") uses cartoons and animations to increase awareness.[8] One of his characters, my friend and colleague Melvin Sanicas, calls scientists to action in his article on p. 22.

Medical entomology
Because of the recent outbreaks of mosquito-bourne diseases such as dengue, malaria, Zika, and chikungunya infections, the field of ***medical entomology*** has reemerged.[9] Here, too, is synthetic biology active, with gene-editing techniques being explored to control, even wipe



out disease-carrying species of mosquito without harming the benign types.[3]

The recently released book *How Mosquitoes Changed Everything* by Brooke Jarvis describes how mosquito-bourne diseases changed the course of human history.

Combination health products: ingestible and wearable devices

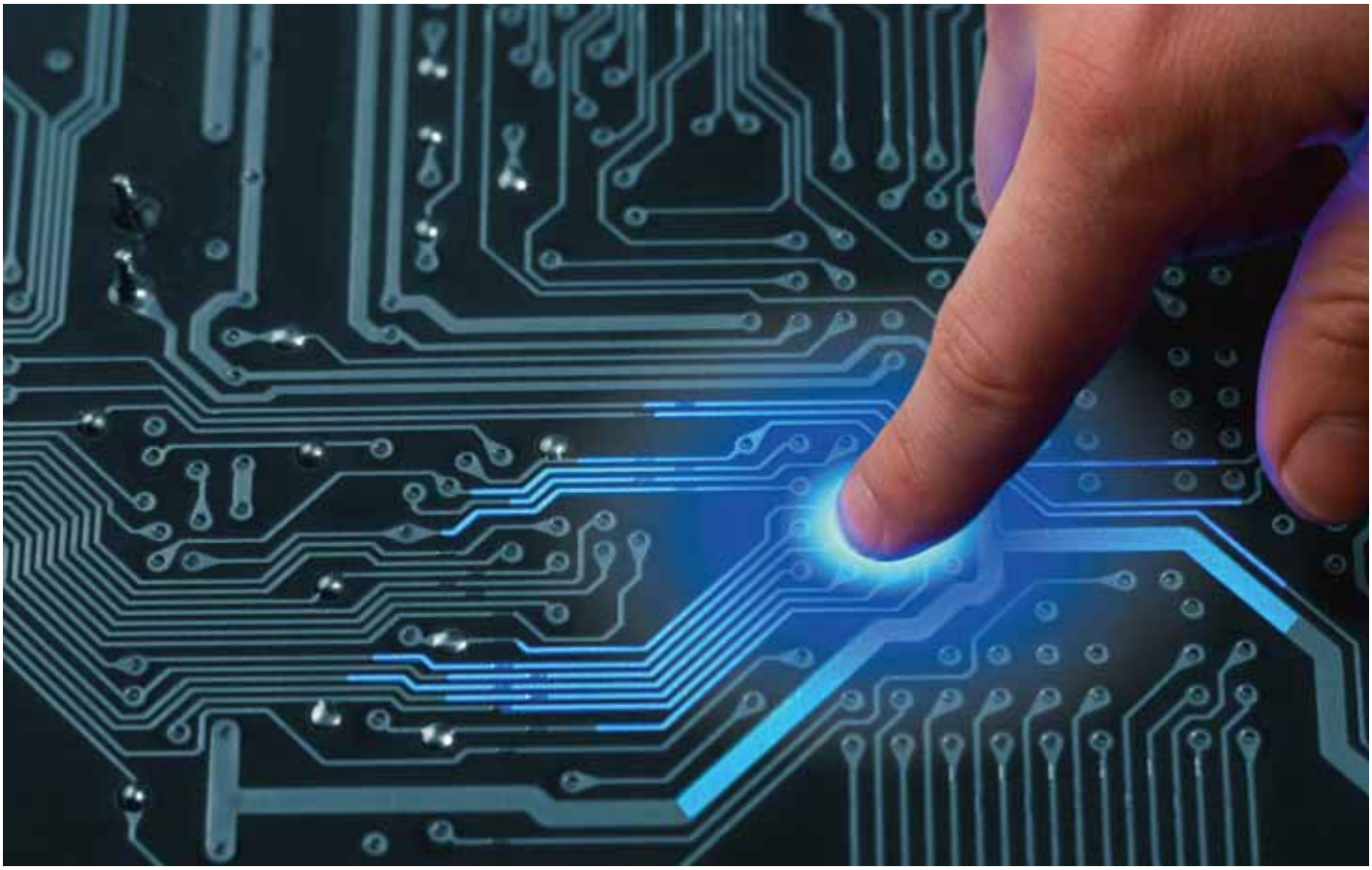
The delineation between drugs and medical devices are becoming blurred, again, as biology and technology merge to develop products that combine the best of both worlds. The EMA, which traditionally only deals with medicinal products, recently released a draft guideline on the quality requirements for drug-device combination products.[10] The term ***combination products*** brings to mind pre-filled syringes and anti-histamine pens. But the trend is towards more complex and ingenuous combinations and delivery systems, some examples of which are described below. We writers need to step away from our comfort zone to deal with new terminologies that may come from engineering, informatics, and material science.

A digital pill

This product comprises a pill with an embedded silicon chip, a wearable sensor, and an App. The chip, once in the stomach, is released and sends a signal captured by sensor and recorded in the App. This way, treatment adherence to the antipsychotic drug aripiprazole can be monitored. It was approved by the FDA in 2018.[11]

Ingestible delivery system

Insulin without injections? This may become possible with a self-orienting mm scale applicator (SOMA) whose needle is made of insulin and its



"plunger" controlled by a sugar disc. This latest breakthrough in oral insulin replacement therapy for diabetes is currently in testing. Insulin is delivered by ingesting the SOMA, which then delivers insulin directly into the peritoneal wall.[12]

Wearable medications

The next generation of wearables might resemble a shirt rather than a watch. Swiss scientists are developing smart medical fibres and drug-releasing textiles. The technology has a wide range of potential applications, from wound care to glucose monitoring.[13]

Ethics and political correctness

Let's have a look at trends in ethical questions and political correctness that can affect the way we write.

Political (over)correctness?

Gender parity and the "me too" movement were big topics in 2018 that have impacted our behaviours. It follows that sensitivity to these issues is also expected in scientific communication. Yet, we do not have clear guidelines on political correctness and cultural sensitivity. A recent manuscript analysed long forgotten medical research projects that are suddenly rediscovered, like "sleeping beauties" awakened by a prince. The paper was rejected by a top US journal on the grounds of sexualisation by using a politically incorrect analogy. Alternative suggested terms are "hibernators" and "awakeners".[14] Do you agree?

Mind your sources

Even if you mind your metaphors, what about scientifically valid yet ethically questionable sources? During an operation, a surgeon had to refer to the Pernkopf Topographic Anatomy of Man to finish a rather tricky emergency procedure. Apparently, no other medical source, paper or digital, can match the accuracy and spectacularly detailed illustrations of human anatomy in this ≈80-year old volume. It was compiled in an Austrian medical school during the Nazi era, and was based largely on the bodies of the victims of those dark times.[15] Is it ethically correct to use the material? Is it allowable to cite such materials in scientific papers? Does the end justify the means?

Watch your language

Though not necessarily unethical or politically incorrect, some terms we use in day-to-day clinical research may be inappropriate for use in medical publications. An ISMPP paper lists examples of common industry jargon that do not belong in a manuscript, mainly because they are too colloquial or even commercial. Two examples on the list that I have encountered frequently are "key opinion leader" (suggestive of influence and bias, use "external medical expert" or "subject matter expert" instead) and "key messages" (messaging is a commercial term, consider "scientific communication points" instead).[16]

The 11th edition of the *AMA Manual of Style* is planned for release this year and will include guidance on terminologies. Here are a few terms: use of "low income" instead of "poor"; addition of LGBTQ as an abbreviation; removal of "CD-ROM" and "fax" from the glossary, but inclusion of "cloud" and "IP address". Furthermore, "sequence variation" and "allelic variant" are preferred over "mutation" and "polymorphism", respectively, according to the recommendations of the Human Genome Variation Society.[17]

All things planetary

Ever heard of the term "***planetary medicine***" or "***planetary health***"?[18] Previously viewed with scepticism, it is now scientifically recognised, even considered vogue. Check out the call for medical practitioners to act for planetary health and sustainable healthcare in the *Lancet*.[19]

In fact, with climate change coming to the forefront, several subdisciplines of planetary health have arisen, including planetary paediatrics,[20] planetary epidemiology,[21] and planetary preventive medicine.[22] Here too, synthetic biology is being harnessed to address environmental issues.[3]

What about digital health?

We cannot discuss healthcare trends without mentioning digital health and there is lots of ground to cover, including artificial intelligence and health data from "prewomb to tomb".[24] As seen in the trends already discussed above, biology, healthcare, and technology are all interlinked.

I will not focus on this topic here but will instead let the next issues of *Medical Writing* – for December 2019 on digital health, followed by the issue on Data Economy in 2020 – do justice to these highly important trends. For now, check out and enjoy Eric Topol's Deep Medicine: How Artificial Can Make Medicine More Humane.[24] It's medical communication at its best.

Disclaimers

The opinions expressed in this article are the author's own and not necessarily shared by her employers or EMWA.

Conflicts of interest

Raquel Billiones is an employee of a pharmaceutical company.

Table 1. Glossary of terms

Term	Definition
Omics	a neologism for the constellation of an organism's "omic" information, which includes the genome itself (genomic), transcription products (transcriptomic), protein products (proteomic) and metabolic products (metabolomic).[1]
Synthetic biology	an interdisciplinary branch of biology and engineering that combines various disciplines from within these domains, such as biotechnology, evolutionary biology, molecular biology, systems biology, biophysics, computer engineering, and genetic engineering. (Wikipedia)
CRISPR/Cas9	stands for 'Clustered Regularly Interspaced Short Palindromic Repeats' and it is part of the defence mechanism found in the immune system of bacteria against viruses. After its discovery, it was used as part of the CRISP/Cas9 genome editing technology, which allows scientists to edit, cut, or replace DNA at precise locations. This technology can be applied to permanently modify genes in living cells and organisms with the aim to correct mutations and treat disease.[1]
in silico	an expression used to mean "performed on computer or via computer simulation". The phrase was coined in 1989 as an allusion to the Latin phrases *in vivo*, *in vitro*, and *in situ*, which are commonly used in biology and refer to experiments done in living organisms, outside of living organisms, and where they are found in nature, respectively (Wikipedia).
DIYbio	Do-It-Yourself Biology, a citizen science driven movement that aims to find innovative solutions by studying life sciences related topics in non-traditional academic and industrial settings, namely in self-made laboratories (e.g. assembled in kitchens and garages) that are not ruled by the policies of a research or academic institution.[1]
Vaccine hesitancy	refers to delay in acceptance or refusal of vaccines despite availability of vaccination services; currently a complex global problem that requires ongoing monitoring (WHO)
Drug-device combination products	therapeutic and diagnostic products that combine drugs, devices, and/or biological products (US FDA)
Medical entomology	also known as public health entomology, is focused upon insects and arthropods that affect human health as disease vectors (Wikipedia)
Planetary medicine or planetary health	body of research that investigates the links between Earth's natural systems and human well-being, looking at how climate change and resource depletion cause problems like infectious disease and malnutrition;[16] not to be confused with the term "environmental medicine", a field that is dealing with environmental excitants in the surroundings, and not recognised as a legitimate specialty but rather more of a quackery.[23]

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New recommendations released: **Good Practice for Conference Abstracts and Presentations**

Research that has been sponsored by pharmaceutical, medical device, and biotechnology companies is often presented at scientific and medical conferences. Although there is an industry standard to guide the development of full publications (Good Publication Practice for Industry Sponsored Research, GPP3),[1] this only touches on conference presentations. Until now, no specific guidelines or recommendations have been available to adequately describe best practice for conference presentations.

The Good Practice for Conference Abstracts and Presentations (GPCAP) recommendations[2] address the specific challenges of developing abstracts and presentations for academic conferences. The authors are all experienced publication professionals, having worked for either medical communications agencies or pharmaceutical companies, who have encountered the practical challenges associated with conference presentations. Having drafted an initial framework, the draft recommendations were published as a preprint at PeerJ[3] for public review and comment to gain broader feedback, which enabled the authors to refine the recommendations further, before submitting for publication.

The recommendations cover the following:

- authorship and contributorship
- transparency
- development, review, and approval of abstracts and presentations
- guidance on re-presentation of data (encore abstracts)
- copyright considerations
- appropriate citation of conference presentations

While developed with pharmaceutical industry sponsored research in mind, we believe that these recommendations are applicable to all research submitted to conferences, and we encourage readers from other fields to offer suggestions for further development via our website (http://gpcap.org).

By following GPCAP recommendations, industry professionals, authors, and conference organisers will improve consistency, transparency, and integrity of publications submitted to conferences worldwide.

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