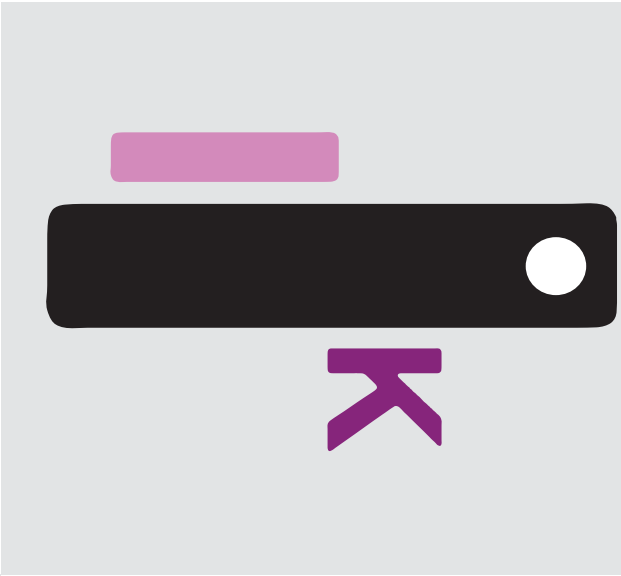


United Kingdom & Ireland Controlled Release Society

Xtend™

Modular. Scalable. Future-proof.
Xtend™ Dissolution Line

Ready for tomorrow. Today.

Respond flexibly to changing workloads and simplify method transfer from R&D to QC with the new Xtend™ Dissolution Line. Standardized modules such as dissolution bath, pump, filter station, and sample manager can be flexibly combined or extended anytime – from manual to semi- and fully automated systems.

sotax
Solutions for Pharmaceutical Testing

www.sotax.com/xtend

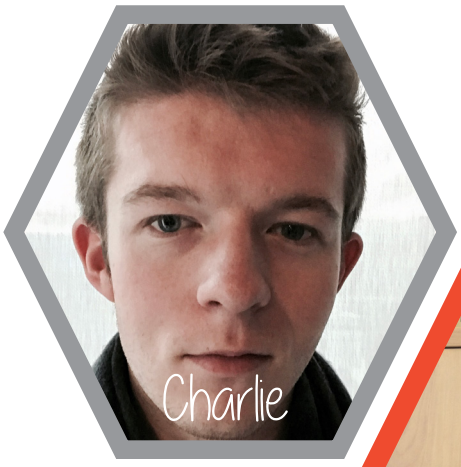
CONTENT

ABOUT

UKICRS is the leading national organisation in the United Kingdom and Ireland for the promotion and advancement of the science of controlled release and drug delivery technology.

ONLINE

WEBSITE: www.ukicrs.org
EMAIL: ukicrs@gmail.com



COMMITTEE

Gavin Andrews
Sion Coulman
Sarah Gordon
Dimitrios Lamprou
Jayne Lawrence
Jenifer Mains
Karl Malcolm
Maria Marlow
Laura Mason
Carol McCarthy
Yvonne Perrie
Katie Ryan
Charlie Winter

A WORD FROM THE WINNER OF THE 2017 UKICRS SUMMER STUDENTSHIP

This summer project was a once-in-a-lifetime opportunity which allowed me to experience what it would be like working in pharmaceutical research. I have always been intrigued about the science behind drug formulation and improving patient health, and was very honoured to be the recipient of the 2017 UKICRS summer studentship.

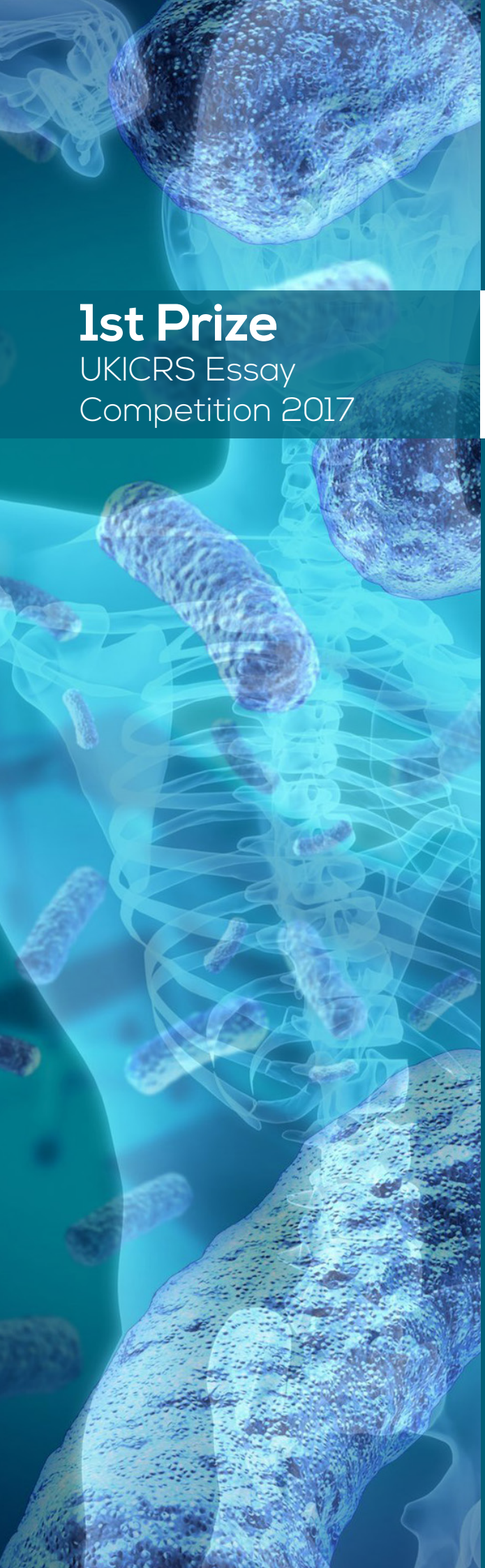
The award enabled me to take part in a summer project at the University of Hertfordshire which involved the development of temperature-responsive emulsions which increase in viscosity upon warming from room temperature to body temperature. I synthesised a range of materials, and learnt to use NMR, GPC, FTIR and dynamic light scattering. Rheology was then carried out to investigate any changes in viscosity with temperature, which allowed us to identify a system which became a gel upon heating. These temperature responsive emulsions could be useful in mucosal drug delivery because the material is able to flows freely through an applicator at room temperature and then when it warms up to the body temperature it increases in viscosity thereby improving the retention of drug, and also potentially reducing messiness.

I received one-on-one training from Dr Michael Cook and I was able to work alongside a dynamic team of researchers in the pharmaceutics group at the University of Hertfordshire. I was able to build on previous skills and also develop invaluable research and analytical skills. This allowed me to experience pharmaceutical research, which is essential to me in shaping my desired career as a pharmacist working in an industrial setting.

The skills which I have gained from the research placement will also be of great use to me in my final year project. I look forward to applying the additional skills and knowledge which I will gain from this research placement to further my studies as a pharmacy student and also improve myself as an aspiring industrial pharmacist. I would also like to thank the UKICRS for providing me with this opportunity.

Halimah Olutayo Bakare

University of Hertfordshire



Pharmaceutical perspectives on the human microbiome: help or hindrance?

1st Prize
UKICRS Essay Competition 2017

by Natalie Morton

Whilst Antonie von Leeuwenhoek wrote to the Royal Society of London detailing the strange, miniscule creatures which he had observed with his homemade microscopes in the 1680s, it took almost two centuries for Robert Koch to draw the link between microorganisms and disease, and another two to being comprehensively detailing those who reside in the human body. Within the last few decades the millions of microorganisms which live on and in the human body are being put under the limelight, and the relationships they hold both with the body and with ingested compounds, be they drugs, or food, or other microorganisms, are becoming more common considerations for the research scientist.

The genes of all of the microbes on and in the human body are collectively known as the human microbiome, and are thought to outnumber our genes by 100 to one. They are incredibly diverse: whilst between two humans there is a genetic difference of 0.1%, between two microbiomes up to 90% of the genetic material can be different.[1] It is even possible to determine which keyboards have been used by which people based simply on the microbes their fingertips leave behind1. It has been estimated that 100 trillion microbes live on each human,[2] and the Human Microbe Project states that between one and three percent of our body mass is made up of microbes.[3] A thriving, diverse community such as this surely does not exist in such proximity to us with no effect. Scientists have recently begun to understand the depth of the interactions between the microbiome and its host, and the consequential effect of the microbiome on disease and pharmaceutical therapeutics.

Whilst it could be assumed that the gut microbiome would only affect diseases of the gut, and the oral microbiome diseases of the mouth, research has uncovered a more complicated truth.[4] Irinoteran is a selective topoisomerase I inhibitor, which exists as a prodrug when it is first administered intravenously. When it reaches a tumour, it is converted into its active metabolite, SN38, by carboxylesterase-converting enzyme (CCE), and there interferes with DNA transcription, thus preventing cancer cells from replicating. When the drug is

eliminated from the body, it is converted to the inactive metabolite SN38G by the hepatic uridine diphosphate glucuronosyltransferase system, before being eliminated in the faeces.[5] However, side effects including toxicity and diarrhoea were observed in the majority of patients, and it was found that bacterial β-glucuronidase was present in the intestinal mucosal lining, and that this enzyme was converting SN38G back to SN386. SN38 is toxic in the intestines, and was 'eating away' at the intestinal lining, causing the diarrhoea and toxicity, partly through electrolytes passing through the weakened intestinal wall and being eliminated from the body.

Researchers tried prescribing oral neomycin and bacitracin alongside irinoteran to patients during a 2004 clinical trial, and found that this prevented diarrhoea for three cycles of infection, and for even longer in some patients' cases. Penicillin and streptomycin were also used in separate clinical trials, and were found to be as effective. The Chinese herb hange-shashite was also suggested, as it is a known β-glucuronidase inhibitor. In 2009, it was proposed that the problematic enzyme was being formed by E coli in particular, and this allowed researchers to target this bacteria specifically, without destroying the microbal ecosystem in its entirety.[6]

Irinoteran isn't the only drug which is affected by the gut microbiome. Another example is levodopa, a drug used in the treatment of Parkinsons' disease, a neurological disorder of several origins. Levodopa is used to correct the dopamine imbalance in the brain. It is ingested orally, and crosses the blood-brain barrier before being decarboxylated in the central nervous system. However, researchers have found instances where the drug has become decarboxylated in the gut, thus preventing it from travelling to the central nervous system and reaching its intended target. This then brings into consideration as to whether oral ingestion is the most efficient way to administer the drug, or whether intravenous methods could be used.

The human microbiome can be split into two groups, defined as either 'core' or 'variable'. The core group is most similar between different microbiomes. The amount of diversity in the overall microbiome correlates to various medical conditions; for instance, a low diversity tends to signal a greater risk of irritable bowel syndrome and obesity, whilst a high diversity correlates with infections such as bacterial vaginosis.[7] A study of the microbiota in mouse obesity showed that the microbiome can directly influence weight. Obese mice tended to have a larger number of Firmicutes, and fewer Bacteriodete in comparison to normal, wild-type mice, and a study of their faeces showed that this allowed them to absorb more energy from the same amount of food.[1] This study was repeated with TRL5 knockout mice, and whilst the overall results were the same, the obesity occurred due to an increased appetite, not a change in the metabolism of food.

A similar experiment was then run using human models, both lean and obese, and it was found that by varying their energy intakes the numbers of Firmicutes and Bacteriodetes changed, as in the mouse models.[8] Each 20% increase in Firmicutes and a 20% decrease in Bacteriodetes correlated with an ability to harvest an extra 150kcal.[9] Naturally, this is not the only factor for energy harvest; for instance, the fibre levels in one's diet can negatively affect energy harvest.

Whilst this experiment included both lean and obese participants, the study group was small and consisted of Caucasian males only. Therefore, a much larger trial would be required so as to check the validity of these results. However, if the aforementioned results are indeed present in humans, then an alteration of the Firmicute and bacteriodete populations could help those with weight issues. This alteration could be brought about either by increasing the number of Bacteriodetes via fecal transplants, or through reducing the number of Firmicutes with antibiotics.

However, the relationship between the microbiome and pharmaceuticals isn't all bad news. Studying the variations across patient groups, such as different ethnic groups, age groups, and taking into account environmental factors, could lead to advances in personalised medicine, be that aimed for the individual or the group. For instance, it has been noted that there is a bias towards Western participants in clinical trials,[10] and therefore studying the differences between the microbiomes of various ethnicities could lead to more successful treatments. Going further along this route, is it possible that future health professionals will become trained at sequencing, so as to provide an immediate diagnosis and prescription or care plan? This would lead eventually to a shortening of the gap between the laboratory and the patient, with personal treatment plans aimed specifically at influencing the army of microbes alongside the main disease treatment. Whilst the idea of precision medicine seems far away now, advances in linking the microbiome to the pharmaceutical industry are coming thick and fast. Who knows what the future of personalised medicine will hold?

For instance, rituximab is a first line cancer treatment, which works for only 20% of participants. A laboratory claims to have designed a test which can tell whether the participant will benefit from the drug, thus sparing the other 80% from false hope, as well as allowing

health professionals to save time and resources which would otherwise be wasted, and to aim these towards alternative treatments. While this seems to be a perfect solution, there are issues with flawed tests, results which are affected by variables unknown, and, of course, the possibility that the pharmacokinetics of the drug are not fully understood. If any of this is the case, 'care plan tests' could become dangerous to the patient, as seen in a recent botched test which caused women to have parts of their ovaries removed unnecessarily. This being said, using pharmacometabonomics to predict the metabolism and toxicity of drugs in specific patients could open a welcome door.[11,12] Even paracetamol, a common painkiller, is affected by the microbiome. There are p-cresol producing bacteria in the gut which inhibit paracetamol metabolism,[13] and simply looking at a patient's pre-dose metabolite profiles could aid doctors in administering the most effective painkiller for each patient. The effects of the human microbiome on the body are as varied as the microbiome itself. In order for the effects of the microbiome on disease and medicine to be fully harnessed, much more research needs to be conducted. The huge variation in microbiomes between humans is surely the largest stumbling block towards fully understanding their interactions on pharmaceuticals, but trends can clearly be seen: from the changes in the microbiome which could potentially aid weight gain to the increase in toxicity of an otherwise life-saving cancer drug.

Hopefully, the future will bring a greater understanding of this personal army of microbes, and personalised treatments may well become the norm. Either way, there are many secrets still to be uncovered, and many questions to be answered right under our noses.

References

1. L. K. Ursall et al, 2012, Defining the Human Microbiome, Nutr. Rev., 70, 38-44
2. P. Amon, I. Sanderson, 2017, What is the Microbiome?, Arch Dis Child Educ Pract Ed, 0, 1-4
3. HMPC, 2012, Structure, function and diversity of the healthy human microbiome, Nature, 486, 207-214
4. M. Zarco et al, 2012, The oral microbiome in health and disease and the potential impact on personalized dental medicine, Oral Diseases, 1, 109-120
5. A. Alimonti et al, 2004, New approaches to prevent intestinal toxicity of irinotecan-based regimens, Cancer Treatment Rev., 30, 555-562
6. A. Stringer et al, 2009, Irinotecan-induced mucositis manifesting as diarrhoea corresponds with an amended intestinal flora and mucin profile, Int. J. Exp. Path, 90, 489-499
7. B. Schroeder, F. Backhed, 2016, Signals from the gut microbiota to distant organs in physiology and disease, Nature Med. Rev., 22, (10), 1079-1089
8. J. Shen et al, 2012, The Gut Microbiota, Obesity, and Insulin Resistance, Mol. Aspects of Med., http://dx.doi.org/10.1016/j.mam.2012.11.001
9. R. Jumpertz et al, 2011, Gut Microbiota and Nutrient Absorption in Humans, Am. J. Clin. Nutr., 94, 58-65
10. N. Schork, 2015, Time For One Person Trials, Nature, 520, 609-611
11. H. Haiser, P. Turnbaugh, 2012, Is It Time for a Metagenomic Basis of Therapeutics?, Science, 336, 1253-1255
12. I. Wilson, 2009, Drugs, bugs, and personalized medicine: Pharmacometabonomics enters the ring, PNAS, 106, (34), 14187-14188
13. J. M. Kinross et al, 2011, Gut Microbiome-Host Interactions in Health and Disease, Genome Medicine, 3, 14

2nd Prize
UKICRS Essay Competition 2017

Social media and science – friend or foe?

by Rita Trindade

Are scientists technology-inept, incapable of using social media, or is there no place for science in that context? I would say neither.

Social media began in the early 2000s and has found a special place in our lives ever since. We cannot imagine a world without Facebook, Twitter or Instagram. The truth is we have become attached to technology and in love with the boundless interactive possibilities that social media offers. It has given us a certain sense of freedom in the way we portray ourselves to the world. Fair enough, there are times when we are just sharing what we had for dinner - but the ability to visually share that in real time with a friend that lives miles away - is something that our grandparents could never have dreamed of. According to the Office of National Statistics, the internet was used on an almost daily basis by 82% of adults (41.8 million) in Great Britain during 2016, 2.5 million people more than in the previous year. We use the internet for everything: read news, spy on our friends' lives, check the quickest way to go to work or forecast the weather for the weekend – hoping to enjoy that pint on a pleasant sunny afternoon. This easy access to information has had a huge impact not only in the way we live, but also in relevant areas like politics, healthcare and, especially, in science.

We have reached an era of knowledge democratization. It is no longer an elite of hand-picked, chosen people who uphold the truth. Everyone can now contribute and have their say. You may think that's great – and truly is! – but as Spider Man's uncle said, "With great power comes great responsibility". Social media, and the internet in general, is filled with all sorts of wonders but it also houses a fair share of (mis)information. "Fake news" has been a recent hot topic but, unfortunately, it's not a new phenomenon in science. Sensationalised and click-bait headlines are particularly common in stories related to scary chemicals or miraculous vegetables. Surely you have read about some innocuous products that after a "study" were found to be carcinogenic. Nutella, canned tomatoes or even Facebook

have made it to the list of nasty human creations likely to cause cancer. Those articles can be a mix of shady unproven science, questionable views from some "off-the-shelf" doctor or a result of misinterpreted original research findings. A recent headline comparing a glass of red wine to an hour in the gym is one of these examples. What the original study, published in the Journal of Physiology demonstrated, was that resveratrol, a natural compound present in some nuts and fruits, such as grapes (hence in wine), enhances exercise performance. These findings, can be especially relevant for physically incapacitated people, boosting the little workout they are able to do. Wine was never mentioned as a substitute for hitting the gym, and it shouldn't be an excuse for you to avoid that Thursday evening spinning session. Besides, to get enough resveratrol to boost your performance, you would have to drink anywhere from 100 to 1,000 bottles of wine per day which seems just a bit excessive. Examples like this are much more common than you may think and can easily be fake news, bad journalism or even a hoax.

The combination of mainstream media channels and highly influential individuals can also contribute for public misinformation. President Trump in one of his (in)famous tweets suggested that China had invented climate change to "make US manufacturing non-competitive" (global warming could not be real as it was "really cold outside"). Additionally, by sharing and retweeting those same articles and statements, the public is allowing a vicious cycle of unreliable ideas on social media to be perpetuated. The Emerging Media Studies division at Boston University found that members of the public spreading inaccurate information about antimicrobial resistance (AMR) on social media were likely to contribute to antibiotics misuse by their friends and family. Such misuse poses a public health threat as it contributes to the emergence of superbugs, which shouldn't be treated lightly. This highlights the increasing need for all the scientific community to have a more active role on social media, particularly when it comes to challenging misleading information online.

Scientists could use social media as an effective tool to get their message across to a much broader, general audience. But the majority seems not to. Where are they hiding then? It could be argued that researchers are not good communicators, or cannot communicate in an exciting way. We can all remember that conference, sitting in the first row, where we almost fell asleep after an hour of a monotone lecture. To have impact, science must be communicated effectively. Why are we so good at posting our last evening's dinner on Instagram, but are unable to make our research look compelling?

A recent study in 2016 investigated how scientists use social media to communicate their research. It surveyed almost 600 individuals from a range of academic subjects and found that although the majority could appreciate the potential of social media to communicate science, they have yet to adopt it as a commonly used tool to disseminate research findings. The study outlined that scientists do lack of training on how to use social media for professional purposes. Curiously, few researchers regarded Facebook as suitable for science communication, yet bad science is still being posted on Facebook. Another survey, by the Agriculture and Food Development Authority, targeting publicly-funded researchers in the UK and Ireland, found that these scientists were more interested in engaging online with other academics or relevant industry key-stakeholders than with the public. Only a small percentage, in fact, used social media to communicate science to lay audiences. Scientists have a social duty to communicate their findings to society. It is "tax-payers'" money that is being used to fund relevant research to tackle some of society main issues, and we owe it to people to communicate our findings to them.

Times are changing and, as I write this article, we are witnessing a science communication revolution. We are moving towards engaged research, especially in the UK and Europe, to draw public attention to science. Scientists, universities and research institutes are allocating more resources to outreach activities. Events such as Cheltenham, Green Man and British Science Festivals are among some of the more relevant, both nationally as well as internationally. Influential scientists, like Neil deGrasse Tyson and Richard Dawkins, or institutions like NASA are helping to promote science to the highest standard and inspire young bright minds. It is all changing and we can – and should – be part of that revolution.

Social media will continue to exert a profound influence on science communication and the way the public perceives research. It is a real double-edged sword. Friend or foe? It all depends on our approach as scientists.

Smart health for the smartphone society: A message from the past

3rd Prize
UKICRS Essay Competition 2017

by Roselle Bunayog

Here's a contemporary tale of Rip van Winkle: we hummed ourselves to sleep and were awoken with the advent of computers, telephones, television sets and autofocus cameras. We reverted back to an ephemeral snooze and to our surprise, found a diminutive tool that accommodated the devices we had applauded years before. With a magnificent record of over 2.6 billion subscriptions,[1] the pocket-sized tool has inevitably penetrated every common household. What is deemed as the most dependent tool of the generation was initially known as the Simon Personal Communicator or IBM Simon. Its humble amalgamation of telephone and personal digital assistant (PDA) elements paved the way for Nokia, Ericsson, Microsoft and yes—Samsung and Apple.[2] The device has proven its absolute aptitude towards convenience and usability. In fact, it is believed that smartphones are more commonly used than laptops or computers. However, as the crowd inherently desires for far more attributes, the generation may suffer a well-rounded discipline of health injuries. Working our way back to the ancient times, our human ancestors were engaged in an immense hunt for food by means of hunting and gathering. Thus, an active lifestyle presented slender bodies and long legs – evolutionary adaptations in a particularly dynamic environment. However, the proliferation of agriculture about 10,000 years ago had abruptly prevented the sloth-like pace of natural selection to take place. Bodies prone to long distance marathons were now exposed to relatively immobile activities such as farming. At about 250 years ago, the Industrial Revolution conferred much rapid changes that it left our bodies out of place.[3] Taking a step forward, the rise of a technological culture had alleviated almost entirely any human effort. We weren't prepared for it, at least our bodies weren't. The excessive use of the smartphone raises physical symptoms such as dry eyes, carpal tunnel syndrome, repetitive motion injuries, wrist, neck, back and shoulder pain, migraine and numbness in the thumb and index fingers.[5] All types of pain related to long-term usage of smartphone occur because these body parts were underused (with the exemption of finger-related numbness). Interestingly, eye vision maladies reap dangers in the survival of hunter-gatherer societies that natural selection eliminated it in the first place.[6] Thus, eye related disorders were found to be rare in these ancient groups. However, the modern generation showed prevalence

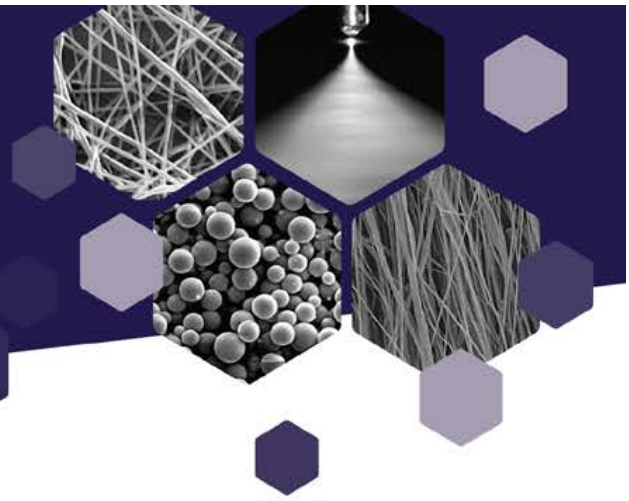
of eye vision disorders due to a myriad of alterations in human behavior, one of which includes spending hours in front of virtual screens. Moreover, prolonged exposure to the electromagnetic waves elicited by mobile phones may potentially cause hearing loss among individuals engaged in daily phone conversations of about two hours5. In 2015, a study revealed that the incessant use of smartphones has been found to be potentially associated with depression, low sleep quality and anxiety. Prior exposure to the luminescent screens may have contributed to the suppression of melatonin secretion resulting to delay of sleep and possibly, anxiety.[4] Inasmuch, sedentary lifestyles which include continuous burrowing into smartphones had developed diseases such as obesity, diabetes and cancer, all of which were never heard of during the early periods. Daniel Liebermann, a professor at the Harvard University, diagnosed the concept as the "mismatch hypothesis.[7,8] From an evolutionary perspective, engaging in an active lifestyle and consumption of a healthy plate seem to be the compelling dose of prevention. "Our old genes can't change but our environments can", says Professor Lieberman.[9] To impede any back or neck pain from those head-bowing phone habit, evolution suggests consistent movement, which means holding those glamorous yoga poses or engaging in a 10-minute aerobic exercise. In this way, it will not be a necessity to purchase those deluxe back supports that would probably elicit more pain. Moreover, consistent referral treatment would only sustain these health flaws in the population. Brittle bones or muscle atrophy may be passed down to generations, further magnifying the problem.[9] Anxiety and stress had played grandiose roles in the strategic survival of our ancestors. The only difference is that the stress experienced in the Paleolithic times lasted only for a short span, targeting acute problems alone. There was no such thing as chronic stress because there aren't really chronic problems in this environment. For instance, if a deer hears a startling noise in the forest, it would rapidly flee from the site until it finds a safe haven, thereby it calms down once it knows the threat is gone.[10] Nowadays, humans can't get off their minds for a considerable number of things for a longer time – shall I impress my boss for next week's conference? Will I be able to achieve my childhood dream? How will I pass my chemistry examinations? But what's exhausting about the present generation is the fear of falling behind digital updates – Did my friends see what I posted online? Why haven't she called me? How many followers do I have now? Our brains are not wired for a delayed gratification or dilemma. Since it has adapted to an immediate response basis (much like the rabbit in the forest story), evolution suggests shifting our long-time worries to a daily routine.10 For instance, if we worry so much about getting that beach body in Instagram photos, we can think about avoiding that movie marathon pizza and soda craves for the evening. If we worry so much about the need to be popular by gaining a multitude of text messages or calls, we can think about spending a girl's day out with our mom and sisters. If we worry so much about achieving a happy and long life, we can think about what limits us from doing so. We can start by gradually restraining ourselves from smartphones by placing it in silent mode or turning off any unnecessary notifications. The small and brave act can lead to a sense of realization that there's more to life than being glued to a thin-sliced pocket-sized box. Evolution seems to be the clandestine chapter that could offer us a renowned, sustainable solution. Twenty years might appear sufficient for our Rip van Winkle-smartphone development but the roles of natural selection and evolution takes more than that. Even if our bodies are incapable of adapting to a smartphone society, our behavior must lead a radical way. As we progress towards the future, it might be a smart move to heed an important message from the past.

References

1. Lunden, I. (2015) 6.1B Smartphone Users Globally By 2020, Overtaking Basic Fixed Phone Subscriptions. https://techcrunch.com/2015/06/02/6-1b-smartphone-users-globally-by-2020-overtaking-basic-fixed-phone-subscriptions/
2. Pothitos, A. (2016) The History of the Smartphone. http://www.mobileindustryreview.com/2016/10/the-history-of-the-smartphone.html
3. Wheelwright, J. (2015) From Diabetes to Athlete's Foot, Our Bodies Are Maladapted for Modern Life. http://discovermagazine.com/2015/may/16-days-of-dysevolution
4. Demirci, K., Akgonul, M., and Akpinar, A. (2014) Relationship of smartphone use severity with sleep quality, depression, and anxiety in university students. Journal of Behavioral Addictions, 4(2), pp. 85-92
5. Oktay, F., and Dasdag, S. (2009) Effects of Intensive and moderate cellular phone use on hearing function. Electromagnetic Biology and Medicine (25) 1
6. Cordain, L., Eaton, S.B., Miller, J. B., Lindeberg, S., and Jensen,C. (2002) An evolutionary analysis of the aetiology and pathogenesis of juvenile-onset myopia. Acta Ophthalmologica, (80) 2, pp. 125-135
7. Kim, H. (2013) Exercise rehabilitation for smartphone addiction. Journal of Exercise Rehabilitation, 9 (6) pp. 500-505
8. How Our Stone Age Bodies Struggle To Stay Healthy In Modern Times (2013). http://www.npr.org/2013/09/30/227777434/how-our-stone-age-bodies-struggle-to-stay-healthy-in-modern-times
9. The Story of the Human Body. (2013). http://harvardmagazine.com/2013/10/daniel-lieberman-story-human-body
10. Clear, J. (2017) The Evolution of Anxiety: Why we worry and what to do about it. http://jamesclear.com/evolution-of-anxietyevening spinning session

Spraybase®

Electrospinning & Electrospraying Instruments



ABOUT:

Spraybase® is a leading supplier of customisable instruments for electrospraying, electrospinning and melt electrospinning a wide range of materials into particles and fibers in the nano and micrometer range.

APPLICATIONS:

Our instruments are utilised to enable your research needs n the fields of:

- Drug delivery
- Cell/Drug Encapsulations
- Tissue Engineering…and more!

ADVANTAGES

- Increased Yield
- Reduction in solution used
- High Encapsulation efficiency

COMPARISON:

Electrospraying Vs. Spraydrying

Comparison	Electrospraying	Spraydrying
% Yield	66%	28%
Approx. solution used /g	4.5ml/g	163ml/g
Particle Diameter	1.5um	1.5um
Optimised % Drug Encpasulation Effciency	93%	93%

Visit our website for more information: www.spraybase.com

THE VALUE OF SECRECY FOR BIG PHARMA

by Andy Sanderson and Ling Zhuang

While pharmaceutical companies are more likely to seek patent protection for their inventions, trade secrets can be useful too, particularly following two recent legislative developments.

The approval of the EU trade secrets directive and enactment of the Defend Trade Secrets Act (DTSA) in the US, both in May, were intended for stronger protection of trade secrets in the world's most developed markets. The aim of the directive was to harmonise national trade secret laws of all EU member states by providing a uniform definition of a trade secret and outlining civil remedies available against unlawful acquisition. Similarly, the DTSA aimed to provide federal jurisdiction for the misappropriation of trade secrets, which previously was addressed only at the state level by the Uniform Trade Secrets Act (UTSA).

Trade secret definition

The DTSA and the EU directive both seek to enhance protection of confidential information, where the commercial value lies in its confidentiality.

According to the directive, a trade secret must satisfy the following criteria:

1. It is secret in the sense that it is not, as a body or in the precise configuration and assembly of its components, generally known among, or readily accessible to, persons within the circles that normally deal with the kind of information in question;

2. It has commercial value because it is secret; and

3. It has been subject to reasonable steps under the circumstances, by the person lawfully in control of the information, to keep it secret.

This is closely aligned with language used to define a trade secret in the TRIPS Agreement (article 39.2), which came into force on January 1, 1995 in all World Trade Organization member states.

The DTSA and the UTSA both define a trade secret as information, including a formula, pattern, compilation, program, device, method, technique, or process, that:

1. Derives independent economic value, actual or potential, from not being generally known to, and not being readily ascertainable by proper means by, other persons who can obtain economic value from its disclosure or use; and

2. Is the subject of efforts that are reasonable under the circumstances to maintain its secrecy.

In both cases, such a broad definition of a trade secret could, in practice, encompass any type of confidential business information with commercial value, such as recipes, data, compilations, programs, client lists and methodology/knowhow.

An unenforceable right

Management of intellectual property assets can lead to opposing choices for companies, such as whether to disclose commercially valuable information in return for exclusive rights, or to keep information secret.

At the outset, there are some obvious advantages to trade secrets. Unlike patents, there is no requirement for a trade secret to demonstrate any statutory requirements before qualifying for protection. Therefore, trade secrets relating to subject matter excluded from patentability, such as abstract ideas, client information and experimental data may represent valuable assets.

While patent protection in many territories is limited to 20 years from the date of filing, the period of protection conferred by a trade secret can be indefinite, as famously exemplified by Coca-Cola's formula and Kentucky Fried Chicken's coating mix.

However, trade secrets do not confer exclusivity. The proprietor of a trade secret cannot enforce any rights over parties who can independently derive or reverse-engineer the same information. In addition, a competitor who discloses the trade secret, irrespective of means, could render it worthless.

Clinical trials

Big Pharma represents some of the most research-intensive companies in the world. Data generated from the research is pivotal to shaping drug development and is, hence, a coveted IP asset. However valuable they are, details of clinical trial methodologies and primary data are generally not patentable.

There is enormous pressure for pharma companies to publish the most polished clinical trial data and in many cases negative data is not published. However, there has been a rising demand for increased transparency and disclosure of clinical trial information, as reflected by the approval of the EU clinical trial regulation in April 2014. The regulation requires companies to submit clinical trial data to the publicly accessible EU database, but provides that information can be withdrawn on the grounds of "protecting commercially confidential information".

Companies argue that 'negative' data can also be considered a trade secret, for instance where failures can point drug development towards new patentable compositions, medical uses, and dosage regimes, etc. The EU trade secrets directive also appears to allow for this interpretation. Moreover, disclosure of such information could provide competitors with clues on avoiding pitfalls in drug development at no extra expense. Hence, it is conceivable that the EU directive may provide companies with greater flexibility and control over their clinical trial data.

Although there are provisions in the directive for cases in which alleged unauthorised disclosure is exempted from the civil remedies, including "exercising the right to freedom of expression and information" and "for revealing misconduct, wrongdoing or illegal activity" in the name of public interest, it is up to individual member states to interpret whether publication of clinical trial data would fall within that scope of exemption.

For example, there have been high profile cases where clinical trials did not fully convey the safety profile of a drug, and as a consequence have put patients and clinical trial volunteers in serious, if not mortal, danger. Such information would presumably be considered in the interest of the general public. The EU clinical trial regulation explicitly states in article 81(b) that confidential information cannot be exempted from publication if there is an overriding public interest in disclosure. However, whether withdrawal of clinical trial data from publication is against the interests of the public can be determined only on a case-by-case basis.

Diagnostics and platform technologies

The rapid advancements in bioinformatics have created opportunities for biotech companies to develop platform technologies, most notably in the field of diagnostics. Diagnostic platforms focus more on large scale screening of genes, proteins and metabolites, than on individual molecules or cells, and derive value from their ability to distinguish between multitudes of diseases when paired with bespoke analytical software.

In practice, patent protection for combinations of biomarkers may not provide comprehensive protection (substitution of just one biomarker in a signature may allow competitors to work around a patent claim and patent protection of each individual biomarker may be economically unfeasible).

As such, analytical software and proprietary biological databases could represent valuable trade secrets. For example, a diagnostic device, although having a unique combination of biomarkers which is patent-protected, may only provide a meaningful diagnosis only when paired with relevant software. In addition, information captured by a diagnostic device could be kept confidential and used to further evaluate and fine-tune analytical methods. Hence, a combination of patent protection on unique arrays of biomarkers and trade secret protection over analytical software could provide complementary protection of IP assets.

Patentable subject matter in the US

The importance of trade secrets in the life science industry is becoming increasingly relevant in the US, where recent changes to guidelines for examination at the US Patent and Trademark Office have applied increasingly severe

limitations on the patentability of natural products and methods using laws of nature.

In 2012, the US Supreme Court, in Mayo v Prometheus, declared that Prometheus's patents related to the application of natural laws (namely, the metabolism of a drug) and therefore were not patent-eligible subject matter under US patent law. Similarly in 2013, the Supreme Court decided in Association for Molecular Pathology v Myriad Genetics that the isolated BRCA1 and BRCA2 genes, which formed the basis of Myriad's patents, were merely products of nature.

These judgments created enormous legal uncertainty on whether diagnostics, genetic or drug screening methods are considered patentable subject matter. As a consequence, many biotech companies are vulnerable to exposing their inventions to competitors while being unable to seek adequate patent protection. Until the guidelines on patentability become more lenient towards the biotech industry, companies in the field of diagnostics may favour trade secrets over patent protection.

Patents have historically provided strong protection for a new composition, such as a new active pharmaceutical ingredient or a new molecular marker. However, as discussed, innovation in pharma and biotech industries also heavily relies on the protection of IP assets not otherwise covered by patent protection. Moreover, advancements in genomics and proteomics mean that many biological molecules are already disclosed to the public, and combined with the growing limitations on patentability in the US, are creating obstacles to claiming exclusive rights over the use of those compounds.

Indeed, companies which focus on developing a few blockbuster drugs for a select number of indications would clearly benefit from patent protection, whereas companies looking to develop diagnostics, personalised therapeutic regimes and the like could also benefit from 'black box' models, in which aspects of the invention are kept secret.

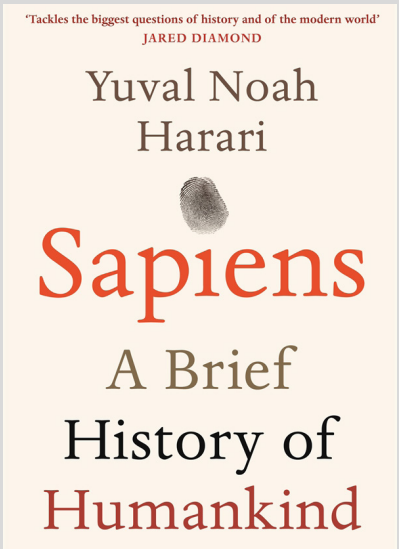
Andy Sanderson is a senior associate at Potter Clarkson. He can be contacted at: andrew.sanderson@potterclarkson.com

Ling Zhuang is an assistant at Potter Clarkson. She can be contacted at: ling.zhuang@potterclarkson.com

Article reproduced with permission from the Life Sciences Intellectual Property Review website (www.lifesciencesipreview.com). Life Sciences Intellectual Property Review tracks the increasing challenges for intellectual property specialists in the rapidly evolving world of life sciences.

LSIPR
LIFE SCIENCES INTELLECTUAL PROPERTY REVIEW

THE BOOK NOOK



Sapiens: A Brief History of Humankind
by Yuval Noah Harari

100,000 years ago, at least six human species inhabited the earth. Today there is just one. Us. Homo sapiens. How did our species succeed in the battle for dominance? Why did our foraging ancestors come together to create cities and kingdoms? How did we come to believe in gods, nations and human rights; to trust money, books and laws; and to be enslaved by bureaucracy, timetables and consumerism? And what will our world be like in the millennia to come?

In Sapiens, Dr Yuval Noah Harari spans the whole of human history, from the very first humans to walk the earth to the radical – and sometimes devastating – breakthroughs of the Cognitive, Agricultural and Scientific Revolutions. Drawing on insights from biology, anthropology, palaeontology and economics, he explores how the currents of history have shaped our human societies, the animals and plants around us, and even our personalities. Have we become happier as history has unfolded? Can we ever free our behaviour from the heritage of our ancestors? And what, if anything, can we do to influence the course of the centuries to come?

2018

UKICRS Symposium & Industrial Workshop

4–5 June 2018
Riddel Hall
Queen's University Belfast
Belfast, UK

www.ukicrs.org/2018-symposium.html

Registration now open!

Postgraduate: £75
Postdoctoral: £95
Academic: £120
Industrial: £200

www.ukicrs.org/register-and-pay.html

Abstract submission now open!

Oral

Poster

www.ukicrs.org/submit-abstract.html

UKICRS

CRS 2018 TRAVEL AWARDS

UKICRS is offering up to two £1000 travel awards for PhD student attendance at the 2018 CRS Annual Meeting & Exposition in New York, USA (22–24 July 2018).

In order to enter the competition, the PhD student must submit a high resolution version of a single figure, published previously in a journal article, that they deem to be particularly impressive, inspiring, or that speaks something important about their research project. The figure can be taken from one of their own articles or the work of other researchers. Full details and the online submission form are available at the UKICRS website: http://www.ukicrs.org/travel-award-for-crs-2018.html

Criteria

- Award recipients must provide evidence that their abstract has been accepted by CRS for a poster or podium presentation at the CRS 2018 conference. Award recipients must present at the 2018 CRS conference before the travel award funds are administered.
- Applicants must be UKICRS members and have actively contributed to the UKICRS chapter activities (presentation at UKICRS chapter meeting - poster or oral presentation). Membership is free (visit ukicrs.org).
- Applicants must be a postgraduate research student or postdoctoral student at a University in the UK or Ireland.
- Applicants must provide a letter of support from their academic supervisor.
- Award recipients must provide evidence that their abstract has been accepted by CRS for a poster or podium presentation at the CRS 2018 conference before funds are administered.
- Award recipients must submit a report about the conference, which will be published in the UKICRS newsletter 2019.

Application procedure

- You will need a high resolution version of the figure, and the supporting text explaining why the figure is so meaningful to the student (no more that 200 words).
- A short letter of support from their academic supervisor
- A brief description of your contribution to UKICRS activities
- The figure together with the supporting documentation should be combined into a single document and then submitted via the website as a single pdf file of no more than 3 A4 pages in length.
- UKICRS will contact the supervisors of the winning students to confirm their registration as PhD students in the UK or Ireland.

SENSE about SCIENCE

Because evidence matters

Workshops in Belfast and Dublin

Sense about Science is delighted to be running our free Standing up for Science workshops for the first time in Ireland, and applications for our workshops are now open. We'd love to be joined by lots of UKICRS members in Dublin on 8 February and Belfast on 23 February.

Join us to find out how to make your voice heard in public debates about science. Meet researchers who have engaged with the media, learn from respected science journalists, find out how researchers can influence policymakers, and get hints and tips from communications experts. Please find more information at: http://senseaboutscience.org/activities/workshops-ireland

These workshops are very popular and places are limited. Please fill out the application form to apply: http://bit.ly/2nX7s4n. If you are a member of or are funded by any of our partner organisations (listed on the flyer), please state on the application – our partners hold five priority places for this workshop. For further details, please email Ilaina (ilaina@senseaboutscience.org)

About Voice of Young Science

VoYS is a unique and dynamic network of early career researchers across Europe committed to playing an active role in public discussions about science. By responding to public misconceptions about science and evidence and engaging with the media, this active community of 2,000+ researchers is changing the way the public and the media view science and scientists.

About Sense about Science

Sense about Science (http://senseaboutscience.org) is an independent campaigning charity that challenges the misrepresentation of science and evidence in public life. We advocate openness and honesty about research findings, and work to ensure the public interest in sound science and evidence is recognised in public discussion and policymaking.

COLLABORATE TO ACCUMULATE

Pharmaceutical research and development has historically been shrouded in mystery, a secretive activity conducted behind closed doors to protect commercial advantage. But, as big data continues to transform the industry must we remain so reluctant to share data? Katharine Briggs looks at the benefits, challenges and considerations surrounding the sharing of proprietary data.

We know that one of the challenges in medical research is the scarcity of real-world data available to academic researchers and other interested parties to develop new and improved drugs.

According to a study conducted by Forbes, the average pharmaceutical company spends $350 million to get a single drug to market. A large proportion of that cost is spent on the research and discovery of new compounds, and the lengthy biological and chemical testing of their properties in the laboratory – both in vitro and in vivo. Consequently, every pharmaceutical company is sitting on a goldmine of big data, the analysis of which could significantly reduce the product development lifecycle, and yet there remains a reluctance to collaborate.

Data sharing does happen in the pharmaceutical industry, but it is not yet standard practice and remains the preserve of special projects. One such example is the ChEMBL database. Hosted by the European Molecular Biology Laboratory's European Bioinformatics Institute (EMBL-EBI), ChEMBL is a vast online database containing bioactivity data on more than 1.6 million drugs and drug-like small molecules and their targets. Originally developed as a private resource by a biotechnology firm, it was acquired by EMBL in 2008 and has become a valued public resource for virtual screening, drug design and product development.

Share and share alike

ChEMBL is utilised by academics and industries of all sizes, strengthening innovation from new research, and the discovery of new treatments and drugs benefiting human health and agriculture. In the Strategic Vision for UK e-infrastructure report, Professor Dominic Tildesley of Unilever identified the ChEMBL database as a crucial part of the company's development of antiperspirants. Unilever used the database to identify active components for antiperspirants and the ChEMBL data to build a model of their inhibition activity. Similarly, chemists from agrochemicals business Syngenta use ChEMBL in their product development. Mark Forster from Syngenta says of the database: "ChEMBL has links between both chemistry and biology data which makes it searchable in ways that the underlying literature would not be. People at the EMBL-EBI do a fantastic job in making a vast amount of data of different types openly available to researchers, and without the EMBL-EBI resources in general I'm sure life science research would be greatly hindered."

Ethical imperative

Increased collaboration and dissemination of data is not only in the interest of public health, but is also increasingly required by funding organisations and is a vital part of achieving a reduction in animal testing. Aside from the ethical benefits, a reduction in animal testing also delivers other savings in terms of time and money, plus the data and knowledge gained in sharing data could enable more informed decisions about what substances to test and what tests to perform. An initiative led by the NC3Rs and the MHRA involving 32 organisations sharing data for 137 compounds and 259 studies, identified that the use of recovery animals could be reduced by up to 66%, saving thousands of animals globally each year.

Regulators recognise that animal testing needs to be kept to a minimum whilst still protecting man and the environment. A fundamental aspect of the European Union registration, evaluation, authorisation and restriction of chemicals (REACH) regulation is the requirement to share data from studies involving vertebrate animal testing through Substance Information Exchange Fora (SIEFs) to avoid unnecessary duplication of tests. Meanwhile, in cosmetics, The Cosmetics Regulation prohibits the use of animal testing of products marketed in the EU and their ingredients, but

also requires data on toxicological properties to be gathered as part of the product information file. In this context, data collaboration is vital to avoid stagnation in innovation.

A case for data sharing can also be made on the basis of the ethos of science described by Robert Merton which states that scientific findings should be made available to the entire scientific community to allow other researchers to conduct their own analyses and verify the results. Independent replication of research findings is seen as the fundamental mechanism by which scientific evidence accumulates to support a hypothesis. The field of genomics is regarded as a leader in the development of infrastructure, resources and policies that promote data sharing and this is cited as one of the main reasons for the rapid advance in genetic research compared to other areas of biomedicine.

Don't be left out

A key obstacle to data collaboration is the perceived need within industry to protect proprietary information. However, organisations need to be clear about how much of a competitive advantage they will lose by sharing data versus the knowledge they will gain. How unique is the knowledge they hold versus the knowledge their competitors could bring to the table? Consideration should also be given to the risk of not taking part in data sharing, as those organisations that participate will have a competitive and economic advantage over those who do not.

Frustratingly, big data in pharma is often 'locked' inside pdfs sitting in individual company archives where it is unavailable even for internal analysis, so companies are often 'protecting' data they aren't actually able to use themselves. Providing access to a larger pool of data can reveal patterns that are simply not visible in smaller component datasets where such relationships may be represented by only one or two chemicals.

It is often the case that only regulatory bodies have ready access to pooled datasets from multiple companies and therefore the opportunity to identify these broader patterns by performing cross-company analyses. This can present problems when pharmaceutical businesses submit a new drug application as broader regulatory knowledge can lead to challenges and assertions that need to be addressed, resulting in delays and the need for additional data generation for the pharmaceutical company. Research data can be valuable many years after it has been generated and fresh eyes can reveal new insights beyond those originally identified. In addition, new research topics and fields are emerging between the boundaries of traditional disciplines. By sharing data, companies can gain from external expertise in the same or different fields, opening up the data to be explored and used in ways which may not have originally been envisioned.

Academics, small biotechs, SMEs (small and medium-sized enterprises) and contractors can be included as collaborators, broadening the skills and experience still further and creating relationships which can be built on in the future. There is also an opportunity to improve data quality, as providing access to other experts will help identify errors and inconsistencies, similar to the crowdsourcing model used by Chemspider. As the costs of generating the data are also shared, it opens up the possibility for exploratory research that otherwise might not be commercially viable.

Big data

Maximising the accessibility of data will become increasingly important as in silico systems move towards the prediction of more complex phenomena for which datasets of an appropriate size, quality and coverage are limited. In a survey by the Publishing Research Consortium in 2010, access to 'datasets, data models, algorithms and programs' was ranked as important or highly important by 62% of the 3823 respondents, whereas only 38% graded these as very or fairly easy to access. Driven by the increased recognition of the importance of in silico systems, the eTOX consortium was a seven-year public-private partnership within the framework of the European Innovative Medicines Initiative. The project aimed to develop innovative in silico strategies and novel software tools to better predict the toxicological profiles of small molecules in the early stages of the drug development pipeline.

The backbone of the project was a database hosted and curated by Lhasa Limited, who acted as the honest broker for the project. The database consisted of pre-clinical toxicity data for drug compounds or candidates, extracted from previously unpublished, legacy reports from 13 European pharmaceutical companies. The database was enhanced by the incorporation of publically available, high-quality toxicology data, which was being collected by the European Bioinformatics Institute and also incorporates the RepDose database donated by Fraunhofer. Early eTOX use cases included the investigation of the relevance of specific histopathology findings (confirmed to be target related and species specific), identification of potential target related effects (leading to inclusion of specific target organs in early in vivo studies), and the implementation of a framework of four key approaches (similarity of structure, pharmacology or adverse effects and use of in silico prediction) as part of an early small molecule drug development pipeline.

The eTOX project has now ended but its legacy has led to the formation eTOXsys, a software solution that can deliver improved early drug candidate safety assessment through access to proprietary toxicology data and predictive models.

So how can pharmaceutical businesses overcome the challenges and concerns relating to data collaboration in order to reap the rewards of projects such as eTOX? Regulations to protect the privacy of personal health information are often seen as potential barriers to data sharing due to the risk of accidental, malicious or compelled disclosure. However, data can still be shared as long as privacy safeguards are in place. Redacting data to strip out individual identifiers, statistically altering data in ways which do not compromise secondary analysis and placing restrictions on access to data are all simple steps that can be taken to secure it.

A survey of 1329 scientists suggested that another concern amongst the pharmaceutical community was the idea that data could be misused. However, creating an End User License where users are required to agree to certain conditions of use, including specific authorisation requirements from the data owner and limiting access to certain users are measures that can easily be put in place to mitigate risk. Data being stored in disparate repositories, in different formats and using potentially incompatible data types presents another significant technical challenge but not one that is unsurmountable. However, the additional resource needed to convert the data to an agreed format will add to the costs of data sharing. It also makes sense to opt for platform-independent file formats for exporting and importing data such as XML (extensible markup language), CSV (comma separated value) or SDF (structure data file), which can be opened using several software applications. However, using the same format for exporting and importing data does not avoid differences in what data are captured or how those data are captured e.g. as a number, text, etc. Here, data standards such as SEND can ensure that the data being captured are compatible.

A controlled vocabulary is preferred when capturing qualitative data in order to avoid problems due to differences in spelling and terminology. The use of ontologies offers additional benefits in that the relationships – synonyms, meronyms/homonym,

hyponyms/hypernyms – between terms can also be captured. Ontologies were developed as part of Lhasa's eTOX data sharing project in order to help with cross-study data analysis where pathology findings could be reported as different levels of granularity e.g. gastrointestinal tract vs colon. Quantitative data should ideally be captured using standardised units to simplify data mining and analysis. However, this is not always practical as recalculation of values can lead to an increase in the number of errors introduced during data entry. When designing the schema, an assessment also needs to be made as to whether precise figures will always be given, or if greater than/less than values and number ranges also need to be captured.

Honest broker

Pharmaceutical companies vary in whether they consider data on marketed drugs to be sensitive data. Sensitivity of data can also change as a result of the repurposing of drugs and drug candidates. One of the eTOX project participants was able to elaborate a procedure for obtaining general permission for full or restricted sharing, dependent on the status of the compound i.e. whether it was marketed, terminated, under current development (excluding new formulations, new indications or combinations of marketed drugs) or subject to product liability claims.

Responsibility for deciding if data can be shared is often delegated to legal and IP departments. The disadvantage of this is that they only see the risks and not the benefits of data sharing and, being risk adverse, say no by default. In addition, the utility of the data can be difficult to demonstrate ahead of the data being donated. The eTOX project participants highlighted the need for a summary about the project which could be shared with upper management and departments involved in granting authorisation in order to increase publicity and to facilitate decision-making.

In the case of confidential data, an honest broker can be utilised in order to protect the security of sensitive data. This organisation needs to be trusted by all partners as they will have access to all the data and be responsible for controlling access for the other partners. A not-for-profit or academic organisation is likely to be preferred over a commercial one for this reason.

Evolution of sharing

Over the past decade, data sharing within the pharmaceutical industry has evolved from being virtually non-existent to a landscape where most companies will have gained experience through one or more initiatives. However, for the pharmaceutical sector to truly benefit, data collaboration needs to be incorporated into business as usual, rather than remaining the preserve of special projects.

Data still exists within silos and the people who could do something useful with that data often don't have access to it. There remains a fear in the sector that sharing data gives away commercial advantages when, in fact, sharing information could significantly reduce overheads and speed up the development of new drugs. With the rising cost of clinical trials and health data, the industry needs to look at collaboration as the way forward. Sharing data is not without its challenges, but with the right partners, the benefits far outweigh the risks.

Author: Katharine Briggs is Research Leader at Lhasa Limited (www.lhasalimited.org), a not-for-profit organisation and educational charity that facilitates collaborative data sharing projects in the pharmaceutical, cosmetics and chemistry-related industries.

APPS THAT MAKE US 'APPY

TUNNELBEAR
https://www.tunnelbear.com

The world's easiest to use consumer VPN (virtual private network) that securely "tunnels" your internet connection to locations around the world. TunnelBear can be used to protect your privacy, to bypass internet censorship, and to experience the internet as people in other countries experience it.

PRIZMO GO
https://creaceed.com/prizmogo

Aim at text. Shoot. It's yours! Prizmo Go lets you grab printed text easily, so you don't have to retype it. After text is recognized in a blink of an eye, you can interact with it in many useful ways. Or just send it to other apps.

iTRANSLATE CONVERSE
https://www.itranslate.com/converse

iTranslate Converse is a revolutionary new speech translation App. By holding your iPhone upside down you dramatically improve results as well as create a more natural conversation experience. It literally turns your iPhone into the first real translation device.

STOCARD
https://stocardapp.com

Fast, easy, smart, and free! Get started without registration and add all your loyalty cards to the app in seconds. No more carrying store loyalty cards.

UKICRS TRAVEL AWARD 2017

I was the recipient of the 2017 UKICRS travel grant, giving me the opportunity to attend the 44th Controlled Release Society Annual Meeting and Exposition in Boston, USA from 16–19 July 2017. I found this experience invaluable as it allowed me to personally participate in an international scientific conference of significant relevance, as well as providing me with the chance to hear numerous and varied speakers discuss their research.

Over the course of the four days, I was able to gain new insights into topics relevant to my own research, which is focused on the development of hydrogels and nanocarriers capable of delivering stem cells and other therapeutic agents to the lungs to reverse structural damage present in chronic obstructive pulmonary disease (COPD). I heard Amar Sawhney – a world renowned leader in hydrogel research – discuss various aspects of hydrogel formulation and applications. With my own interest in nanoparticles for drug delivery, I also thoroughly enjoyed talks by Yvonne Perrie ('High Throughput In Vitro Screening of Surfactants and Surfactant-based Nanomedicines for their Biological Action') and Cian O'Leary ('The Development of a Tissue-engineered Tracheobronchial in Vitro Co-culture Model Using Bilayered Collagen-Hyaluronate (CHyA-B) Scaffolds: A Platform for Predicting Outcomes in Respiratory Drug Development').

Attending a conference which showcases scientific research that aligns closely with my own was a very interesting experience, and I felt that being able to network with other researchers with similar interests was very beneficial. I was presented my research during a poster session at the conference, and received useful feedback from other conference attendees.

Many other presentations at the CRS Meeting and Exposition were both interesting and inspirational, including those by plenary speakers Robert Langer and Henry Brem, and also Paula Hammond, whose talk on 'Nanolayers for Drug Delivery: From Cancer to Wound Healing' was the highlight of my conference.

Another bonus of attending CRS in Boston was of course that I had the opportunity to visit this fantastic city. The committee of CRS provided some great 'extra-curricular"' activities such as walking Boston's famous Freedom Trail (a very educational and historical afternoon!) and a field trip to Harvard, MIT and the JFK Museum.

Overall, I found the CRS Annual Meeting and Exposition in Boston to be a hugely rewarding experience and I would like to thank UKICRS for funding my trip.

Christina Payne

PhD Candidate
Royal College of Surgeons, Dublin, Ireland

Review

UKICRS 2017 SYMPOSIUM

by Carol McCarthy

This year's annual UKICRS Symposium (30th – 31st May 2017) was hosted by the Strathclyde Institute of Pharmacy and Biomedical Sciences, University of Strathclyde, Glasgow and featured an exciting two day programme of events. As always, the symposium offered a wide range of opportunities for both young and established scientists to present their latest research and network with others from academia and industry.

The first day of the symposium was opened with a very interesting talk from Cristina De Matteis (University of Nottingham) entitled 'Public Engagement and Sharing Your Science'. This is a hot topic in the academic world as public engagement has recently become a necessary part of our job description as researchers and scientists. It is essential to start improving our science communication skills at an early stage in our careers so Cristina's talk was timely and contained many nuggets of information to help us develop our sci-comm abilities! Our second speaker was Clive Wilson (University of Strathclyde) who spoke about 'Re-inventing Yourself…the Many Roles of a Scientist'. This was another insightful talk for early stage researchers as it shows us that a successful research career is not always straight forward! Our career paths can twist and turn in many directions but that is what makes our jobs so interesting!

UKICRS is passionate about cultivating relationships with UK and Irish companies working in the pharmaceutical sector. In the afternoon, we welcomed our industrial exhibitors, including Croda, SOTAX, Spraybase, Biopharma Process Systems, Sirus, Pfizer, Precision Nanosystems, Nisco and Stable Micro Systems. They showcased their products and technologies through a series of short talks and exhibitions. Our symposium dinner took place on Tuesday evening at Maggie Mays, Glasgow where delegates enjoyed tasty burgers (with haggis for those brave enough!) and networking in a relaxed atmosphere with great live music.

The scientific programme for the second day included two keynote speakers, eleven talks from postgraduate students and postdoctoral researchers and 38 poster presentations. A total of 80 delegates attended the conference. Yvonne Perrie (University of Strathclyde) introduced the first keynote speaker, Steve Schwendeman from the University of Michigan. Steve gave a very interesting talk entitled 'Controlled Release of Large Molecules from PLGA' and touched on some highlights of his research career to date. The keynote lecture was followed by two short presentations: Edel Durack (University of Limerick) who spoke about manipulating the physicochemical properties of antimicrobial peptides using delivery matrices for therapeutic applications and David King (University of Glasgow) who discussed mathematical modelling of controlled antibiotic release from prototype orthopaedic fixation pins.

After the first session, there was a coffee break with some delicious cakes and biscuits. Some bottles of Irn Bru were also available for the local crowd and anyone feeling they needed a strong sugar rush! The second session chaired by Jayne Lawrence (King's College London) consisted of three short lectures. Najla Altwaijry (University of Strathclyde) discussed therapeutic efficacy of lactoferrin-bearing polypropylenimine dendriplex in targeting prostate cancer tumours. Twana Mohammed M.ways (University of Reading) described mucoadhesion study of silica nanoparticles in rat model and U.Eranka Illangakoon (University College London) spoke about nanofiber based drug delivery systems prepared by electrospinning and pressurized gyration.

Following a very busy poster session and lunch, the afternoon session was chaired by Carol McCarthy (University College Cork) and began with a talk from our second keynote speaker Joanne Thomas, programme manager at Sense About Science, who gave a talk entitled 'Standing Up for Science'. This nicely tied in with Cristina's talk from the previous day to once again reinforce the importance of science communication and public engagement for all those working in the science

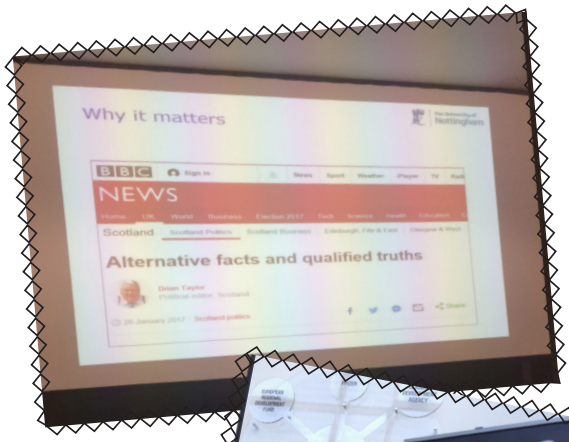
field. Hopefully, we have inspired some early stage researchers to get more involved in different forms of science outreach! She was followed by Jeremiah Kelleher (Trinity College Dublin) who discussed a comparative study to assess the suitability of spray drying versus hot melt extrusion in the production of compatible monolithic fixed dose combination products. Pundarik Prasittisart (University of Nottingham) described the distribution of hydroxypropyl methylcellulose in controlling drug release of tablets using chemical image analysis and Nicole Welsh (Queen's University Belfast) spoke about model drug delivery devices fabricated by fused deposition modelling.

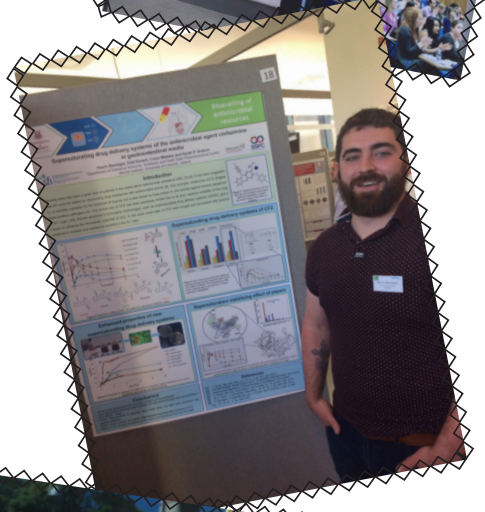
After more coffee and posters, three talks closed out the final session of the meeting chaired by Gavin Andrews (Queen's University Belfast). Diane Leite (University of Portsmouth) gave a presentation on peptide nanofibers as targeted therapies for glioblastoma multiforme. Ziad Sartawi (University College Cork) described how fingolimod and siponimod do not affect proliferation of MC3T3-E1 cells and John Totten (University of Strathclyde) discussed how silk nanoparticles are endocytosed by live breast cancer cells and facilitate lysosomotropic delivery of an anticancer drug.

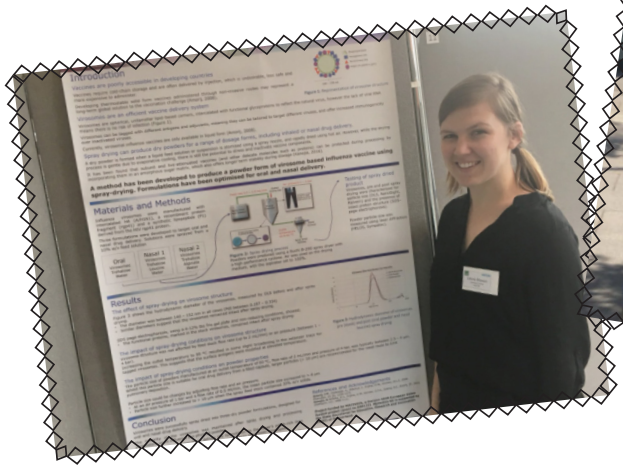
The meeting was concluded by the UKICRS chair Gavin Andrews and Yvonne Perrie who announced the prize winners for best oral and poster presentations. The prize for best oral presentation was awarded to Diana Leite (University of Portsmouth) while two poster prizes were awarded to postgraduate student Pauric Bannigan (University of Limerick) and undergraduate student Jessica Millar of Royal College of Surgeons in Ireland. Congratulations to all the prize winners for their excellent presentations!

Thank you to all the delegates, sponsors and speakers for your contributions to what was another great symposium.

We look forward to welcoming you all to Queen's University Belfast in 2018!







SCIENCE FUNDING IS A GAMBLE SO LET'S GIVE OUT MONEY BY LOTTERY

by Shahar Avin, edited by Sally Davies

Perhaps your life, like that of many of my friends and relatives, has been improved by propranolol – a beta-blocker that reduces the effects of stress hormones, and that's used to treat conditions such as high blood pressure, chest pain, an uneven heartbeat and migraines. It's considered one of the most important pharmaceutical breakthroughs of the 20th century.

Thank goodness, then, that the United States in the 1940s didn't have the same attitude to science funding that it does today. If it had, you could expect to see seven experts sitting around a table, trying to assign a score to an unorthodox grant proposal to study the function of adrenaline in the body. 'If I have properly understood the author's intent, then this mechanism has already been settled, surely,' a senior physician might say. A lone physiologist mounts a defence, but the pharmacologists in the room are dismissive, with one who remarks that the mathematics 'look cumbrous and inconvenient'. So the pathbreaking research of the late Raymond Ahlquist, a professor at the Medical College of Georgia who laid the foundations for the discovery of propranolol, could easily end up with low marks, and his theories would never see the light of day.

Science is expensive, and since we can't fund every scientist, we need some way of deciding whose research deserves a chance. So, how do we pick? At the moment, expert reviewers spend a lot of time allocating grant money by trying to identify the best work. But the truth is that they're not very good at it, and that the process is a huge waste of time. It would be better to do away with the search for excellence, and to fund science by lottery.

Superficially, the grant-giving process seems rational. Following an application deadline, academics assess and rank the proposals they've received. For example, members of a molecular biology review panel might find themselves weighing up a proposal to investigate a new biochemical pathway that's potentially relevant to Alzheimer's disease against a request to screen large protein datasets that could give rise to new treatments for diabetes. Each reviewer gives the proposal a score, and the scores are averaged across reviewers. Grants are awarded from the highest average mark downwards, stopping at the point at which the money runs out.

One big problem with this approach is that the monetary cut-off point still tends to be way above the quality cut-off point. Even though money for research has been generally increasing, the number of researchers is growing even faster. As a consequence, success rates for applicants have been falling, and adventurous proposals rarely get funded. A review panel in the 1970s might have been able to fund 40 per cent of applications, which meant it could support all of the excellent, solid proposals and still take a few risky bets. Today, a review panel can often fund 20 per cent or less of proposals submitted, leaving little chance for the likes of Ahlquist to secure funding.

Peer review adds another layer of irrationality. Sir Mark Walport, the UK government's chief scientific adviser and the former director of the Wellcome Trust, the UK's largest philanthropic funder, has labelled peer review a folie à deux because it relies on the researcher and the reviewer sharing a delusional belief in their capacity to make accurate predictions.

On the part of the applicant, she is forced to commit to a plan of action and a set of objectives or 'deliverables', most of which are probably quite hazy at the outset. Research, after all, is about finding out what you don't know, so it's a pretty messy and unscriptable process. The systems biologist Uri Alon, in a TED talk, has likened science to improvisational theatre. You might think you're going from A to B, but halfway there you get lost, stumble around, completely forget what you're even doing

there – yet, if you manage to hold on for a while, you might find C, which is valuable in its own right. But if you promised your funder to go from A to B, then finding C becomes much harder, and you aren't likely to find B anyway.

Reviewers suffer from their own version of precision-madness. When ranking proposals, panellists are making conjectures: which of these projects, given enough time, will contribute most to society? But the path from initial funding to wider social impact is poorly understood, and can take 30 to 50 years to unfold. It's ludicrous to think that you can specify, down to multiple spaces after the decimal point, the ideas that are most likely to succeed. This obsession with ranking means that we also demand excessive amounts of information from applicants, and waste a colossal amount of their time. In Australia, during a recent annual funding round for medical research, scientists spent the equivalent of 400 years writing applications that were eventually rejected.

Finally, 'expert reviewers' are not fungible commodities. One reviewer is not the same as another, and their judgements tend to be highly personal. Of the nearly 3,000 medical research proposals submitted for public funding in Australia in 2009, nearly half would have received the opposite decision if the review panel had been different, according to one notable study. As a result, the process isn't just ineffective – it's systematically biased. There's evidence that women and minorities have lower chances of securing grants than people who are male or white, respectively.

Fortunately, there's a simple solution to many of these problems. We should tell the experts to stop trying to pick the best research. Instead, they should focus on filtering out the worst ideas, and admit the rest to a lottery. That way, we can make do with shorter proposals, because the decision to accept or reject a ticket to a random draw requires less information – and highly specific proposals are unrealistic anyway. So instead of asking reviewers to make unreasonable predictions, they can turn their minds to weeding out cranks and frauds. Bias will still occur in the filtering stage, of course, but many more proposals will make it through to a lottery, which is inherently unbiased. The New Zealand Health Research Council is experimenting with such a programme, although with funding extended only to about four researchers per year, their sample size is too small to convince larger funders.

A lottery might sound like an extreme, baby-and-bathwater kind of solution. Not all scientific enquiry takes decades to play out, and sometimes there's genuine agreement that a certain strand of research is important and timely. But perhaps we could keep a small proportion of the grant money for ideas where there's a consensus among the expert panellists. Then we pluck out the bad ones and throw everything else into a pot. The trick with this triage would be to keep the bulk of the funds for the higher-risk, randomly selected proposals. My own view isn't settled – I've run computer simulations for both scenarios, and while each one comes out looking better than the current system, the comparison between them is inconclusive. Other experts who study science funding, and accept the need for a lottery, still disagree about the best model (appropriately enough). More experiments are needed.

The late Sir James Black, the Nobel prizewinning inventor of propranolol, said that the peer review system was the enemy of scientific creativity, and that his own work would have been impossible without Ahlquist's theory. Scientific thinking can often lead to progress, but the institutions of science can also create a major regress. Let's face it: getting a grant is a lottery anyway. We should at least make it official, so the whole process can be cheaper, fairer and more efficient.

WEBSITES WELOVE

DRUGBANK
https://www.drugbank.ca

The DrugBank database is a unique bioinformatics and cheminformatics resource that combines detailed drug data with comprehensive drug target information.

DISSOLUTION METHODS
www.accessdata.fda.gov/scripts/cder/dissolution/

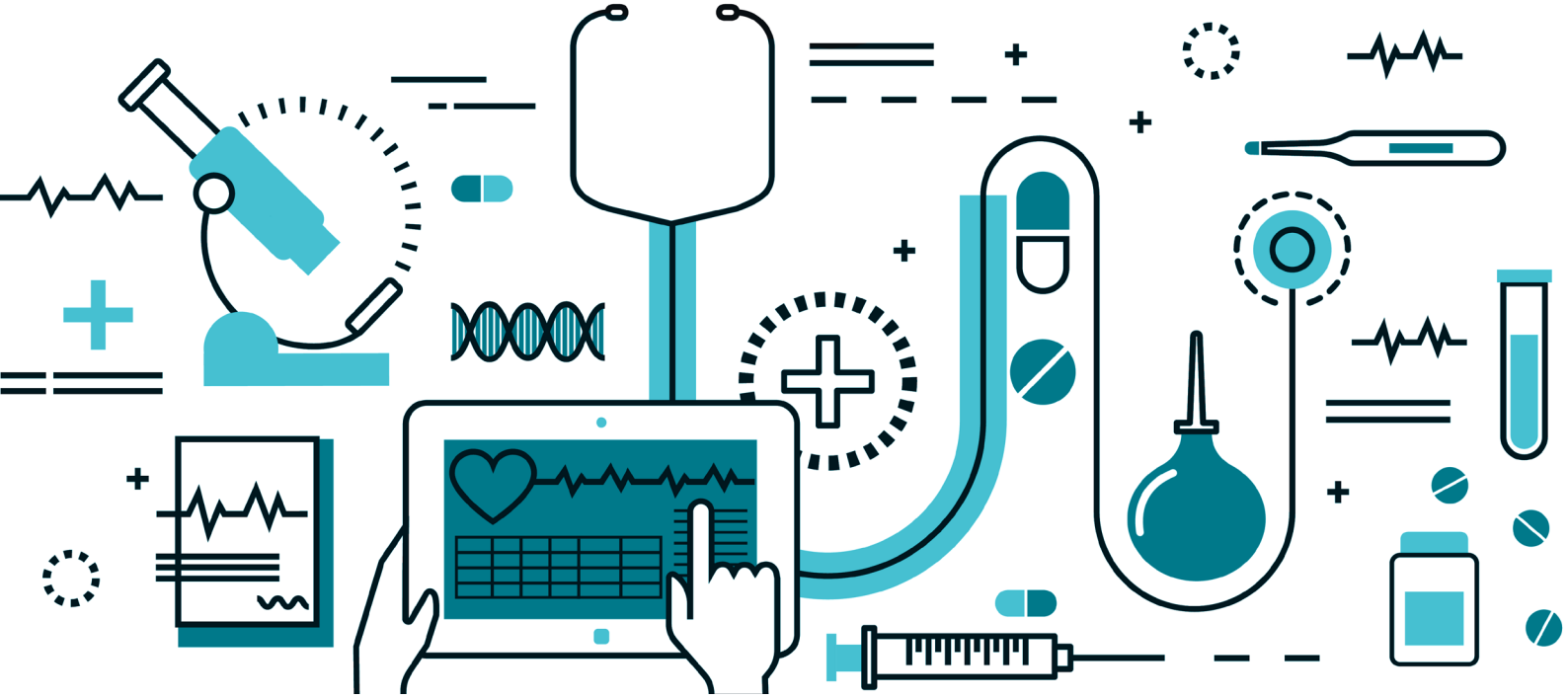
A comprehensive databse maintained by the FDA describing dissolution methods for all drug products listed in the United States Pharmacopeia.

SCIMAGOJR
http://www.scimagojr.com/

The SCImago Journal & Country Rank is a publicly available portal that includes the journals and country scientific indicators developed from the information contained in the Scopus® database. Use it to compare journals, and much more.

SENSE ABOUT SCIENCE
http://senseaboutscience.org

Sense about Science is an independent campaigning charity that challenges the misrepresentation of science and evidence in public life. It advocates openness and honesty about research findings, and work to ensure the public interest in sound science and evidence is recognised in public discussion and policymaking.



THE HIDDEN SIDE OF CLINICAL TRIALS

“[There is] a culture of secrecy that has grown up around clinical trials results. It has become the norm – in fact it has become okay – that if you get a result in a trial that you don’t like, that you can put that trial in the bottom drawer, forgot about it and move on to the next thing. It’s what’s been done the world over. It is not okay. It has got to stop.”

Síle Lane, Head of International Campaigns and Policy, Sense about Science, at TEDx talk Madrid

AllTrials is a global campaign run by Sense about Science that calls for all clinical trials, past and present, to be registered and results reported.

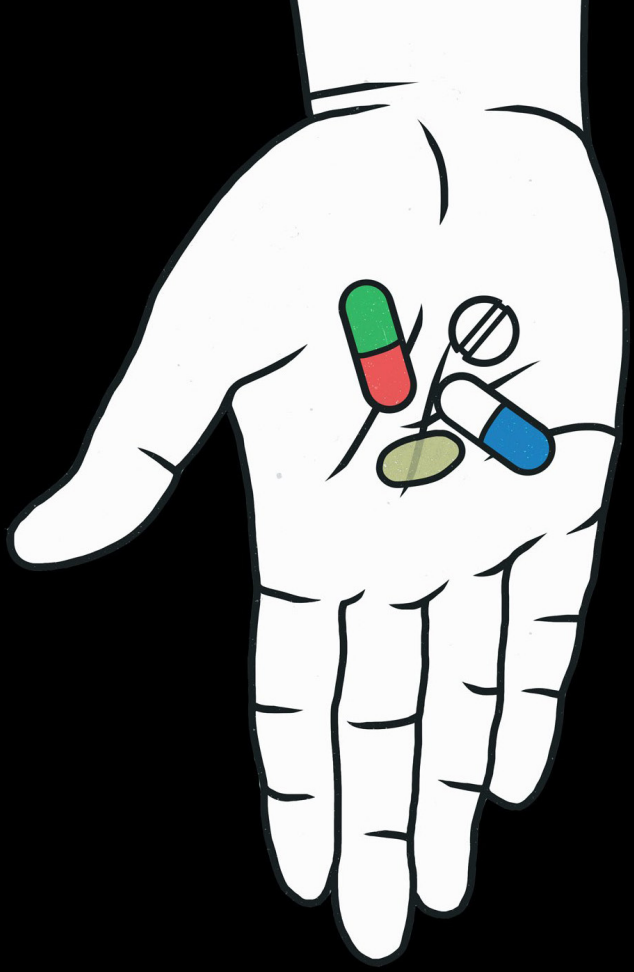
When trial results are missing, withheld, or not even registered in the first place, decision-makers, doctors and patients cannot make informed choices. It also ignores the sacrifice of the millions of volunteers in trials who enlist either because it could help them now or because it could benefit others in the future. This is an urgent issue. We risk results being lost from trials done decades ago, on current medicines, when researchers and software retire.

With the support of the thousands of patients, clinicians, researchers and members of the public, along with hundreds of organisations and the millions of people they represent across the world, we have made progress. The issue of clinical trial transparency has been recognised by the UN, the WHO and government officials across the world. In 2016 nine major global funders agreed to adopt the WHO’s strong transparency standards.

Tools like the TrialsTracker (https://trialstracker.ebmdatalab.net) are also being developed to highlight which funders, companies and academics have outstanding trials and put pressure on them to fix that.
The UK has been leading the way in shaping EU law on trial transparency, expected to come into force in 2019. With Britain slated to leave the EU in March 2019, we risk losing crucial advancements we’ve fought so hard to gain. We need to ensure that government continues to recognise their commitment to clinical transparency, and adopts the high standards they helped to develop in the EU.

Transparency around clinical trials is an ethical imperative. It’s also something everyone plays a part in – from journals who publish only trials that have reported results, to shareholders who demand transparency policies for their companies, to the researchers who can ensure every trial they conduct is registered before it begins and reported within a year of completion. Our roadmap to transparency highlights what individuals and organisations can do to push for trial transparency.

Join the conversation on Twitter using #AllTrials
Find out how you can get involved in the AllTrials Campaign by visiting www.alltrials.net



THE DARK WEB AND ITS ROLE IN THE SUPPLY OF ILLEGAL DRUGS AND MEDICINES

Jayne Lawrence (Head of Division Pharmacy and Optometry, University of Manchester) & Colin Cable (Assistant Chief Scientist, Royal Pharmaceutical Society).

The phenomenal growth of the Internet since the 1990's has resulted in people's working and personal lives being increasingly influenced by the methods of communication and the information that it offers. You only have to look at the impact of any outage in connection to appreciate how reliant we now are on the Internet for even the most simple of activities.

However, the internet can be thought of as an iceberg, with less than 1% of the total content of the World Wide Web freely accessible using search engines such as Google, Yahoo or Bing, the so-called 'surface web'. The remaining 99% of web content forms what is termed the 'deep web' of which the 'dark web' forms a small part. The 'deep web' comprises pages that are not indexed and hence search engines are unable to find them, and includes things like online banking and services that require payment such as video-on-demand.

The 'dark web' is a very small part of the 'deep web' that has been intentionally hidden and is inaccessible through standard web browsers, requiring special software or authorisations to access. The best known browser for accessing the 'dark web' is Tor (The onion router). Tor is particularly attractive to groups such as political dissidents and activists, investigative journalists and those living and working in countries where the Internet is censored as it allows an anonymity of browsing due to the type of routing and levels of encryption it uses.

The level of anonymity offered by the 'dark web' allows the proliferation of sites offering any number of criminal activities including the sale of illegal drugs and firearms, illegal finance activities such as selling credit card information, trading copyrighted materials, child pornography and the hiring of contract killers. To enable anonymity when making transactions, the 'dark web' uses the Bitcoin, which is a type of digital money.

One of the best known websites for the supply of illicit drugs is The Silk Road. In spite of the anonymity offered by the 'dark web' the FBI shut down the website in 2013, although other incarnations, some of which have also been shut down, have subsequently appeared, the latest of which is The Silk Road 3.0. A survey of the Silk Road website in October 2014 found that there were almost 14,000 listings for drugs under headings such as stimulants, psychedelics, prescription, precursors, opioids, ecstasy, and steroids.

Legal highs, now known as new psychoactive substances, produce effects that are similar to illegal drugs such as cocaine, cannabis and ecstasy. The Psychoactive Substances Act, which came into effect early 2016, makes it illegal to produce, supply, or import these agents for human consumption. However, N-Bombs (powerful hallucinogens, similar to LSD and members of the NBOMe 'family' of Class A drugs) are amongst the 'legal highs' freely available on the 'dark web'.

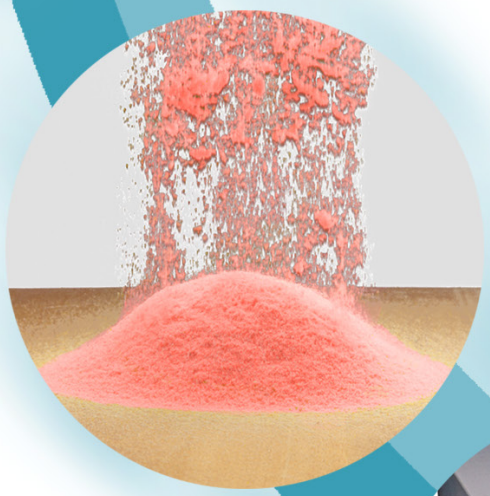
While most of the drugs available on the 'dark web' are for recreational use, prescription medicines used for conditions like asthma, depression, anxiety, and high blood pressure, can also be purchased. While the 'dark web' will not be of interest to majority of internet users extreme caution is required when buying medicines from any part of the Internet – be that the surface, deep or dark web - as there is no assurance that a product is a legitimate medicine unless obtained from a registered internet pharmacy site where some medicines can be bought but others require a prescription before a supply can be made. Even in situations where patients' unexpectedly run out of medicines, other approaches (not involving purchasing on the internet) are available including obtaining emergency supplies from a pharmacy.

While all parts of the Internet are undoubtedly useful sources of information, there is also a more sinister side to internet activities. The purchase from the Internet of anything which is to be taken, including medicines or supplements, should be approached with extreme caution as, unless bought for a registered internet pharmacy site, products may not turn out to be as expected.

biopharma group

UK contact:
bps@biopharma.co.uk
+44 (0)1962 841092

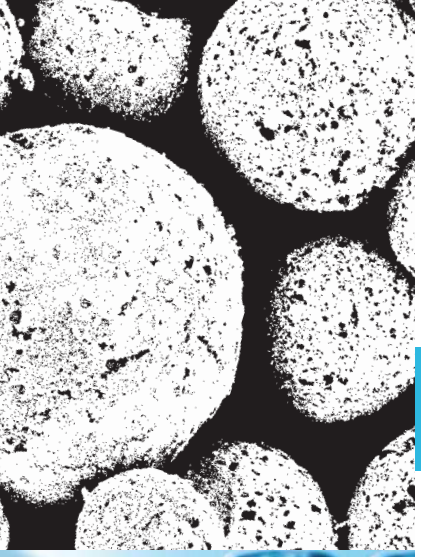
World Renowned Specialists in Freeze Drying and Associated Technologies

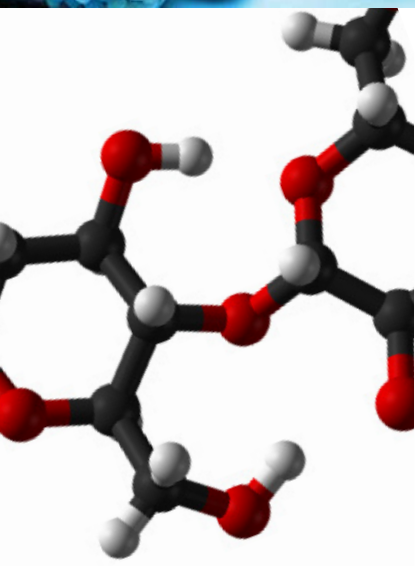


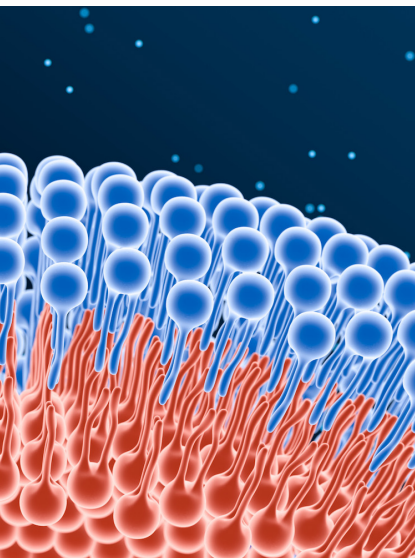
Exclusive distributors in the UK and Ireland, consult the freeze drying experts today!

Ireland contact:
info@bpscrowthorne.ie
+353 (1)1824 3670

BPS CROWTHORNE







UKICRS

United Kingdom & Ireland Controlled Release Society

ESSAY COMPETITION 2018

The 2018 UKICRS Essay Competition aims to promote scientific communication and creative thinking within the general arena of pharmaceutical sciences and drug delivery. Original essays are now invited having one of following titles:

- **'Getting it into solution'**
- **'Innovation in formulation'**
- **'Small particles for big problems'**
- **'Lipids in the limelight'**
- **'When less is more'**
- **'Breaking the rules'**

Entrants may approach the essay and the topic in whatever manner they see fit. Creative thinking and quality of writing are the key factors by which the essays will be judged. The winning entry, as judged by a panel comprising UKICRS committee members, will be awarded a cash prize of £250. Runner-up prizes of £150 and £100 will also be awarded. All prize-winning essays will be published on the UKICRS website and in the 2019 edition of the UKICRS newsletter.

The very, very important small print …

The competition is open to any and every human being living anywhere on earth. Aliens, Time Lords, creatures from advanced civilisations in this or a parallel universe, and all forms of artificial intelligence are not permitted to apply.

Essays must be submitted using the online form (http://www.ukicrs.org/essay-competition-2018.html). The essay can be uploaded either as a Word or PDF document. The deadline for receipt of applications for the essay prize is 1st September 2018. The essay should be no more than 2000 words. Please do not include graphs, diagrams or illustrations in your essay. By entering the competition, the entrant agrees to transfer copyright of the submitted essay to UKICRS, giving the Society the right to reproduce, distribute and broadcast the essay in printed, electronic or any other medium. UKICRS will also have the right to edit the essays as deemed appropriate for publishing. If your essay is not amongst the prize winners, all rights will revert back to the author. The article must be the original work of the person making the submision. Essays will be checked electronically for plagiarism. UKICRS reserves the right to withhold the prizes if the standard of essays submitted is not of sufficiently high quality.

ukicrs.org

2018

Newsletter

United Kingdom & Ireland Controlled Release Society