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Life Science Research: Tomorrow's Trends and Technologies

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As a discipline, life science research has come an extraordinary long way over the last century. The revolutionary work of life science researchers has changed how we view and understand biological systems and this new knowledge has led the way to innovative opportunities, allowing the sector to grow and evolve at a phenomenal rate.

Understanding the Life Science sector as it is today and more importantly, anticipating the changes and developments set to meet us in the future, is crucial for life scientists wishing to continue this trend of improvement and development. The current economic climate means that all researchers are facing similar challenges, with upcoming technologies and increased communication pathways enabling a whole range of new advancements.

The LifeSight report, published in July 2014, took the views of over a thousand researchers and scientists and produced a unique glimpse into current and developing trends within the life science research sector. In this article, we discuss the key issues and prospects recognised by the participants, who included Lab Managers and Heads of Department, in areas such as collaboration, funding, big data and Super-resolution microscopy and consider the impact they may have on the future of life science researchers.

Working Together

No sector can hope to develop without successful communication and sharing of data. When speaking to the life science research community, one of the key trends recognised as having an impact on day to day work is the ways in which researchers communicate, both with each other and the world as a whole.

Initially, it would appear we are talking more. An increasing amount of collaboration, internationally and between disciplines, has had a real impact on life scientists. This could be partly due to the emergence of 'Big science', which has seen an increase in large-scale projects requiring financial support and labour from many international parties. However, collaborations have also emerged due to heightened possibilities. Thanks to advances in transportation and telecommunications, including the rise of the Internet, communication between institutions has never been easier [1].

This increased communication could have some unexpected advantages. For those looking to acquire funding, the complementary skills provided by different life science researchers, may help projects meet grant conditions. Private foundations have also shown themselves willing to fund centres combining a variety of specialities and several universities have set up funds for projects running across departments [2].

Finding the funds

Across the world, in Southern Europe in particular, securing funding is proving challenging. The economic downturn in 2008 led to many government budgets being slashed and many expect the decline to continue in coming years. This is supported by recent developments – in 2012, the UK Chancellor announced the country's R&D budget would remain at its current level, which amounts to about £4.6 billion per year, through to the next election. Publicly funded science in the UK will have to try to continue to grow with another period of fixed spending [3].

With limited grants available, funders are being more particular about where money is allocated. According to life science researchers certain areas, such as translational research and clinical research, appear more likely to receive funding than others. In addition, funding is expected to become more concentrated around centres of excellence, making it more difficult for external institutions to access resources.

Crowd-funding, or funding by non-government bodies, generates a more polarised response from life scientists and the general feeling is one of uncertainty, suggesting that it may be a longer wait until we start to see this appearing more regularly. Although there are many opportunities available for life scientists to obtain funding through non-government channels, there is no strong indication that this will become normal practise.

Reaching a Wider Audience

As all researchers know, research funders have an interest in ensuring that the work produced is scientifically sound and reproducible. Published papers remain the main channel used to prove this and to communicate data and the latest discoveries.



Panel representatives at the launch of the LifeSight Report at mmc 2014: Baba Awopetu – Marketing Director, EMEA, Leica Microsystem, Dr Julian Heath, Professor Jason Swedlow, Dr Patrick Dixon, Dr Paul Verkade.

Having your name in print can also improve reputation, making funding more likely and opening doors into additional research opportunities. Therefore when it comes to the future of life science research publishing is seen as one of, if not the most important aspect in life scientists working lives.

The feeling within the life science community is that researchers who spend time and effort adding value to their data should be acknowledged. Access to scientific publications, both for professional life scientists and the interested public is a common aim throughout the sector. The rise of online journals makes this an achievable goal.

Furthermore, many feel that the huge amount of investment currently required to access scientific material puts it out of reach of the majority of the population. In 2012, it was reported that British universities pay approximately £200 million a year in subscription fees to journal publishers [4]. In the same year, Harvard University aimed to reduce its own costs for subscriptions by encouraging members to make their research freely available through open access journals. They were also recommended to resign from publications which required payment to view articles [5].

These dramatic figures demonstrate the general feeling towards this topic, which is prompting a rethink of how scientists will publish. Free access to scientific publications is seen as the next opportunity for life scientists and peer recognition.

Tomorrows Technologies

Collaboration, funding and publishing all play crucial roles in the life science research sector. However, they become irrelevant without the correct methodologies and techniques to undertake the research itself. Improvements in instrumentation allow laboratories to focus on delivering results more rapidly and accurately.

With upcoming developments pushing life science research into new areas, many laboratories are feeling positive about adopting new technologies. This includes technologies that we see every day, such as mobile devices.

Recent breakthroughs in communication and informatics technology, such as cloud data storage and wireless devices, have had a dramatic impact on day-to-day laboratory work.

With the increased speed and ease of use of the internet for example, data can be shared and transferred faster than ever before. In addition, while many of us use wireless and mobile technologies every day, the majority of life science professionals do not think they are being used to full advantage in the laboratory itself.

With general agreement that this adoption will allow new research to be explored and completed, scientists are looking to vendors to push the boundaries in technology in order to extend their own limits.

When looking at scientific instrumentation, microscopy has been recognised as one of the most exciting areas to watch within life science research technology.

Until recently, microscopy has had to strike a careful balance between achieving high resolution images and acquiring them quickly. Time efficiency is always a priority within a laboratory, however, this is being increasingly compromised by the demand for large, high quality images, especially when working with complicated biological structures. However, recent developments in technologies, such as Super-resolution microscopy, may help researchers achieve this balance more effectively.

Super-resolution microscopy allows life science researchers to significantly increase knowledge of cellular molecular interactions and dynamic processes. Using this technology, scientists can directly visualise biological samples in exquisite detail and support any information gained from traditional molecular and cell biology approaches.

Recently, two new methods have emerged, producing exciting results - confocal and widefield 3D Super-resolution. The dynamic information with large statistics provided by these techniques opens the door to a range of new applications – from dynamic vesicle movements in the sub-100nm range to fluorescence images of sub-cellular structures, making it an exciting area of development. Many feel this technique can significantly increase our knowledge of cellular molecular interactions and dynamic processes.

The Value of Data

It is not only research techniques which are expected to change, but how we deal with the data once it is generated. Over the last few years, accessing big data – data sets so complex that they are difficult to process using traditional applications - has become simpler and cheaper.

Alongside the exciting opportunity that big data presents, it does come with challenges. This is especially true in the field of visualisation, where there is the question of how researchers will manage the huge amount of additional, valuable data that may be produced by high resolution images. Many specialists argue that the image itself is the strongest proof available to researchers – “a picture is worth a thousand words”. However, it cannot be denied that there is additional, valuable information that can potentially be drawn out from these images using big data tools.

On top of dealing with the complexity of the data, security becomes a major issue - especially in strictly regulated clinical and pharmaceutical fields. Despite the increase in the speed of computers and the internet, there is a huge amount of computational infrastructure required to manage such large-scale information securely. Huge amounts of data must be generated, maintained, transferred and analysed on a regular basis, without any risk of loss or error. These challenges still need to be properly addressed, but once resolved, could help pave the way for a whole new era of data management.

Conclusion

Regardless of discipline, the last few years has seen life science researchers share similar experiences. All have been impacted by the limitation of access to funding, but have also benefited by developments in new technology. With specific interest around areas such as data analysis and increased image resolution, many laboratories are keen to have access to new innovations and reap the benefits these new technologies provide.

By staying aware of the trends and direction of the sector, researchers can anticipate changes and get ahead of the curve, making them ideally placed to receive tomorrows advances. The annual LifeSight report delivers this information straight to researchers, and is ideally placed to continue to do so in years to come. According to the 2014 report, future research is expected to not only delve into new areas, but to also do so in a more insightful and novel way. Researchers can look forward to the creation of a sector which is not only international but more accessible.

To download the 2014 LifeSight report, and to sign up to take part in 2015's survey, please visit www.leica-microsystems.com/lifesight

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