https://doi.org/10.1595/205651320X15954136194837 *Johnson Matthey Technol. Rev.*, 2020, **64**, (4), 394–395

JOHNSON MATTHEY
TECHNOLOGY REVIEW
www.technology.matthey.com

Guest Editorial

Breaking Down Barriers and Borrowing from Biology

Introduction

As humans, we seem to desire structure, relationships and laws to understand the universe. Through increased understanding, we can solve the problems and challenges that we perceive. This method and the output are given the label of science. At its best, science provides exquisite understanding, life-changing solutions or sometimes both.

The downside of the structures and rules we impose is that they can create inertia. Because the structure or rule served a purpose in the past, we can be more willing to stand by it blindly than openly seek the understanding or solutions we truly desire; a dynamic seen in the natural and social sciences alike and revealing more about human nature than the universe. One such structure is that of the disciplines within science. We should challenge ourselves to be very clear on the purpose of any structures we adhere to and be ready to remove barriers that get in the way of progress. One such example is uncovering the fertile ground of interdisciplinary research. In recent years interdisciplinary research has been of increasing importance across the sciences. Volume 64 of the *Johnson Matthey Technology Review* started a celebration of interdisciplinary science by looking at when chemistry collaborates with physics (1) and in this issue, we will celebrate the cross-disciplinary contributions of biology with other fields.

This wide-ranging issue explores topics such as: what we can continue to learn from organisms in unusual environments; how we might leverage biology in artificial situations; and even how we manage the interface between human-made, controlled systems and the outside world. In particular, the diversity of industrial applications is striking. Some are familiar to Johnson Matthey and this journal such as fine chemical synthesis, while others, such as hides and textiles, show that as boundaries within science are removed, previously distant industries will have much to learn from one another.

Themes on Interdisciplinary Science

I have reflected on three themes as this issue has come together. There are numerous examples on each theme and I would challenge the reader to think "what next?" for each:

1. Interdisciplinary understanding coming into biology; for example, computational methods and coding which go hand-in-hand with the biological understanding required for directed evolution of proteins
2. Interdisciplinary understanding coming from biology; for example, improved understanding of biochemical pathways and the relevant biological structures being coupled with synthetic chemistry understanding to allow much more targeted small molecule therapeutics to be designed
3. Platform technologies; for example, clustered regularly interspaced short palindromic repeats and CRISPR-associated protein 9 (CRISPR-Cas9) genome editing where you can custom design the edit while following standardised procedures.

This third theme is perhaps the most important as it turns niche expertise into something accessible to scientists across fields. Understanding the technology may be beneficial but is not a prerequisite to accessing it. Biology follows favourably in the footsteps of computing in producing such platform technologies and it is an attribute that perhaps we should value and prioritise more in other fields. To expand on this theme, it is exciting to look both backwards and forwards to the contributions made possible by platform technologies from the field of

biology. Often these point back to unlocking our understanding of the structure and function of DNA at a molecular level and have resulted in some of the most impactful scientific contributions of the last 50 years or so. Our health has been a significant beneficiary of these advances with cancer drugs providing an illustrative case study. Looking back, we can see recent classes of therapeutics that were significantly enabled by this flow of understanding and platform technologies such as tyrosine kinase inhibitors and antibody-based therapies (2). Most importantly, patient outcomes have improved substantially in part, thanks to these therapies (3).

Looking to the future, gene and cell therapies appear to be following a similar pattern and will hopefully deliver similar patient benefits. Outside of cancer treatments and healthcare, we can see many industries set to benefit from being able to access biological understanding and technologies. This is particularly as we seek to learn from biology and reduce our impact on the planet by using materials and energy in keeping with what Earth can sustain.

Conclusions

As you read through this issue, I hope you enjoy reading something outside of your current field. I would take you back to my earlier challenge and see if you can gain any greater insights by not seeing the separation between your field and those of the authors. Rather, question what you can leverage, what you can learn and what next?

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References

1. A. Smith, *Johnson Matthey Technol. Rev.*, 2020, **64**, (2), 101
2. T. A. Baudino, *Curr. Drug Discov. Technol.*, 2015, **12**, (1), 3
3. M. Quaresma, M. P. Coleman and B. Rachet, *The Lancet*, 2015, **385**, (9974), 1206