

How can we use eResearch to enable Australian Bioscience?

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INTRODUCTION

This Birds of a Feather session is motivated by some simple questions including:

- How can we use eResearch to enable researchers to participate in national and international bioscience research consortia?
- How can we use eResearch to enable researchers to spend less time managing bioscience data and more time analysing it?
- How can we use eResearch in the biosciences to promote collaboration and avoid reinvention?

The “we” in these questions primarily refers to those of us working in the biosciences within (or in collaboration with) Australian research institutions because it is primarily up to us

- To use the opportunities that eResearch currently affords
- To make the most of Australia’s investment in eResearch
- To help inform the development of eResearch to better support bioscience.

As a collective, “we” face some challenges including

- Dealing with new measurement platforms and preparing for further technological change
- Settling upon standards or consistent approaches to simplify collaborative bioscience research
- Bridging gaps and crossing barriers between “wet” and “dry” science (including differences in language, skills and culture)
- Communicating with a very diverse set of researchers.

This session is aimed at people working in the biosciences and people who want to see eResearch used to greatest effect in the biosciences. The intended format is to use case studies to promote discussion and exploration of how eResearch can, should (and might?) be used to enable Australian bioscience.

WHY BIOSCIENCE NEEDS ERESEARCH

The “industrialisation of biology” is founded on new measurement platforms that enable bioscientists to generate data on living organisms at unprecedented scale and complexity. This, in turn, has driven changes within the bioscience research community, including

- The pursuit of bioscience research by multi-institutional consortia (e.g., the Wellcome Trust Case Control Consortium [1])
- Different approaches to infrastructure investment, including more multi-institutional investments, and greater reliance on external facilities to provide access to the latest equipment.

Even though the term “eResearch” has not yet made it into the Oxford English Dictionary¹, it is commonly taken to mean “the use and development of innovative computational and information technology in multidisciplinary collaborations” [2, 3] or “large-scale, distributed scientific collaborations enabled by the Internet and related technologies” [4].

The biosciences are well and truly in an era where research efforts go beyond individual researchers, individual departments or even individual institutions. Australia needs to ensure its bioscience researchers can participate efficiently and effectively in multi-institutional research consortia, nationally and internationally. Clearly, eResearch is necessary (but not sufficient) for Australian bioscience to thrive in this era.

NON-TECHNICAL CHALLENGES TO ERESEARCH IN THE BIOSCIENCES

Technology alone will not suffice for Australian Bioscience to thrive in this era of industrialised biology; there are non-technical challenges that we must address for eResearch to deliver its potential benefits. Three of these challenges are described below. (Note that the first two arise whenever human endeavour requires individuals or groups to cooperate.)

1. **Cultural challenges.** Even though we might all nod and agree that greater sharing of bioscience data increases our chances of new discoveries and better outcomes, the reward systems of traditional science culture militate against collaboration. Typically, career advancement for individual researchers depends strongly on their publication record as evidence of their scientific capability. What does this mean in an era where science depends more on collective, rather than individual efforts? This cultural issue is not new and the Fort Lauderdale Agreement provides a guiding light for Australian Bioscience’s approach to data release [5].

¹ The nearest match to “eResearch” in the OED is, at the time of writing, the obsolete term *eresop* (meaning “earwax”)

Leaving aside issues around sharing knowledge, our traditional science culture (and training) harks back to an era of data written carefully into lab notebooks. What does this mean in an era where a single sequencing run can generate several terabytes of data? Has our science culture—the way we do things—kept pace with the way we *can* do things?

2. **Organisational challenges.** Let us pretend for a minute that we have a bioscience research culture that embraces sharing and collaboration in the pursuit of knowledge. How then do we put that desire into effect? One of the major challenges we face is around standards to enable and facilitate data sharing. This is a distinctly unglamorous part of science, but the benefits of standards for data description and representation are immense. Put simply, the grand vision of understanding life and its biological systems will not be realised until the data we observe can be linked and integrated. We note that European institutions are addressing challenges on this front through the Elixir project whose mission is “to construct and operate a sustainable infrastructure for biological information in Europe to support life science research and its translation to medicine and the environment, the bio-industries and society” [6].
3. **Intrinsic challenges.** Let us pretend for another minute that we have not only the right bioscience research culture, but also that we have organised ourselves and our data so that we can assemble comprehensive pictures of living organisms and their key processes. This still leaves the huge challenge intrinsic to this area of science—understanding how life works. Unlike the issues of culture and organisation, there’s no escaping this challenge, but Australia’s chances of success on this front will be greatly enhanced if we can attract or engage the best and the brightest minds. What sort of an environment would attract these creative individuals? Surely one where the research culture and the way in which research data are organised ensure their efforts will take their research as far as possible, as quickly as possible.

If we ignore these challenges, then we cannot reasonably expect eResearch to enable Australian Bioscience to the greatest possible extent. Also, we (i.e., those of us working in the biosciences) cannot reasonably expect eResearch to address these challenge for us—part of the motivation for this session is to face that reality in a constructive way.

WHAT TO EXPECT FROM THIS BIRDS OF A FEATHER SESSION

This session is meant to facilitate discussion about how can we use eResearch to enable Australian Bioscience. To do that, we will use short presentations to highlight instances where eResearch is already enabling bioscience, and to pose scenarios where eResearch could yet play a critical role. However, true to its format, this session will be primarily about discussion and interaction, rather than passive listening. With that in mind, we strongly encourage conference delegates who are working in the biosciences, or who want to see eResearch used to greatest effect in the biosciences, to come and participate in a lively and constructive exchange.

REFERENCES

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