EMBL

EMBL Genome Biology Unit Review

The EMBL Genome Biology Unit was reviewed on 11 to 13 May 2020 by a panel of 12 international experts, including four members of the Scientific Advisory Committee (SAC). The review was chaired by Susan Gasser, Friedrich Miescher Institute for Biomedical Research, Basel (CH). The Chair of SAC Paul Nurse, the EMBL Director General Edith Heard, the future Director of EMBL Heidelberg Peer Bork, EMBL Council Secretariat Michael Thompson, and Strategy and Analysis Officer Emma Steer attended the review as observers. Due to the SARS-CoV-2 pandemic and the resulting travel and physical distancing restrictions, the review was convened exceptionally via video conference.

Evaluation Summary

EMBL's Genome Biology Unit, headed by Eileen Furlong, comprises of eight group leaders, one team leader, with one further group leader joining the unit later in 2020. EMBL Director Matthias Hentze is also thematically associated with the GB unit. The unit encompasses a diverse range of interests associated with genome function including the links between gene expression and DNA sequence variation, chromosome organisation, chromatin modifications, as well as protein expression and folding. Research topics range from microbial genetics and virulence, human cancer and genome stability, genome folding and *Drosophila* development, as well as human neuronal differentiation.

The undeniable strength of the unit is the strong computational capacity, which includes the development and application of cutting-edge computational technologies to biology. It is clear that these essential tools impact the global research community.

The breadth of the unit's creative ideas, innovative approaches, and clear success is underlined by numerous significant publications, prestigious grants, nine patents, and two spinout companies. The publications from the unit are characterised by their multidisciplinarity and a high degree of computational rigour, with an exceptional amount of collaboration both within and outside of the unit. There is also a palpable sense of excitement and enthusiasm for each other's research and findings, indicating a healthy environment of mutual respect. The panel praises Eileen Furlong in leading this unit, especially given the diversity of topics and approaches. Eileen Furlong has successfully encouraged members of the Genome Biology Unit to integrate their vast range of efforts into overlapping and synergistic studies of ground-breaking nature.

The panel would also like to highlight the generous contribution of the members of the Genome Biology Unit to the conceptualisation and writing of the upcoming EMBL Programme. The emphasis within the Programme on ecological systems, microbial systems and infection biology, as well as the cross-cutting theme of data sciences, clearly bear the mark of almost every member of the Genome Biology groups and team.

Among the scientific achievements of this review period, the panel highlights the pan-cancer genome consortium publications of Jan Korbel - a highly collaborative five-year effort that enabled a deep understanding of genome variation among individuals and individual cancers. A collaborative study, by Eileen Furlong and Oliver Stegle, deployed population genetics to uncover the existence of extensive genetic epistasis within enhancer elements and showed that the deleterious impact of large effect variants are buffered by other variants within the same element attenuating their effects. In another collaborative study, with the Structural and Computational Biology Unit, Nassos Typas has developed one of the most comprehensive experimental frameworks to study the human gut microbiome and used it to monitor the impact of medication. A novel and powerful computational method that integrates different omics datasets to elucidate underlying biological processes that explain the data, Multi-Omics Factor Analysis (MOFA), was developed between the labs of Oliver Stegle and Wolfgang Huber. Thermal proteome profiling (TPP), a method to measure the thermal stability of proteins through mass spectrometry in high throughput was pioneered by Mikhail Savitski to show the involvement of ATP in the stability of many proteins.

The panel noted that the number of open-ended contracts in the Genome Biology Unit is exceptionally high. However, the panel acknowledged that this is due to the strong computational approaches within the unit, which are considered essential to EMBL-wide research, and due to the outstanding quality of the scientists hired within the unit. Nevertheless, this represents a problem for the dynamic growth of the Genome Biology Unit, as there is little or no space or resources for further recruitment of young group leaders. The panel recommends that this should be remedied by redeployment of at least one senior group from the unit as young hires are essential to future innovation.

The unit's balance between large-scale biology, consortium science, and model systems needs to be considered, particularly in the context of the upcoming EMBL Programme. At the basis of large-scale biology is small-scale biology, and the molecular interactions that regulate genes are still at the heart of genome function. The panel recommends that this balance be maintained.

The panel felt that the percentage of pre- and postdoctoral fellows leaving without a paper is suboptimal, even though their mentoring is excellent. The experience of writing a manuscript and of dealing with peer review is integral to pre- and postdoctoral fellows' training and will enable them to be competitive for future positions. The Genome Biology Unit could better support the principles of DORA and open science by ensuring that students have experience of publishing methods or review papers earlier during their training at the EMBL.

Continuing on the topic of DORA, the panel expects that successful Genome Biology Unit scientists, should illustrate to trainees that the best science is not necessarily published in high-impact journals, but instead to equip the next generation with the judgement and skills necessary for evaluating science based on content, in accord with the DORA principles.

Overall, the panel finds the current unit to be a harmonious, collaborative, and scientifically productive, internationally-leading research unit.

Response to the Panel's Recommendations

I would like to thank the panel for their time and effort in reviewing the Genome Biology Unit, particularly given the virtual format the review had to take, due to the SARS-CoV-2 pandemic. I am very pleased to hear the extremely positive and enthusiastic evaluation of the unit and I join the panel in warmly congratulating Eileen Furlong in successfully leading a highly motivated, multidisciplinary unit.

The Genome Biology Unit has been extremely productive over the review period, with a range of diverse scientific outputs that place them at the forefront of global life science research. The mix of computational and experimental research within the unit is key to this success and the unit's highly collaborative and interdisciplinary atmosphere captures the essence of EMBL. These values will be further encouraged and prioritised as part of the next scientific EMBL Programme (2022 – 2026). Almost all Genome Biology Unit group and team leaders have been actively involved in the conception and writing of the new EMBL Programme and I would like to praise them for being great assets to EMBL, at both the unit and the organisational level.

The panel noted a high number of open-ended contracts in the Genome Biology Unit. This is indeed unusual for EMBL which prides itself on its 9-year turnover model, fostering early-career scientists and enabling EMBL to evolve constantly. I would like to reassure the panel on two matters. First, this is not a growing trend within EMBL: the Genome Biology Unit is an exception in hosting such a high number of open-ended contracts compared to other units. Second, it must be noted that all Genome Biology Unit scientists with open-ended contracts play an important role at EMBL, with EMBL-wide responsibilities. In the run up to the next EMBL Programme, several of them participated very actively and will be involved in its implementation, by being part of or even leading some of the new transversal themes which will overlay the current unit structure and provide interactions and synergies between EMBL's six sites. This new organisation, that is currently being explored together with Peer Bork for EMBL Heidelberg, should free up some group leader positions in the unit to ensure the dynamic turnover of group and team leaders.

EMBL

In response to the panel's second recommendation, the unit's future balance between large-scale biology, consortium science, and model systems will be carefully considered, particularly in the context of the new EMBL Programme. Indeed, one core philosophy of the new EMBL Programme, which will aim to explore life in the context of environments at different scales, is that an understanding of mechanisms at the molecular level in model organisms is essential for an understanding of large-scale biology. Eileen Furlong's own research, and her excellent track record in hiring talented individuals, gives me confidence that future group and team leaders in the unit will ensure this balance is maintained and will propagate out to further the aims of the new EMBL Programme.

Finally, on the topic of fellows and of publications: I fully agree with the panel's recommendation that students must have experience in publishing early on in their PhDs and also that the best science is not necessarily published in high-impact journals. EMBL's training programme actively encourages students to think about and acquire the skills that they need, including writing and publishing, to help them embark on successful careers. However, I do not agree that there is pressure within the Genome Biology Unit, or EMBL in general, to publish only in high impact journals. Indeed, as part of EMBL's own evaluation processes, which includes this review, impact factor is not evaluated. Furthermore, through EMBL's active Open Science Working Group, which is co-chaired by one of the Genome Biology Unit's senior scientists, EMBL has been revising several of its internal policies to further encourage publication in open access journals, including practices that are in line with DORA principles. The points raised by the panel concerning DORA, will be discussed at EMBL's next senior science management meeting.

In conclusion, I would like to warmly congratulate all of the Genome Biology Unit for their outstanding contributions, as well as their enthusiasm and motivation which fosters science and scientists of the highest quality across a diverse range of collaborative disciplines.

Professor Edith Heard, FRS
Director General

8 June 2020