Report of the Topical Review Panel, Soft Matter and Biophysics (SMBP) Institute for Science and Technology Austria (ISTA)

May 2022

Review Panel

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All Committee members contributed to the writing.

Introduction

The following report was written after a 2.5 day in-person visit in April 2022 and addresses four Questions in the 2021 Rules for Topical Reviews at ISTA. Although the in-person review was delayed by COVID, the committee feels overall that they were either provided with or gathered sufficient information to address at least some key aspects of the four Questions. Question #3 was prioritized above all because we felt it had the greatest impact on the current program. The style of the Report includes specific 'Recommendations' per the common style of reports to the US National Academies of Science, Engineering, and Medicine.

The committee acknowledges and appreciates the ISTA staff for making all of the arrangements and also their responsiveness in adjusting the program to help conduct the review and address our numerous questions. The committee also appreciates the open discussions with the students, the fellows, the faculty, and the IST administration. We sought to consider all of the input provided in both formal and informal settings in the following, focused Report.

ISTA Questions & Committee Responses

1. *What is the international standing of the Soft Matter and Biophysics (SMBP) faculty as a group? What are its strengths and weaknesses? How could the weaknesses be addressed and what would be appropriate strategic goals for SMBP at IST Austria? Is there a minimum size and the necessity to cover certain fields in order to compete for a spot among the top 10 SMBP groups in Europe?*

A. Overall, the SMBP faculty is **World Class** in its science. It is perceived by the committee to be among the top SMBP groups in Europe. From the more detached perspective of the US-based members of the committee, some of the dozen or so leading groups are in Paris, Marseilles, Dresden, Barcelona, Cambridge, London, Berlin/Potsdam, Heidelberg, Lausanne, Milan, the Netherlands, and perhaps also Zurich, Munich, Leipzig, and Goettingen. A main strength of many of these groups and also of SMBP is in the approaches to multicellular animal biology using soft matter physics and engineering science, where materials, methods, or concepts such as fluid-solid complexity, microfluidics, gelation, colloids (including active matter), self-assembly, etc. are being used and sometimes further developed to deepen insight into biology and sometimes physics. The core facilities that support the groups are impressive. The various groups are publishing very well. Although the soft matter physics groups are perhaps few in number and more junior compared to leading Programs elsewhere in Europe and the US, the integration as SMBP adds strength in multiple ways, especially with crossover theory and computation.

Recommendation: Nurture and promote the current faculty hires in soft matter to ensure strength and size in context, and do the same for the biological physics group. For senior faculty and in light of limits to group size, incentivize interactions.

B. The 'T' in IST stimulated some early and frequent discussion about SMBP at various points throughout the visit. During the first overall presentation about the IST, a new and growing Tech Park across the street from IST was introduced by the administration. During the first presentation of the program by the SMBP faculty, the faculty seemed to address the issue by proposing to hire several faculty in "Engineering".

Towards the end of the visit, there was a brief discussion with the administration about the value of patent filings to faculty evaluations, and the message seemed to be that such IP was not valued relative to publications - which is a frequently held view in academia in the US and likely around the world. Nonetheless, in the 'bio' field, patents filed in academia have been key to establishing new fields, building reputations, and much more. Biomolecular examples of patents range from CRISPR-based gene editing, which led to a Nobel Prize, to modified mRNA, which is the basis of the COVID19 vaccine and likely many others.

Recommendation: Patented advances and their impact(s) in SMBP's field(s) and adjacent fields should be given some attention in teaching and research. If not already instituted, Intellectual Property (IP) information sessions should be held once a year with students, fellows, and faculty to educate and seek a suitable balance between discovery based publication and patentable discoveries suited to academia - especially in the context of SMBP. These discussions should include clear value statements by IST on IP with regard to PhD theses and faculty promotions.

C. Growth of the SMBP faculty was presented as an essential strategic goal, which the committee agrees with. Some nascent ideas of topic areas were also presented and seem reasonable but also prompted discussion of mechanisms by which this highly interdisciplinary SMBP group could work together at some new interfaces between groups. Goals would be to help with further discussions of forward-looking topic areas outside SMBP that this group could interact with (e.g. in geosciences, synthetic chemistry, materials engineering, instrument development), to help attract new faculty in such topic areas, and to help build expertise beyond any group's self-directed trajectory. During the visit, there were some open discussions among the administration, the faculty, and the committee about possible mechanisms that focused on the idea of 'IST Centers' with funding for finite time periods from the administration (or elsewhere); it was pointed out that NSF and NIH center grants in the US are often 2 x 5 years. Center associated visitor programs, symposia, seminar series, etc. could help achieve the above goals.

Recommendation: Discuss and implement mechanism(s) to increase expertise and build bridges in novel directions and between diverse groups in SMBP.

D. Academic reputation of a 'department' such as SMBP often reflects the very high achievement and recognition of a few faculty members rather than the many, but IST might be limiting this by capping the size of a faculty member's group at 15. For physics and biosciences, such a number seems reasonable compared to US groups, but some of the most successful IST groups could probably exceed the limit and help SMBP's reputation. Some, including faculty recruits, might consider the cap as a restriction on academic freedom, merit, and ambition, which should all be avoided.

Recommendation: The faculty and administration should consider mechanisms to incrementally lift the group size cap. In the bio-sciences at many institutions, formulas are applied such as grant costs for extra lab space per desk for several years.

2. *In the near future, specifically with regard to new hires: Shall IST Austria focus on its existing strengths or expand into new subfields of SMBP? What are subfields of SMBP and adjacent directions that would fit particularly well to the research portfolio of IST Austria? Are there any subfields of SMBP that you recommend not to pursue?*

Recommendations:

A. Given IST's stated interest in expanding into astrophysics and climate science, it could be strategic to hire an earth/planetary scientist who connects several existing experimental strengths in SMBP. Examples include granular tribology and turbulence as both triboelectricity (Waitukaitis) and turbulence (Hof) are relevant to planetary formation and geomorphology.

B. A chemist, chemical engineer, or molecular biophysicist with broad interests in self-assembly and in the functionalization of colloids with specific ligands could synergize with and strengthen several physics groups in SMBP. These include the experimentalists working in active matter/colloids (Waitukaitis, Palacci) and the theorists with expertise in predicting self-assembly pathways (Goodrich) or simulating dynamics at the small scale (Saric).

C. A physics-trained biological physicist could strengthen SMBP if the focus of such a candidate was complementary, for instance in the measurement of forces. The other biophysics faculty in SMBP come primarily from biology, which obviously works very well, but work in the biophysics field is typically distinct, more quantitative at the molecular scale.

[Note from Academic Affairs about pages 4-10: The sections on individual professors of the review report are treated in the same way as confidential review letters. Hence, they are not included in this version of the report.]

4. *How does SMBP fit into the larger goals and culture of IST Austria? How does the Institute, its structures, and its culture support SMBP as a discipline, and how could the support be improved? What does SMBP contribute to the Institute, its culture, and to other disciplines at the Institute, and how could the contributions be improved? How do you assess doctoral education at IST Austria, in particular the multidisciplinary PhD program, with regard to SMBP, and how could it be improved?*

The following are filtered from diverse conversations with faculty, postdocs, and students:

A. Several experimentalists, at various career stages, were concerned by the undelivered promise of access to a **machine shop** that interns/students/postdocs/faculty can use for small and/or urgent work, on their own. This is in marked contrast to the other Service Centers, where scientists do seem to have access on their own. Such access is greatly appreciated.

B. Postdocs who are experimentalists are very concerned about not having guaranteed access to a **non-laboratory desk**: this greatly impacts their ability to do important parts of their jobs. There was some sense that the new building would/could ameliorate this, but this requires detailed attention.

C. A more general concern about IST's growth in services and facilities is that they are not keeping up with growth in new faculty, for example regarding capacity of the **cafeteria** and the **bus** to/from Vienna.

D. The **Kindergarten** is under-performing, and causing much stress to the users at various career stages who depend on it. Those who can move to a local Kindergarten, do so, even though they don't provide the level of support required for full time researchers. The concerns have risen to the level where it could come up during recruitment of new faculty who would depend on it - especially faculty new to Austria or Europe. This is a particular issue regarding gender equality, and there was frustration that there didn't seem to be a path forward.

E. Access to **mental health care** is limited by supply, and not necessarily available to people who do not speak German.

F. Students mentioned concerns about the **quality of the courses** they are required to take. The committee seemed to use some classrooms during the visit, which were modern and likely suited for hybrid and recorded lectures - which was a necessity during and the pandemic and a plus afterwards. However, what specifically was taught to SMBP students was not discussed in sufficient detail. One opinion of the committee is that comparisons to peer programs be made.

G. The **gender-equity staff person** covers enforcement, mediation, and advocacy - which has a high likelihood of creating conflicts of interest. Recommendation: these roles should be separated from each other.

H. **Gender bias**. Recommendation: educate faculty hiring and promotion committees about the role gender bias plays in the evaluation process, from the bias of letter-writers to bias in interpreting presentations and outcomes.

I. The availability/assignment of **mentoring of faculty** is unevenly distributed, both giving and receiving, leading to uneven confidence that tenure criteria are well-understood. Additionally, ensuring that untenured women faculty have access to mentoring by a senior woman is crucial, and may need to be supplemented by external mentoring and/or from other fields. Faculty from non-European backgrounds may similarly require targeted mentoring.

J. The **level of institutional service** being performed by junior versus senior faculty should be reviewed for equity across various axes.

K. COVID has caused delays in career progression at all levels. **Allowance for COVID delays** is needed, and is likely to require institute recognition, communication, and support for delays. These include longer timelines for tenure, and for finishing postdoc and PhD appointments. Related to these, networking has been severely disrupted, and IST should try to facilitate visits from prominent researchers to both give talks and interact with early career researchers; mini-workshops on topics of interest could be one way to do this.