Report of the Area Evaluation Panel, Molecular and Genomic Life Sciences Institute for Science and Technology (IST), Austria.

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Review Panel

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Executive Summary

The Area Evaluation Panel, composed of six international members, met on the campus of IST in January 2019. The Panel reviewed the research programs of eight faculty in the areas of structural biology, molecular biophysics, genetics and evolution, and neuroscience. Six of these scientists are currently untenured. In addition, the Panel considered aspects of the management and operations of IST pertaining to the Life Sciences.

The members of the Review Panel are in complete agreement that IST is a world-class research institution that fosters the development of innovative research programs in fundamental science. We are impressed by the extent to which IST provides a supportive and stimulating environment for life sciences research, and we commend both the management of the Institute and the faculty for building and maintaining such an enviable place for scientific research.

Our overall response to the group of reviewed faculty was very positive, with some concerns expressed regarding the mentoring of faculty prior to tenure. Detailed reports on individual faculty are provided at the end of the main report.

The most important issue that we identified concerns the management structure of the Institute. The Institute is currently in very good hands, but rapid growth makes it difficult for the flat structure of the Institute to continue to be a workable operating mechanism. We recommend that the governance of the institute be changed in a way that preserves its essential character, while enabling effective response to management challenges that will continue to arise as the institute grows and the scope of the research expands.

We recommend that an intermediate level of leadership be created that represents faculty input, and can serve to coordinate discussion and craft strategy from insights drawn from the faculty. This should be done while avoiding the imposition of conventional academic structures, headed by Deans and Departmental Chairs. The IST should draw strength from its interdisciplinary nature, which avoids conventional discipline-specific groupings, and it should retain a flexibility in governance that will best position it for adapting to as yet unforeseen changes in scientific priorities.

A strength of the Institute is the high level of technical expertise that is made available to IST research groups, through centralized facilities and staff scientists. In particular, we were impressed by the speed with which a state-of-the-art cryo-EM facility has been set up. The technical staff whom we met with impressed us with their competence, and communicated to us forward-looking plans for maintaining equipment at the cutting-edge. We were made aware by the faculty of concerns about the setting of priorities for equipment purchases, and the responsiveness of the facilities to individual needs. These issues could be dealt with effectively with changes in the management structure that enable closer links with a growing faculty to be maintained.

We commend IST for hiring junior faculty of very high scientific potential, and for providing an environment in which their careers can thrive. There are some concerns about the mentorship of the junior faculty that are detailed in the main report. We recommend the institution of a formal mid-career evaluation process, which will provide feedback to the junior faculty in a structured way. We are also concerned by gender imbalances in the Institute, although this is not an issue that we were able to examine closely due to lack of time.

We are impressed by the unique aspects of the graduate program and the quality of the students. We feel that all of the key distinguishing features of the program should be retained, so that the program can continue to develop as a very special opportunity for students interested in interdisciplinary science. At the same time, we have some concern that students in the Life Sciences may not be optimally benefiting from the opportunities available for interdisciplinary science at the Institute. The Institute is encouraged to continue its efforts to provide opportunities for graduate students from different fields of biology to broaden their horizons.

General Report

Overall Summary of the Review Process

The review panel visited IST during the period January 14-16, 2019. The meeting began with a briefing dinner on the evening of January 14th, and then continued with detailed discussions and presentations at the IST campus over the next two days.

The panel was provided with a comprehensive and clearly written report that was most helpful, both for the perspective that it provided on the current state of development of the Institute, as well as for the in-depth descriptions of the research programs of the faculty members who were evaluated specifically.

The committee expresses its appreciation for the careful planning behind all aspects of the review, and we thank Dr. Verena Seiboth and her support staff for their efforts in ensuring that the review process was carried out in an efficient manner, while allowing sufficient time for all matters on the agenda to be discussed to an appropriate extent.

A notable feature of IST, and one that we will return to later, is that it is not organized into academic departments. In particular, the committee appreciates that the specific faculty who were reviewed do not represent a particular academic or administrative unit within the institute. Rather, the grouping simply reflects the pattern of periodic review that all faculty at IST are subject to. The review group includes scientists focusing on structural biology (Bernecky, Sazanov, and Schur), molecular biophysics (Loose), genetics and evolution (Kondrashov and Vicoso), and neuroscience (Hippenmeyer and Siegert). Six of these scientists are currently untenured (Bernecky, Schur, Loose, Vicoso, Hippenmeyer, and Siegert).

In addition to evaluations of these specific faculty, this report also identifies a few general issues that impact research in the Life Sciences at IST. We also provide our responses to several specific questions put to the panel by the President of IST.

The on-site visit provided the panel with a good overview of the state of Life Sciences research at IST. In addition to research presentations from each of the reviewed faculty, a poster session facilitated detailed discussions regarding research programs in the evaluated research groups. Professor Nick Barton, Dean of the Graduate School, described the IST PhD program, a distinctive feature of the institute. This perspective was augmented by a lively meeting with graduate students, mainly from the groups of the faculty being reviewed, over lunch. Additional insights into the workings of the institute were provided by meetings with a cross-section of life sciences faculty and the review group's post-doctoral fellows. We also met with staff scientists and facilities managers, and we were favorably impressed by the high level of technical expertise that is made available to IST research groups through centralized facilities and staff scientists.

General Conclusions of the Review

The interactions that the review panel engaged in during the review have left us with the general sense that IST provides a supportive and stimulating environment in which to do science of the highest quality and impact. As elaborated on below, our overall response to the group of reviewed faculty was extremely positive.

We discuss below some important issues that were raised by the review, and that need urgent attention. We are convinced that the overall positive nature of our experience points to a responsive environment at IST, and a matrix within which the issues that we identify can be dealt with effectively. We are also confident that necessary changes can be made without compromising the aspects of IST that make it a unique research institution.

1. Administrative Structure of the Institute

The Review Panel views favorably the flat structure of the Institute, which does not have localized power structures that control resources, space, and hiring. The rapid growth of the Institute has, however, raised several issues that can only be addressed if the governance of the Institute is changed in a way that preserves its essential character, while enabling effective response to management challenges that will continue to arise as the Institute grows and the scope of the research expands.

The President of IST, Thomas Henzinger, provides the institute with leadership that is an impressive blend of scientific acumen, empathy, and vision. He is complemented in an extremely able way by Vice President Michael Sixt, who combines support for the scientific goals of the faculty with an ability to manage the delivery of technical infrastructure to meet a diversity of needs. We judge the current leadership of IST to be outstanding, and we believe that scientists at any institution would be grateful to have leadership of this quality. The issues that we identify do not in any way reflect on the qualities of these two individuals, but are simply a natural consequence of the growth of the institute to the point where it is no longer feasible for just two individuals to provide leadership at all the levels that are required.

A very consistent message that we have heard from a broad cross-section of the faculty is that the imposition of conventional academic structures, headed by Deans and Departmental Chairs, is undesirable. We recognize that a change in governance will naturally bring with it the creation of new administrative positions, and it will be necessary to recognize the roles of people in management with appropriate titles. Our sense is that reservations expressed by the faculty reflect an understandable distrust of administrative structures in which considerable power is invested in individuals who control access to resources and play a disproportionate role in setting the future

direction of the institute. We take these concerns seriously, but believe that it is possible to make the necessary changes to governance without falling into the trap of dividing the institute into narrowly concentrated power centers.

We have identified the following issues that we believe point to the need for a change in governance at IST.

(a) The need for institutional scientific vision and strategy

During the early days of the Institute the emphasis was, appropriately, on recruiting the best talent to Gugging, without imposing a preconceived plan that restricted hiring to specific areas. Now, with the build-up phase of the Institute essentially completed, it is imperative that strategic decisions be made concerning the future growth of the Institute. These decisions must reflect how best to capitalize on the strengths already present, which new areas to invest in, and how best to create synergy with the strengths of other institutions in the greater Vienna area.

The guiding strategy for forward planning must, we believe, include substantial faculty input. While the future growth of the institute will be best achieved if it is driven by the faculty, we recognize that conservative or parochial thinking on the part of the faculty can impede movement into new directions. As a case in point, IST has made exemplary hiring decisions in Structural Biology and in Chemistry, but we understand that there has been some significant faculty resistance to this. We are also led to believe that these new directions were pursued in response to the last external evaluation of the Institute, rather than in response to faculty-driven strategic plans. While the results are commendable, we believe that the quality of the faculty at present assembled in IST is such that completely appropriate strategic decisions could, in principle, be made from the ground up, provided that an appropriate management structure is in place to facilitate this. We were, however, left with the impression that IST suffers from the fact that a minority of the Life Sciences faculty with a lot of say in the Institute may project an unnecessarily narrow strategic vision. We encourage Life Sciences faculty to think more broadly and develop a vision that goes beyond their individual fields.

Unfortunately, however, the current flat structure can be an impediment to forward progress along these lines. We have concluded that the format of the strategic discussions that the Life Sciences faculty currently engage in, while laudably democratic, can be easily dominated by a few individuals. We also understand, from our discussions, that junior faculty feel that there is difficulty in having their voice heard. We also received the impression that decision making can sometimes take too long, and that the rationale behind particular decisions is not always clearly communicated to all the relevant faculty.

There is a pressing need, we believe, for an intermediate level of leadership that represents faculty input, is trusted by both the faculty and the President, and can serve to coordinate discussion and craft strategy from the insights that the faculty at IST are quite capable of providing.

(b) Centralized instrumentation facilities

We have heard from multiple sources that the speed and flexibility of major equipment purchases is quite often misaligned with the research requirements of the faculty. We are not entirely certain as to the origin of this perception, since there is no doubt that the financial resources that IST invests in instrumentation are comparable to, or better than, at other leading institutions world-wide. Nevertheless, we heard from both faculty members and post-doctoral fellows that the substantial investment in equipment does not always translate into timely delivery of state-of-the-art equipment they need for their science.

We are not sure to what extent this perception reflects a misunderstanding of necessary processes, unrealistic expectations, or real problems in the implementation of decisions to purchase. We were also made aware of issues related to how decisions are made regarding what equipment is purchased. These comments echo issues raised in the discussion of scientific strategy. In a flat organizational structure, everyone has a say, but there may not be a collective will for making bold and risky decisions. Also, more esoteric equipment with fewer users may not get priority. This may adversely impact the research of innovative scientists, favoring those who use more standard equipment. This is of particular concern to faculty who have not yet received tenure, and to post-doctoral scholars, for whom a year's delay in instrument access can have serious career consequences. In addition, if a faculty member needs a specific type of equipment for which there is little need by others, they should have the opportunity to buy it with their own funds. We were left with the impression that this is presently either not allowed, or is discouraged.

Viewed from a high level, IST has an enviable institutional commitment to making investments in cutting-edge instrumentation. We were impressed by the speed with which a state-of-the-art cryo-EM facility has been set up, for example. We were also impressed by the technical staff whom we met with, and the forward-looking plans for building instruments such as a lattice light-sheet microscope. Nevertheless, the concerns about equipment purchases that we have noted were voiced by a broad enough cross-section of faculty and trainees that they must not be ignored.

We believe that the creation of an intermediate level of leadership could do much to alleviate these concerns and fix issues in decision making and purchasing processes.

(c) Mentoring of junior faculty

We commend IST for hiring junior faculty of very high scientific potential, and for providing an environment in which their careers can thrive. We were struck, however, by the apparent lack of mentorship of the junior faculty with whom we met. Interestingly, the junior faculty seemed not to perceive deficiencies in the mentoring they receive, perhaps because they receive considerable help from their peers in similar fields. They are also supported by various institutional programs that help with issues such as personnel management and lab leadership. The junior faculty also acknowledge the exceptional guidance provided by the institutional grants office.

The Review Panel believes, however, that there are gaps in junior faculty mentoring at IST which can only be filled by senior scientists who are experienced and compassionate. This includes advice on project choices, publication strategy, funding opportunities, and nomination for external prizes and awards. It is clear to us that the leadership of IST clearly understands these issues, and we recognize the excellent mentorship provided by some senior members of the faculty, such as that provided by Nick Barton to the evo/devo group. Nevertheless, the size of faculty makes it increasingly difficult to provide the appropriate level of mentorship for the junior faculty. Due to the rapid growth of the institute there are relatively few senior faculty compared to the growing number of junior faculty. We understand that IST allows junior faculty to formally have external mentors, and that the Institute can provide travel funds for such mentors to visit the campus. We were told, however, that few junior faculty take advantage of such opportunities.

We appreciate the flexible timeline that the institute provides for the tenure process. This is increasingly important in the Life Sciences, as experiments become more complex, the time to get publications becomes longer and longer, and the expectations for high-impact publications keep increasing. We recommend the institution of a formal mid-career evaluation process, which will bring focus to the mentoring process, and will also help by requiring a set of interactions and discussions mid-way through the pre-tenure period.

(d) Fostering a collaborative research environment within the life sciences

The meeting with post-doctoral fellows was a spirited one. To our surprise, several of the postdocs questioned the collegiality of the scientific environment at IST, and noted an apparent lack of inter-lab cooperation in some of the areas of Life Sciences. Some of the postdocs expressed the opinion that the IST is an isolating place in which to do science. Interestingly, this response appeared to be somewhat field specific (perhaps more marked in neurobiology). We discussed this issue at some length, and have concluded that the example set by senior faculty in various sub-disciplines may be an important component to differences in the collaborative "feel" of various groupings of faculty.

A highly collaborative environment that encourages the sharing of methodologies and reagents is key to maintaining the highest levels of scientific research in the life sciences. Here too, we believe that the introduction of intermediate-level leadership could have a positive impact.

(e) Gender balance at the Institute

The Review Panel was struck by a marked gender imbalance in tenured faculty at IST. This is not a topic that we considered in any detail, but we recognize this issue as a problem for an institution aiming to compete with other elite international institutions. We note the absence of a clear policy to support dual-career recruitment, and recommend that this issue be addressed as part of an effort to correct the gender imbalance.

An opportunity for creating a new model for scientific administration at IST

The Review Panel was left with a highly favorable impression of the quality of both the faculty and the leadership of IST and the speed with which the flat structure of the Institute has enabled the growth of a highly competitive scientific enterprise, as viewed from the Life Sciences. Given this, we do not wish to make specific recommendations concerning how the internal governance of the Institute should be changed. Instead, we note that the situation provides an opportunity for IST to define for the world how a unified and interdisciplinary research institute should best be managed.

The Institute may consider discussions with consulting firms who have expertise in the management of scientific research enterprises. Such discussions may help facilitate an effective discussion within the Institute on the best way forward for itself.

2. The Graduate Program.

The poster session, at which graduate students and postdocs presented their research, was stimulating, and provided a good window into the science going on in the evaluated laboratories. We were impressed by the quality of the trainees at IST.

The unified and cross-disciplinary nature of the graduate program at IST is unique. In our discussion with graduate students we sensed some dissatisfaction with the core courses, in terms of the degree of difficulty of unfamiliar material, and the lack of depth in familiar material. Nevertheless, we noted the appreciation that the students felt for the continuing efforts of the faculty to improve the course offerings. We also sensed considerable resistance in a subset of students to the necessity of doing three rotations, which these students felt impeded progress towards their degree.

It is our conclusion, reached after vigorous discussion with the students, that all key aspects of the program should be retained. Rotations should not be made optional, as this would weaken the strong potential that rotations have to foster links between the laboratories that various students rotate through. The Institute is encouraged to increase the venues in which graduate students from different fields of Life Sciences can interact with each other, and with students from other disciplines. A specific request was made by some graduate students that the budget of the student retreat should be increased so as to facilitate their ability to invite external speakers.

Despite the interdisciplinary nature of the graduate program, we were struck by the fact that there seemed to be no students with backgrounds in Physics, Computer Science, or Mathematics, in the group that met with us over lunch. We are not sure about the extent to which this represents a lack of crossover of students from those fields into Life Sciences at IST, but we feel that this is something that should be fostered. We recognize that it may be difficult for students trained in biology to move towards the more mathematical fields, although more than one student appreciated the opportunities to increase their exposure to these areas and to data sciences. It is generally easier for students trained in the quantitative sciences to move into biology, and many leading bioscience researchers have followed this path. Furthermore, the biology faculty at IST are strong in quantitative analysis, and the Institute is well placed to support this transition. We feel that IST should increase its efforts to encourage such movement, aiming to be internationally attractive for those wanting to follow this path.

Some of the postdoctoral fellows we met with expressed an interest in teaching while at IST. We encourage IST to increase the participation of postdoctoral fellows in graduate school teaching in any way possible.

Questions from the President to the Review Panel

The Review Panel was formally asked a series of questions by the President of the Institute. While we provide our answers to these questions, we feel that the best way to answer these questions is to engage the faculty in a discussion of these topics as part of a general formulation of institutional strategy in the life sciences.

1. *Within the life sciences at IST Austria, which include, in addition to genomics and molecular life sciences, also cellular and evolutionary biology, as well as cellular and systems neuroscience, would you advise an adjustment of the balance and interaction between the various topics?*

   We believe that the balance at present is good, and that the spread of contemporary biology is sufficiently vast that the best way to answer this question is for IST to develop a strategic plan from the ground up.

2. *Would it be advisable to hire theory and computational groups in the fields of genomics (bioinformatics) and structural biology?*

   Unreservedly, yes. This is important both for genomics, and also for structural biology.

3. *Would it be advisable to hire groups focusing on technology and methods development?*

   Many of the breakthroughs in modern biology have been made possible by the development of methods that have caused science to leapfrog over formidable barriers to advancement. Conventional academic institutions often resist the appointment of faculty who focus on methods development and technology. IST, with its unique integration of the physical and life sciences, as well as computer science and mathematics, is very well positioned to make strategic hires in this area.

4. *Would it be advisable to establish a genomics facility at IST or is it sufficient to outsource? Is it required to have a mouse genetics facility on campus? Which other centralized resources would benefit our researchers in genomics and molecular life sciences?*

   We did not see the demand or need for a genomics facility at IST. More and more institutions have closed their in-house genomics and transgenics facilities and instead rely on outside vendors to satisfy needs in these areas. We suggest that unless a group of faculty insists on developing such in-house facilities to generate unique tools or satisfy high throughput that cannot be provided by commercial

vendors at reasonable costs, the institute utilizes its resources to support other facilities.

We were told that the Vienna BioCenter has an excellent genomics facility that people are happy to use, but that individual groups need to make their own agreements to do so. We encourage IST to make a formal arrangement with the BioCenter to facilitate access to their facility by IST researchers. With respect to mouse genetics, again the consensus was to use external service providers; in this case there are commercial organizations who provide transgenic mouse services competitively at the state of the art. There was some discussion about bioinformatics, which is essential for many modern studies in the areas we reviewed. Our view in general is that this is better viewed as part of the science of a project, carried out within the research group, not a service. There is, however, a case that staff scientist posts would be relevant in Bioinformatics, perhaps associated with the IT core. These could also be involved in the provision of training and a core supported software environment for standardized workflows for common tasks such as RNAseq data analysis.

5. *Are we cutting edge on equipment and support in bioimaging and electron microscopy? Are we centralizing too much of our infrastructure and should we allow PIs to have their own high-end microscopes?*

   We have addressed the issue of maintaining cutting-edge instrumentation in the general body of the report. Regarding equipment, such as high-end microscopes, that is to be placed in individual laboratories, we feel that there should not be a policy against this. As mentioned earlier, faculty should be allowed to purchase their own equipment if they want to.

6. *In which fields could we benefit from additional staff scientists?*
   The ability to analyze large data sets has become an integral part of modern biology. Bioinformaticians can provide critical support in this line of research. Most if not all leading life science institutions provide such services to their researchers. The Institute should consider hiring one or more PhD-level experts in this area.

7. *In view of the outstanding life sciences at the Vienna biocenter (VBC), IST Austria has tried to build its own independent and complementary profile. Has this been successful and what do you recommend for a mutually beneficial relationship with the VBC?*
   IST has established a thriving life-science community, comprised of young, motivated scientists. While it is not advisable for IST to copy efforts at the VBC campus, avoiding overlap ought not to be a priority. Having said this, IST has established a strong presence in Neuroscience and Molecular Evolution, two research areas not very well represented at VBC and in that sense has built a

program highly complementary to the research enterprise at VBC.

8. *Would it be advisable to build a close relationship with a Vienna hospital that performs translational and clinical research?*

   We suggest that such relationships ought to be built on a need basis, and ought to be spearheaded by researchers requiring such resources.

9. *What do you consider the most unique positive and attractive aspect of the research in genomics and molecular life sciences at IST Austria?*

   IST has succeeded in creating a very attractive and favorable environment for the Life Sciences. Key aspects to this have been mentioned in our report, and include the unified and interdisciplinary structure, the unique graduate program, the strong commitment to technical support, the funding levels for laboratories. Because it is such a young institution, IST has the unique opportunity to build an institution that does not suffer from the usual problems that century-old institutions have, such as entrenched structures, inflexible administrations, gender inequality issues, and so forth. Please take advantage of this and make a difference!

10. *Are there any scientific or technological trends on the horizon in genomics and molecular life sciences which IST Austria should not miss?*

    Advances in the life sciences are occurring at a breathtaking pace, and many of the recent breakthroughs are ones that could not have been easily foreseen one or two decades ago. In our discussions of this topic we reached the conclusion that there would be as many answers to this question as there are members on the Review Panel. We believe quite strongly that it is critical for the Life Sciences faculty at IST to engage in strategic planning to put in place decisions that will best prepare the institute to take advantage of the unforeseen advances that will occur in the next two decades.