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Letter of Recommendation for Ido Golding

by
Eshel Ben-Jacob

I am writing this letter of recommendation for my former student, Dr. Ido Golding, with great enthusiasm and satisfaction. I feel like a father who is thrilled and proud to watch his 'intellectual son' becoming mature, independent and an already internationally known scientist beginning his own academic career.

As members of the academic community we write and evaluate many letters of recommendations. With current "inflation" in superlatives in such letters it becomes harder to convey the message when one is truly exceptional, and even more so when the research is multidisciplinary. Yet, this is what I will try to do in this letter on behalf of Ido.

Ido started as a physicist, yet all along he was aiming towards meeting the challenge posed by living systems. His first step on this journey was a master's degree under the supervision of Prof. Kantor on the statistical physics of polymers. This research gave him a very important and solid intellectual infrastructure and mathematical expertise and brought him closer to biological systems.

During the time Ido worked with me, he acquired the biological knowledge by taking courses, self-reading, guided reading and endless conversations with my group, including Professors Drossel and Helbing (who were then postdoctoral fellows with my group and currently C4 Professors in Germany). In addition, Ido was directly involved in our experimental activity on self-organization of bacterial colonies which afforded him the opportunity to develop a true "biological intuition". In parallel, he mastered both the advanced theoretical methods for the study of biocomplexity and the state of the art techniques in large scale computations.

Ido is not the only one who can master advanced methods; what makes him exceptional is his ability to incorporate his physical intuition with the biological knowledge and intuition and to develop new generic models to decipher hidden biological principles.

To be more specific, until Ido joined my group we focused on the agents modeling approach to describe colonial development. After first learning thoroughly this approach, Ido moved on and developed a new continuous (Reaction-Diffusion type) approach while utilizing the effect of nonlinear diffusion. This technical term refers to a crucial biological strategy of the bacteria by which they emit surfactants to

collectively create a lubricating layer on top the substrate. This collective strategy enables them to move on hard surfaces as they swim within the layer of fluid they generate and push forward.

Having the model at his disposal, Ido turned to meet the challenge posed by the phenomenon of bursts of sectors of new mutants. This long-existing problem in bacteriology has important potential implications in understanding malignant tumors. To this end, he generalized the model to account for the appearance and expression of mutations. The task was a true achievement, as he had to deal with the question of finite cutoff in the continuous description of the bacterial colony. Ido was the first to be able to analyze the expression of mutations both during branching and compact colonial development. Next, Ido turned to explaining the effect of non-lethal levels of antibiotics on the colonial patterning. Keeping in mind that currently the number one world health problem is bacterial resistance to antibiotics, these studies have far-reaching applications. For example his studies can provide a crucial understanding for the developments of new strategies to fight bacteria, by tempering their communication channels.

At this stage, after building sufficient “biological confidence”, Ido showed intellectual courage in facing the most challenging task – to model adaptive mutations and perform quantitative comparison between experimental observations and model simulations. I was very impressed by how fast Ido grasped the vast literature and understood in depth the different proposed mechanisms to the point that he could translate the conceptual ideas into a specific model for simulation. Moreover, he could extract from the observations quantitative measures so the qualitative observations could be quantitatively compared with the model simulations. Again, like in the previous studies, Ido was the first to be able to do so.

Towards the end of his PhD years, having established himself as an expert in model studies of colonial developments, Ido made a decision to continue his postdoctoral studies as an experimentalist. Based on his pioneering achievements of his PhD, he won the prestigious three-year Thomas Lewis fellowship at Princeton to work with Prof. Cox who is one of the world leading microbiologists. Since he can better describe Ido’s research at Princeton, I would only emphasize here that again Ido took upon himself a great challenge – to be able to track individual RNA molecules in living bacteria. And again Ido is the first in the world to be able to do so. This research, now published in PNAS, has already evoked much excitement in the scientific community. More recently, Ido and his collaborators published a second PNAS paper in which they describe their new findings about long range interactions between DNA and repressor. These novel experimental findings are expected to dramatically deepen our understanding of genome-wide regulation mechanisms in gene-network dynamics, especially in the context of bacterial cooperative behavior (see his PLoS recent publication) – a topic that has been gaining much attention in recent years. I would like to emphasize that in general there is recent increasing interest in bacterial collective behavior. This is largely due to the finding that bacterial cooperation in colonies or biofilms affords them high resistance to antibiotics.

Ido’s special research program is so successful thanks to his devotion as well as his unique multi-level perspective of biology: from the investigation and understanding of intra-cellular single molecule kinetics to the inter-cellular collective

behavior. In addition, Ido's research abilities are so powerful thanks to his mastering both the most advanced experimental methods and the most sophisticated mathematical analysis methods. I am sure that the outcome of his current and future research will turn out to be a crucial step in our understanding of the biocomplexity of the prokaryotes kingdom.

It is now almost ten years since I first met Ido. I had the pleasure of working closely with him as his PhD advisor and help bring into full bloom his initial promise as a scientist. I was thrilled and proud to watch Ido's transformation into a mature researcher during his three years at Princeton.

Aside from his demonstrated ability to contribute to research and his strong teaching skills, it seems to me that a comment should also be made on Ido's personality. This is a matter which reflects strongly on the ability to collaborate successfully both within a department and with researchers at other departments and other institutions. Ido is both direct and outgoing in his interactions. At seminars, conferences and workshops, his presence is felt both through his keen questions and knowledgeable answers. It is this constructive approach to doing science and interacting with others which already led him to participate in much collaborative work.

During his Master and PhD studies, Ido was a teaching assistance. Both from my own experience and reports received by other faculties, he was one of the best TAs. His lectures are very organized and pedagogical, yet convey intellectual inspiration and motivation. His charming sense of humor adds flavor to the lectures and induces warm feeling in the students. He is flexible and friendly and answers questions during classes and afterwards. I used to watch his interaction with students that came to consult with him not only on topics related to the courses he was TA for but also about other courses. His developed rhetoric abilities are also apparent in the excellent seminars he gives on his own research. Clearly, he will be a most popular lecturer among students.

Usually, it is hard to predict at the postdoc stage how one will perform as an advisor of graduate students. In the case of Ido, it is easier since during his PhD he was in direct charge of two of my Master students. The same characteristics that make him a superb lecturer have been demonstrated during his supervision of the students. Moreover, he knows to find the crucial balance between hard drive and reward - posing challenges to the student to make the most of their potential and helping them build intellectual self-confidence.

Each individual is unique, yet the question of comparison with others is always raised. I know very closely Uri Alon and Naama Barkai since they have been PhD students in Physics. Both had a similar career to Ido's and both did their postdoc at the department of molecular biology at Princeton. When Naama and Uri were ready for academic positions, I refused to rank them and insisted that they are both exceptional and should be offered a position since I am confident that they are both going to have a most successful academic future. For the same reason, I can not rank Ido and them when they were at the same stage. What I can do is share again my confidence that Ido's future development as a scientist will be as successful if not more so.

I hope that the above letter did convey the message that Ido is truly an exceptional researcher. Based on all of the above, I strongly recommend him for your position at a high level Assistant Professor.

Sincerely yours,

Eshel Ben-Jacob.

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