



ARMENIAN BIOINFORMATICS INSTITUTE

SCIENTIFIC EDUCATIONAL FOUNDATION

RESEARCH
SCHOLARSHIP & FELLOWSHIP
FUND
FOR
GENOME BIOINFORMATICS

EXECUTIVE SUMMARY

Technologies have revolutionized the way we produce data in life science, bringing data analysis to the forefront of biological discoveries. Bioinformatics encompasses the analysis of biological data to generate new knowledge in genomics and support innovation in modern biotechnologies. With a negative employment rate of nearly 50%, bioinformatics has become one of the most needed and hard-to-find competencies of the 21st century. Hence, excellence centers to promote the development of bioinformatics capacity are getting established in the US and Europe for more than 30 years.

In Armenia, however, the field of genome bioinformatics is still in its infancy. There is a small group of specialists with more than 10 years of experience in the field, providing a solid track record and involving in strong R&I collaborations with the EU and USA. However, there is no critical mass yet, and the pace of growth of human capital is not yet enough to support the development of the life sciences and the genomics-heavy biotech sector in the country.

To develop the competency in genome bioinformatics, personalized medicine, and biotechnology, a group of researchers from Armenia and from abroad established the Armenian Bioinformatics Institute (ABI) as a non-profit scientific educational foundation, in February 2021. The first ABI activities, such as the summer school and the research projects have already started and shown promise. Many students are joining the institute and engaging in research projects supervised locally or remotely from abroad.

To support these students and recruit new ones, we are calling for an establishment of a joint scholarship & fellowship fund. With a 140.000\$/y of the total budget, the fund should provide remuneration for up to 7 new BSc/MSc students, as well as for 2 PhD and 2 Postdoctoral researchers per year, with the possibility of recruiting them from abroad.

The impact of this initiative will be detrimental to the development of the genomics and bioinformatics competency at ABI and in Armenia. With the pace of 6-7 new dedicated students and 4 young researchers per year seriously committing to research in the field we will be able to achieve our goal of establishing 5-6 research groups/labs at ABI within 5 years. This will not only increase the scientific output of ABI but will educate a new generation of genomics & bioinformatics specialists that will drive the development of biomedicine and biotechnologies at a sufficient pace to finally see an establishment of Armenia based biotech companies and start-ups.

BIOINFORMATICS: WHY IS IT ESSENTIAL FOR ARMENIA?

Medicine, pharma, and biotech have largely been transformed into data-dependent ventures, where large-scale molecular, clinical, and population data are cornerstones of success. Technologies that have revolutionized bio-related research and development, such as large-scale sequencing, have posed the challenge of having enough bioinformaticians able to transform data into knowledge. Recent surveys report that only 50% of demand in bioinformaticians is fulfilled in academia and industry worldwide. This gap between the availability and the need for a workforce continues to grow.

CHALLENGES AND OPPORTUNITIES

The first group in Armenia specializing in genomics & bioinformatics (Bioinformatics Group, Institute of Molecular Biology NAS RA), established ten years ago, has shown a successful track record of conducting original research and acquiring valuable collaborations and attracting significant funding from national and international agencies. However, the speed of organic growth at BIG wasn't sufficient to produce enough bioinformatics manpower. Since its establishment in 2011, BIG has produced several alumni (now a postdoc, a PhD and MSc students elsewhere), and currently has two PhD students. Today, the amount of genome bioinformatics specialists in the country that hold a PhD degree is only two.

As a consequence, many labs conducting research in life sciences and medicine in Armenia are in extreme need of bioinformatics specialists. Despite the presence of educational programs with partial coverage of bioinformatics subjects, those only prepare seeds for bioinformatics researchers. Today, the number of people with a PhD degree in genome bioinformatics in the country is just 2, instead of at least 30 that are needed in the academic, medical, and industrial sectors according to international standards. Even more troubling is the fact that presently the educational programs in Armenia do not prepare genomics/bioinformatics specialists at a solid level and in sufficient numbers to satisfy the needs that academic, medical, and industrial entities will soon have. There is a gap between the content of educational programs and the latest advancements in bioinformatics, as well as a lack of academic entities supporting the transition of students to master's, PhD, and postdoctoral levels.

Moreover, such modern educational programs must be built around modern science programs and infrastructure enabling research on cutting-edge topics. Unfortunately, there is still a gap between these needs and the reality of science politics in Armenia.

WHY ABI?

The only way to overcome this problem is to initiate an independent educational/research program based on available local and international expertise to build a minimum fundament of the required human capital.

With this aim, in February 2021, a team of bioinformatics specialists from Armenia and from abroad established the Armenian Bioinformatics Institute (ABI) as a non-profit scientific educational foundation. ABI plans to develop the human capital in bioinformatics required to boost data-driven research and innovation in life sciences including biomedicine and biotechnology. **ABI serves as a platform to unite experts from around the world, and to recruit students to the exciting field of bioinformatics, connect them to qualified mentors and supervisors, and provide a fruitful environment for learning, research, and networking.**

ABI'S STRATEGY TO ATTRACT AND RETAIN TALENT

During its first year as an independent organization, ABI has mobilized over 30 dedicated (both international and diasporan) scientists and industry leaders worldwide, recruited 12 young researchers and students engaged in research projects with the local and international ABI community, launched the first international lab (Binder lab), launched a bioinformatics support program to international life science Postdocs, co-authored four papers in peer-reviewed journals, organized an intense summer school in bioinformatics and a few specialized courses, overall targeting nearly 40 students from various universities in Armenia.

To achieve speedy expansion of the human capital, ABI mobilizes researchers from Armenia and from abroad, who are engaging in research project supervision, teaching, consultancy, and scientific discussions. It implements a model of supervision that enables researchers from abroad to establish their labs in a partly remote fashion.

RESEARCH

ABI hosts an international lab, led by Dr. Hans Binder, focused on machine learning and systems biology applications to several research questions, e.g. cancer heterogeneity, aging, and vine genomics. It hosts three research students at ABI, four mentors from ABI, and one from IZBI. A second group led by Dr. Lilit Nersisyan started in 2022, with 3 ABI students. The lab aims at developing algorithms and software tools for genomics research, with a current focus on microbiome research and gene therapies. ABI also implements a Research school concept to attract students from various universities and engage them in research projects. Since 2021, there have been [8 such projects](#) four of which are supervised remotely by researchers from abroad (topics spanning cancer & population genomics, single-cell RNA-seq in development, aging, telomere research, and pathway analysis). ABI is also collaborating with Postdocs from abroad, to provide bioinformatics support to their research, while getting their mentorship to train ABI students (see: [M&M program](#)). Within the last year, ABI has co-authored four research papers, has collaborated on joint projects with research institutions in Armenia, Germany, Sweden, Belgium, Austria, and the US, and has received a research grant from PMI Science.

EDUCATIONAL ACTIVITIES

To bridge the knowledge gaps and recruit students to the field, ABI constantly organizes courses, seminars, and schools. In 2021, an intense 11-week long full-day summer school ([OMICSS-2021](#)) was launched, with 38 speakers from 11 countries and 3 local mentors, that hosted 19 students (selected from 47 applicants), of whom 10 continue their activities at ABI to the present day. In addition, ABI is hosting [courses](#) in Applied Bioinformatics, Advanced molecular biology, and Machine learning in 2021-2022. Overall, more than 40 students have been targeted via educational activities at ABI within the last year.

HOW MUCH FUNDING IS NEEDED?

With this call, we are planning to host 6-7 BSc/MSc students and 4 PhD/Postdoctoral researchers per year. This requires nearly 140.000\$ in funds per year. As the budget is quite big for one organization, we suggest an establishment of a joint research scholarship fund with the participation of several organizations and individual donors.

The two research scholarships described in the sections above were intended for six months, 300\$ per month, totaling 1800\$ each. It is important to note that in both cases, the students had already started the projects when the donation requests were made. However, it is important for all the prospective students to realize the opportunities that exist for them, and to have clear timelines of what to expect, both academically, as well as financially. Sustainable financing of students over the full duration of their projects is an inevitable requirement to make science-oriented qualification programs attractive, effective, and competitive with job offers from the industry. In addition, at least 3y and 2y guaranteed fellowships for PhDs and Postdocs is a basic requirement to be able to recruit those researchers from abroad.

We are suggesting a remuneration scheme of 300-600\$ per month for BSc/MSc students and fellowships of 1500-2000\$ per month for PhD/Postdoctoral fellows. In addition, we suggest mobility and family allowance for researchers that move countries and/or have families. According to international standards, students need commitments for one year (master) and three years (PhD) given that their projects are scientifically approved and given that they work full-time on their topics under their own and supervisor's responsibility. Contracts must define possible exit points every 6 months in case of insufficient progress (Table 1). Please, refer to Appendix 2 for details on fund management and reporting.

	Commitment	Monthly remuneration, \$	Duration	Number of recipients in 2022	Number of recipients in 2023	Total, \$ for 2 years
BSc scholarship ^a	Part-time (4h/d)	300	6m +	2-3	4-5	25200
MSc scholarship ^a	Part-time (4h/d)	400	6m +	1	1	10800
MSc scholarship ^a	Study-free-time (6h/d)	600	1y +	1	1-2	18000
PhD fellowship ^{bc}	Full time	1500	3y -	0-1	1-3	135000
Postdoctoral fellowship ^{bc}	Full time	2000	2y -	0-1	1-2	96000
Mobility allowance				1	2	43200
Family allowance				1	1	21600
Total						285000

+ The scholarship is given for an initial defined period, with an opportunity to prolong for additional periods.

- The fellowship is guaranteed for the given period but may be terminated in case of poor performance.

^a Scholarships are not tax-deductible

^b Fellowships are tax-deductible

^c Mobility and family allowance is envisioned for researchers who move countries or have families

ABI will organize calls for prospective students and researchers after matching them with project mentors and labs. Reporting periods will be defined for each scholarship and fellowship to ensure a high standard of project implementation (Appendix 2).

The remuneration amounts for PhD and Postdoctoral researchers are computed based on the respective salaries in the US, Germany, and Sweden, as well as the difference in purchasing power and the HDI coefficient as an indirect measure of social security level (Appendix 1). Also, we take into consideration the recent government decree that defines the minimum base salaries for PhD-Postdoc level researchers in the range of 569-916 \$ (without grants) for 2025 [[12](#)].

The expected number of candidates to receive each of the scholarship/fellowship positions proposed is based on the currently active students, as well as on the expected student flow from the universities. The case with PhD and postdoctoral fellowships is tricky, and this is where we need to be proactive, not only to support the few local PhD and Postdoctoral students but also to make international calls for those positions and attract them from abroad.

APPENDIX 1: SALARY CALCULATIONS

Calculation of gross salaries for PhD's and Postdocs in Armenia. We assume that the ratio between west and Armenia in terms of the local purchasing power and the HDI index (as an indirect measure of social security level) should be taken into consideration to provide similar quality of life to the researchers in Armenia.

	Stockholm	Berlin	Boston	Average
Consumer Prices (without rent)	1.44	1.07	1.60	1.37
Consumer Prices Including Rent	1.76	1.34	2.60	1.90
Groceries Prices	1.72	1.13	2.24	1.69
Local Purchasing Power (LPP)	2.14	2.55	2.86	2.51
References	[1]	[2]	[3]	
HDI ratio (HDI)	0.821	0.819	0.838	0.83
References	[5]	[6]	[7]	
PhD net salary \$ average	2348	2475	2274	2366
Postdoctoral fellowship \$ average	3000	3400	3400	3267
References	[8]	[9]	[10] [11]	
	Arm = West/LPP/HDI			
PhD net salary for Armenia	1339	1185	950	1158
Postdoc net salary for Armenia	1710	1628	1420	1586
PhD gross salary for Armenia	1717	1519	1218	1484
Postdoc gross salary for Armenia	2193	2087	1821	2033

APPENDIX 2: MANAGEMENT AND REPORTING

SELECTION CRITERIA FOR SCHOLARSHIP/FELLOWSHIP RECIPIENTS

The recipients of the scholarships/fellowships will be carefully selected by a dedicated committee formed by the researchers in the Executive and Advisory boards at ABI, as well as the director. For specific topics, researchers from the field may be asked to join the evaluation committee.

The selection process will involve an evaluation of a written application and follow-up interviews. The following criteria will be taken into consideration:

- Background, experience, and prior knowledge;
- Statements of motivation
- Reference letters from professors/lecturers (undergrad/graduate/PhD scholarships) or from supervisors/colleagues (postdoctoral fellowships).
- For PhD/Postdoctoral fellowships: research project – its originality, soundness, and potential impact, as well as fit into priority research areas of ABI.
- Statement of commitment by the supervisor.

Mostly, the applications will be accepted on a rolling basis, but specific calls may be announced from time to time.

REPORTING

The recipients will be obligated to provide periodic written and oral reports on their progress. Undergraduate and graduate scholarship recipients will have to provide a written report once every 6 months for projects lasting for at least a year, or once every 3 months for shorter-term projects. PhD and postdoctoral fellowship recipients will be asked to provide annual reports. The reports should highlight:

- scientific objectives, milestones reached and deliverables, and possible obstacles
- deliverables, such as capstone theses, publications, conference participation
- reference by the supervisor

The recipients will have to present their progress once every 6 months to the international ABI community. By the end of the scholarship/fellowship, the recipient should deliver a popular talk about their project to a wider audience.

FUND MANAGEMENT

- The ABI scholarship/fellowship committee will be responsible for evaluating and approving the reports or asking for amendments/revisions.
- The ABI scholarship/fellowship committee is obliged to report to the donors about the status of the projects, whether or not the milestones have been achieved and whether or not the funding should be continued/halted according to the reports.