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Research at the Bulgarian Academy of Sciences

Panel 2 Report:
Biological Sciences

Volume 3 of 5

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Acknowledgements

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Part 1: Panel-level Report

1. Panel-wide executive summary

The 15 life science Institutes of the Bulgarian Academy of Sciences (BAS) represent a highly valuable scientific potential for Bulgaria. The Panel of Experts was in general highly impressed by the quality of research in these life science Institutes. The scientific output of the Institutes is clearly visible internationally, and in some field the production is internationally competitive. Although there are some smaller topics in which the research activity of BAS scientists is at the forefront, currently there are no BAS Institutes that could be considered as international leaders in their field. This is reflected in the scores for the Quality/Productivity criterion, which yielded five A (internationally competitive), six B (internationally visible) and four C (nationally visible) scores. The Panel had the strong opinion that research activities of the life science Institutes have high relevance regarding scientific and socio-economic impact, which is reflected by the A (highly relevant) score given to thirteen of the Institutes and the B-moderately relevant score to the remaining two Institutes. It has to be noted however, that the activity areas of the Institutes are often heterogeneous, and in some cases (Institute assigned museums, Institute of Experimental Morphology and Anthropology, Forest Research Institute) socio-economic significance at the national level was clearly dominating scientific impact. The future prospects of the Institutes are generally good, although their capacity to tackle the problem of ageing scientific personnel, as well as attracting research funding from Bulgarian and international sources is largely different. This heterogeneity is reflected in the five A (high prospects), seven B (moderate prospects) and three C (low prospects) scores given for the Prospects criterion.

2. Overall summary of the Institute-level scores

In this Section, the scores given to all Institutes for the three criteria are summarised.

Table 1: Scores for all Institutes in PE-2

No.	Institute Name	Quality and Productivity	Socio-economic Impact	Prospects
401	Institute of Molecular Biology	A	A	A
402	Institute of Neurobiology	A	A	B
403	Institute of Biophysics	A	B	A
404	Institute of Plant Physiology	A	B	B
405	Institute of Genetics	B	A	C
406	Stephan Angeloff Institute of Microbiology	A	A	A
407	Institute of Experimental Morphology and Anthropology with Museum	B	A	B
408	Institute of Experimental Pathology and Parasitology	C	A	B
409	Institute of Biology and Immunology of Reproduction	C	A	A
410	Institute of Botany	B	A	B
411	Institute of Zoology	B	A	B
412	Forest Research Institute	C	A	C
413	Central Laboratory for General Ecology	C	A	A
414	Centre of Biomedical Engineering	B	A	B
415	National Museum of Natural History	B	A	C

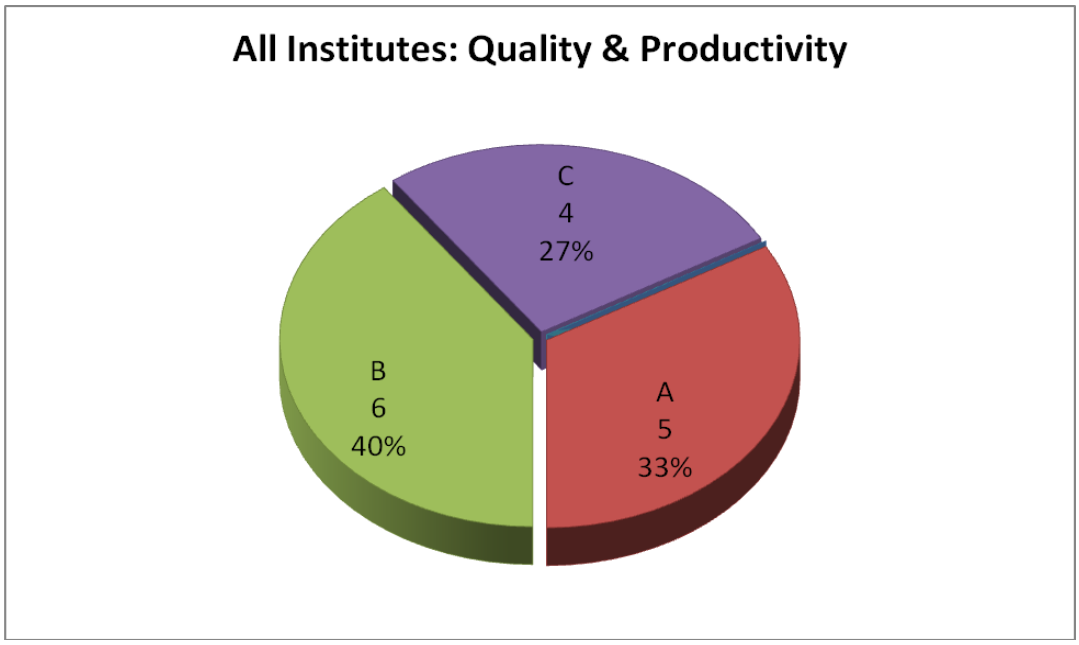

Figure 1: Distribution of Scores for Quality and Productivity for all PE-2 Institutes

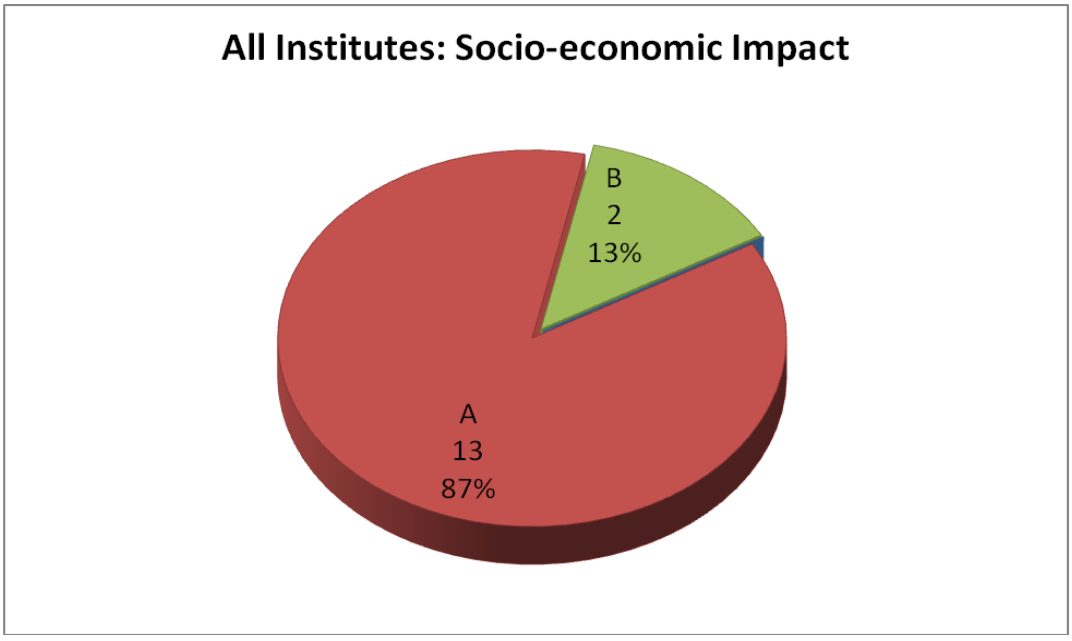

Figure 2: Distribution of Scores for socio-economic impact for all PE-2 Institutes

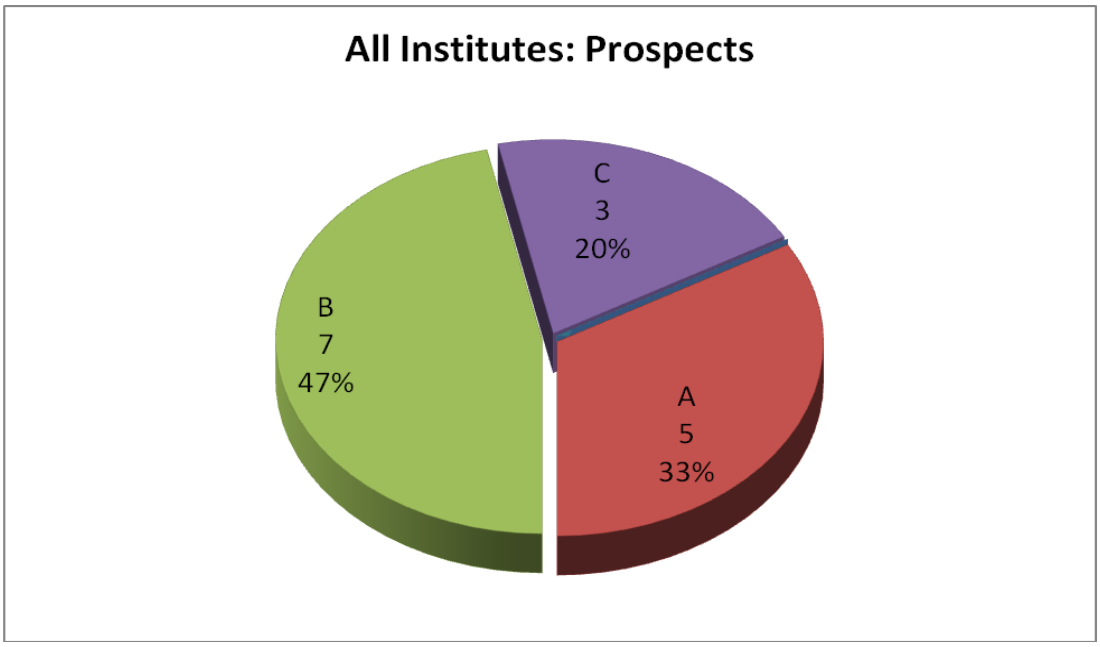

Figure 3: Distribution of Scores for Prospects for all PE-2 Institutes

Panel-level Strengths and Weaknesses

Overall strengths:

The life science Institutes of BAS are performing at an internationally visible and often competitive level. The research topics pursued by the Institutes are in general highly relevant for Bulgaria and the international scientific community. The life science Institutes in general have well trained, well qualified and creative scientists who perform against the odds of the unfavorable conditions that exist in the BAS system (salary, research facilities) when compared to international standards. The relatively few young scientists who stay in the BAS system despite the significantly better situation abroad are also well trained, with good language skills and dedication towards scientific work.

Overall weaknesses:

The age distribution of the scientific personnel is unfavorable since approximately half of the scientists are above 50-55 years of age. As a consequence, the proportion of young scientists (those below 35 years of age), as well as of the active middle generation
(35-45 years) is low. New PhD holders (who obtained their degree in the reporting period) represent approximately 12% of all scientists, which is low considering the need for well qualified young scientists. The age problem stems to a large extent from the unfavourable salary situation of the BAS scientists, with significantly lower salaries than those of equally well-qualified colleagues in the Bulgarian University system. Publications of the life science Institutes are dominated by papers appearing in Bulgarian journals (60 % of all papers), which have no impact factor and have only limited international visibility. The research support of the Institutes was very fragmented in the reporting period with many small projects receiving support of only a few thousand euros. The ability of the Institutes to attract significant funding from international sources was also limited, since in average the total foreign grant support amounts to only ca 7 % of the BAS subsidy.

Panel-level Recommendations

Main Panel recommendations

- Establish a salary system in the BAS Institutes that matches that of the Universities, i.e. to provide equal salary for scientists in the corresponding rank in the BAS and in the Universities.
- Establish post-doctoral and startup grant systems to keep young scientists in Bulgaria, or attract back qualified young scientists from abroad.
- Establish an advisory council for each Institute with international membership, to help strategic planning of future research.
- Encourage publishing in international journals with impact factor, instead of local Bulgarian journals.
- Set up a "matching fund" system to help the Institutes, which are successful in obtaining research grants from foreign sources, but have no own resources to cover co-funding expenses, and VAT.
- Improve synergies between Institutes through the creation of joint infrastructural facilities.
- Set up a grant office that facilitates project and application writing.
- Set up a technology transfer office to support practical utilization and patenting, and establish a specific fund system to cover patenting expenses.
- Recruiting talented young people for science is very important and should be a high priority for the Institute as well as for the whole BAS system.
- It is advised to raise the minimal criteria for obtaining the PhD for the student title to have at least one publication in which the candidate is first author in an international journal with reasonable impact factor. (This could be done even if the general requirements in the Bulgarian system are lower.)
- It is suggested to post the defended and final PhD theses as a downloadable document on the website of the Institute and/or of the BAS. This will make them accessible to the scientific community at large (national and international) and increase the visibility of the Institute's research.
- It is advisable to encourage PhD students to prepare their PhD theses in English.
- It is advised to have all scientists of the Institute including PhD students present regular seminars and progress reports in English.
- It is advised to implement regular journal clubs for PhD students and young scientists, also in English in order to get acquainted with the latest results in their field,

The Institute should make efforts to recruit well-established scientists, possibly by bringing home successful Bulgarian scientists from abroad, who could shape the future scientific profile of the Institute according to international trends. In order to achieve this goal it is suggested to develop specific 'brain gain' career programmes.

3. Panel-level evaluation

The BAS system has 15 Institutes and research units in the field of life sciences. Some of these Institutes were established in the first half of the 20th century, and have produced results of international quality since then. The PE-2 Panel was in general highly impressed by the quality of research in these Institutes. It also feels that the scientists of the Institutes should be congratulated on their achievements in light of the rather unfavourable funding situation during recent years.
The quality of the research reports (Self Evaluation Report, Answers to the additional questions) provided by the Institutes was very high. The Panel was also impressed in general by the high standard of the presentations during site visits interviews, although some Institutes have solved this problem much better than others. The Panel had very good impression of the young scientists, who stay in the BAS system in spite of their obviously very unfavorable financial situations when compared to conditions either abroad, or to competitive business environment in Bulgaria, and even to conditions in the university system in Bulgaria.

3.1 Human resources

General situation:

The life science Institutes typically employ 40-50 scientists, although larger and smaller units exist as well. A specific feature of the BAS system is the large number of so called specialists with higher education, who seem to work mainly as technicians, or as young scientists working for their PhD degree. The number of these specialists in average reaches almost 50 % of the number of scientists, adding in average another 20 individuals/Institute to the research personnel with university degree.

Age structure:
(Here we consider only the various categories of research associates, without taking into consideration specialists with higher education)

The life science Institutes of BAS are clearly in their senior phase as regards the age of the scientists. In average ca. half of the scientists are more than 50-55 years of age. In contrast, only 24 % of them are less than 35 years old, and the middle generation of active scientists between 35-45 years of age also has a low proportion. This age structure is very unfavorable for the future scientific productivity of the BAS life science Institutes, and will cause serious problems in the midterm future, when the now 55-65 years old generation will retire. This problem has been recognized by all Institutes, but only a few of them were able to take successful counter measures. The best example is the Institute of Molecular Biology, where the proportion of the young scientists is as high as 47 %! The lack of young scientists is clearly related to the low salary level in the BAS Institutes, and adequate measures should be taken to reverse this trend.

Keeping scientists in the BAS system:

For the revitalization of the BAS Institutes it is essential to have a sufficient number of highly qualified young scientists with international research experience. Young

scientists should be encouraged to go abroad for post-doctoral work, and the Institutes should attract them back with special packages (i.e. 3 years postdoc + start-up grant when back in Bulgaria). In order to recruit new group leaders, BAS is advised to provide attractive working conditions: e.g. the prospect of developing own line of research, being a Team Leader very early in the career, having additional responsibilities at Institute level, special research grants for young group leaders.

Salary level:

Salaries of Bulgarian scientists are low in general in the whole country, but a particularly unfavourable situation seems to exist for scientists in the BAS Institutes. According to the information the Panel has obtained, the salaries are ca. 30-40 % higher in the university system for scientists with the same scientific qualification and corresponding rank in the hierarchy, than in the BAS Institutes. This causes lots of friction between the two research systems of Bulgaria and induces a brain drain from the BAS Institutes towards the university departments in spite of the apparently more favorable research conditions in the BAS system.

It is strongly advised that this problem be eliminated by establishing a salary system in the BAS Institutes that matches that of the Universities, i.e. to provide equal salary for scientists in the corresponding rank in the BAS and in the Universities.

Teaching activity:

Involvement of scientists in teaching of undergraduate and graduate students is desirable, since this provides a unique opportunity to meet young people, and to recruit and educate the new generation of scientists, who are so much needed to maintain the scientific productivity of the BAS system. Educational activity is present in almost all Institutes, and is in general in acceptable proportions. However, there are BAS Institutes in which the teaching load is apparently very high (Institute of Biophysics, Institute of Botany), with the involvement of relatively few people whose main activity seems to be teaching. The high teaching load in these Institutes is not healthy, since it diverts too much energy away from research. It appears to be motivated by the desire to increase the income of scientists. The friction caused by inadequate salaries should be solved by harmonizing the salary system of the BAS and the Universities, not by taking university level teaching load by the scientists working in the BAS Institutes. For active senior ranked scientists 2-3 hours of lecturing per week appears to be a reasonable activity to keep up contact with university and post-graduate education. This level of teaching should be preferentially focused on special training of graduate students and young scientists.

3.2 Scientific quality and output

International and national publications:

Most of the Institutes produce internationally visible results, which appear in scientific journals abroad and receive a significant number of citations. As a whole the 718 researchers of the life science Institutes have published ca. 1400 papers in international scientific journals with a cumulative impact factor of ca. 2500 in the

five years reporting period. This corresponds to 0.39 SCI papers/scientist/year, which is a relatively low number. (In the number of scientists polled, we have not taken into consideration the specialists with higher education who seem to be working as highly qualified technicians). However, the quality of the SCI papers is good as shown by the average 1.8 IF/paper value for the SCI publications.

It has to be noted that, besides the significant scientific output in international journals, the life science Institutes of BAS are publishing a very high number of papers in local journals, which have no impact factor, and thus have no, or only very limited international visibility. The number of these local publications is actually exceeding the number of SCI publications. A typical explanation given by the Institutes for the high proportion of local publications is that the results are not good enough to meet the requirements of international journals. In this case, the Panel feels that production of these studies and publications does not enhance the optimal use of time and energy of BAS scientists, and strongly advises the Institutes to minimize efforts for local publications in this category. Another typical argument was that the results have only national relevance, that is why they can be published only in Bulgarian journals. This argument can be partially accepted in special fields dealing with Bulgarian flora, fauna and human population. However, the higher national relevance of these studies cannot be used as excuse for the lack of international publications, which is characteristic of these areas.

In the five-year time window of the report the Institutes received ca. 14,000 citations for their publications, which contained the name of the Bulgarian Institutes and are accessible via the Internet (Web of Science). This corresponds to ca. four citations/scientist/year, reflecting the relatively low impact of Bulgarian Life Sciences abroad. It has to be noted that the number of citations appears to be higher by about 60 % if the numbers declared by the Institutes are used. However, these additional citations appear in local sources (self-edited journals, books, monographs, PhD theses, etc.), which are not internationally visible, and cannot be referenced by independent evaluators. The ratio of the Internet-accessible and self-declared citations scatters in a very wide range from 98 % in the case of the Institute of Biophysics to merely 5 (9) % in the case of the Forest Research Institute (National Museum of Natural History). This phenomenon is strongly correlated with publication practices. In case of Institutes that are publishing their results in high quality peer-reviewed international journals the citations are also visible via the Internet. In contrast, in the case of Institutes which publish their results in self-edited journals, books etc., the citations also appear in similar publications with low international visibility.

Journals of the BAS Institutes

The life science Institutes of the BAS system are very active in publishing their own journals. These journals are typically in English, and all of them are included in Web-based resources for references (Thomson Reuters Master Journal List), but none of them has an impact factor yet (although *Acta Zoologica Bulgarica* was recently included in the Science Citation Index Expanded). These journals are mainly edited by researchers from their home Institutes with few international members on the

advisory board. They often have low quality and low visibility by international standards. Some of the journals have a website, but none of them provides full on-line access to the published content. In some cases publication is delayed by years (for *Genetics and Breeding*, the last published issue is of 01-02, 2006, according to the journal website). In spite of these shortcomings in quality, these journals are popular among Bulgarian scientists, but often serve for publishing papers that do not reach the level required by international journals.

The Panel feels that it is very important to raise the level of the best journals (international editorial board, fast publication time, inclusion in reference databases, good website, on-line content access) such that they will be admitted to have an impact factor. If these criteria cannot be reached it is better to stop the publication of local journals in order to avoid further diversion of time and energy (by maintaining these journals at their current low level) from the more important research sources.

Services provided by the Institutes:

The Panel has noted that some Institutes have a significant amount of activities which are outside the scope of direct research activities. Typical examples of this situation are the museums (where the main activity is the keeping and maintaining of the collections and exhibitions), as well as the Forest Research Institute (where the main activity appears to be the provision of surveys for ministries and state agencies). Since these activities yield only negligible amount of scientifically appreciable output it is very difficult to evaluate these units together with the others. Therefore, the BAS administration could consider operating these units as service units. A more ambitious long-term solution could be to move all museums and collections to a common location as outlined in the next section.

Dispersed nature of natural history collections in Bulgaria:

The Panel has noted the existence of several parallel collections in BAS Institutions, and Universities. It cannot make a specific recommendation that can be implemented in the near future, as the real solution seems to be rather ambitious, and it is not familiar enough with the Bulgarian situation. However, it can express its view that in the long term, a well planned and defined pooling of the most important collections (e.g. moving the experts and the collections from other BAS Institutions and from Universities to NMNH) would create an internationally excellent, visible, larger and stronger museum. The Panel expects that the pooling of collections with the related faunistics, floristics, palaeontology, taxonomy etc. research will have ca. 4 million items, and a research staff of round 40. This museum would be a strong player at the European level. Obviously, it would also need one large, attractive and impressive building, high-tech storage, a unified publiclyavailable database, and exhibition hardware. Then, the overlap would be smaller with descriptive aims, i.e. taxonomy, faunistics and floristics, being based at the Museum, while other, evolutionary, ecological and conservation biology research stays at the other Institutes, where the burden of maintaining collections will cease.

3.3 Research support

General situation

Support from BAS covers mainly the salaries and the maintenance of the buildings. Research projects are supported primarily by NSF, and to a smaller extent by the BAS subsidy, Bulgarian ministries and agencies, as well as by foreign grant agencies. The total amount of grant support from Bulgarian sources amounts to ca. 24 % of the total subsidy from BAS. In contrast, the total foreign support reaches only 7 % on average of the BAS subsidy.

It should be noted that the total BAS subsidy of the life science Institutes amounts to ca. 11.5 million BGN (5.75 million EUR)/year, or 16,000 BGN (8,000 EUR)/scientist/year (covering all costs of the Institutes). The total grant support from Bulgarian sources is 2.75 million BGN (1.37 million EUR)/year, or 3800 BGN (1900 EUR)/scientist/year (covering the costs of nationally supported research). In contrast, the total grant support from foreign sources is 0.84 million BGN (0.42 million EUR)/year, or 1200 BGN (600 EUR)/scientist/year (covering the costs of internationally supported research). These support levels are quite limited for supporting high quality, competitive science.

Fragmented research support

The Panel has noted that in some Institutes the number of projects was over 200-250 for the five years reporting period. This number is very high, and in general reflects a fragmented research support, which does not allow researchers to concentrate their efforts on important research targets. According to the information the Panel received during the site visits and interviews, this situation has been recognized by the NSF as well. Recently, the funding policy of the NSF has changed, and now it prefers to award significantly larger grants. The Panel feels that it is very important to keep this policy of concentrated funding in the future.

Support for joint infrastructural facilities

Modern life sciences are very much dependent on the availability of state-of-the-art infrastructure, which requires a rather high amount of investment that is not easily available for individual Institutes. The panel has noted that support from NSF and other European sources is already available for joint infrastructural centers, which are used together by the BAS Institutes and Universities. This trend should be continued. Considering the very close location of several BAS Institutes (many of them are in the same building) it would be very effective to establish joint infrastructural facilities, by pooling BAS subsidy and support obtained from outer sources, which could be shared by several Institutes.

Support for patents

It is very important for Bulgaria and for the whole society that the innovation potential of new research findings will be sufficiently utilized to ensure that scientific and technological developments are accessible to a wider range of users who can then further develop and exploit the technology into new products, processes, applications, materials or services. An important step in this technology

transfer process is the protection of the intellectual property rights of results by patents, which are important for potential applications. Only a few of the Institutes have patented results, and it seems that overall the Institutes have no specific support for this purpose, which makes it difficult for them to obtain patents. Therefore, it is advised that the BAS administration helps the Institutes in the patenting process by establishing a patent office (to provide expert help in patenting issues), and by creating a specific financial system to cover the patenting costs. The latter could be done by a grant system through which the Institutes can apply for patenting costs.

International funding

For the success of Bulgarian science it is essential that the researchers can increase their success in obtaining international funding. In this respect the Panel has noted that Institutes working on ecological and biodiversity topics (Institute of Botany, Central Laboratory of General Ecology), for which large cross-European or regional networks are needed to cover different geographical areas, are in a better situation in obtaining collaborative EU research grants as compared to Institutes working on more basic science topics (Biophysics, Plant Physiology), in which top quality science is preferred to geographical location.

Since application to international projects and complying with the administrative issues is often very complicated, it is advised that the BAS sets up an international grant office. Such an office could continuously monitor the European and other international calls for proposals, and advise the researchers about the upcoming possibilities. In addition, the grant office could provide expert help in dealing with administrative issues regarding the use of and accounting for the obtained support. It is of note that such grant offices could be set up also in the Institutes, where they are in closer contact with the researchers.

4. Panel-level strengths and weaknesses

Strengths:

- The life science Institutes of BAS are performing at an internationally visible and often competitive level. The research topics pursued by the Institutes in general are highly relevant for Bulgaria and the international scientific community
- The life science Institutes in general have well trained, well qualified and creative scientists who perform against the odds of the unfavorable conditions that exist in the BAS system (salary, research facilities) when compared to international standards. The relatively few young scientists who stay in the BAS system despite the significantly better situation abroad are also well trained, with good language skills and dedication towards scientific work.
- No significant overlap has been identified by the Panel in the scientific topics of the different Institutes although increased interest in some fashionable areas (biodiversity, climate change) has been observed in several Institutes. Fortunately, actual research in these fields has not led to redundancies so far.

Weaknesses:

- The age distribution of the scientific personnel is unfavorable since ca. half of the scientists is above the 50-55 years of age. As a consequence the proportion of young scientists (below 35 years of age), as well as of the active middle generation (35-45 years) is low. The number of new PhD holder (who obtained their degree in the reporting period) is ca. 12 % of all scientists, which is low when the need for well qualified young scientists is concerned. The age problem stems to a large extent from the unfavorable salary situation of the BAS scientists, which is significantly lower than those of in the Bulgarian University system.
- Publications of the life science Institutes are dominated by papers appearing in Bulgarian journals (60 % of all papers), which have no impact factor and have only limited international visibility.
- The research support of the Institutes was very fragmented in the reporting period with many small projects receiving support only to the value of few thousand euros. The ability of the Institutes to attract significant funding from international sources is also limited, since in average the total foreign grant support amounts to only ca 7 % of the BAS subsidy.
- The Panel has noted that the BAS Institutes and related museums maintain several large collections in a fragmented way, which does not make possible the optimal utilization of these resources for the research community as well as for the society.
- The Panel has also noted that some important research topics, especially cancer research has spread over several Institutes. Efficiency of this field could benefit from concentration of these topics in one Institute with the main profile in biomedical research.

5. Panel-level recommendations

5.1 Human resources

- It is strongly advised to establish a salary system in the BAS Institutes that matches that of the Universities, i.e. to provide equal salary for scientists in the corresponding rank in the BAS and in the Universities.
- In order to acknowledge the scientific output of researchers in terms of potential, publications, grants, patents, etc., the Panel recommends the introduction of a performance-oriented salary system.
- Establish post doctoral and startup grant systems to attract back qualified young scientists from abroad.
- Encourage teaching activity to a level that serves as an attraction to the Institutes, as well as their special education to become scientists.
- Discourage excessive teaching activity, that serves mainly to raise income and divert energy away from research.
- Motivation of scientists towards high quality research could be increased by postponing the promotion of BAS scientists to permanent status after their success in science has been demonstrated. However, this uncertainty in employment should be counterbalanced by establishing the university-level salaries accompanied by significantly better conditions for science than that available at the universities (otherwise scientist would again prefer the 'safer' university conditions).

5.2 Training of young scientists

- The panel recommends English as the language for regular Institute seminars, journal clubs and progress reports.
- The Panel recommends the institutes to introduce as criterion to attain a PhD title at least one first authorship publication in an international journal with impact factor, in order to increase the scientific potential of young scientists to an internationally competitive level. (This could be done even if the general requirements in the Bulgarian system are lower.)
- It is advisable to encourage the PhD students to prepare their PhD thesis in English.
- It is suggested to post the finalised PhD theses as downloadable document on the websites of the Institutes and/or of the BAS in order to increase their visibility for the national and international scientific community.
- It is suggested to promote participation in international conferences, e.g. by funding young researchers on a competitive basis.
- Organization of annual BAS symposia would be beneficial to present the latest results of obtained by the BAS scientist with specific attention of presentations by young scientists.

5.3 Scientific quality and output

- It is highly advisable to establish an advisory council for each Institute with international members, to help strategic planning of future research.
- Encourage publishing in international journals, which have an impact factor, instead of local Bulgarian journals.
- Encourage the Institute journals to fulfil all requirements to obtain an impact factor.
- Encourage the Institutes to organize large international meetings, which increase the visibility of science in Bulgaria.
- The Panel feels that on the long run it would be advisable to establish a new natural history museum facility, where all large collections and the qualified scientists dealing with them could be pooled together to create a strong player at the European level.

Research support

- Continue the favorable change of NSF policy in providing larger scale funding. This increases prospects of the Institutes for research targeted and concentrated on important problems of life sciences.
- In order to help the Institutes, which are successful in obtaining research grants from foreign sources, but have no own resources to cover co-funding expenses, BAS is advised to set up a "matching fund" to cover these additional costs.
- It is advised to set-up a Grant Office that supports BAS researchers in the preparation/writing/accounting of international/European research proposals.
- The Panel recommends that BAS pools funds in order to cover for VAT expenses for research equipment.
- It is advised to improve synergies between Institutes through the creation of joint infrastructural facilities.
- Introduction of training programmes to write EU applications
- Support for technology transfer and patenting by setting up a technology transfer office, and a specific fund system to cover patenting expenses.
- The BAS Institutes have to be prepared to follow new European laws concerning scientific work. This concerns mainly animal facilities, working with protected species, human samples, dangerous substances, etc.). The necessary infrastructure should be provided to fulfil these requirements.

Part 2: Institute-level Reports

Biological Sciences

Institute of Molecular Biology (IMB) - 401

Executive Summary

IMB is a strong player in the field of molecular biology and internationally competitive (Quality/Productivity score A). The relevance of the scientific projects and the socio-economic impact (such as teaching and PhD programs) is high (Socio-economic Impact score A). The IMB has a unique prevalence of young scientists associated with the production of good level manuscripts in national and international journals with impact factors. The IMB has a national and international dimension with both Bulgarian and international funding contributions. The overall prospects are high (Prospects score A).

Overall strengths:

The publications have a good impact factor with respect to Bulgarian standards and in general, and their scientific subject is of high biological interest. Scientists from the IMB are nearly always in relevant positions (first or last authors or both) on the main publications in international journals with impact factor. These publications are also highly cited. The Institute has already recognised that new research directions (bioactive compounds, nanoparticles) will have to replace older, historically originated projects. The proportion of young scientists to more senior scientists is one of the best among all life science Institutes of BAS. The supervision of PhD students at the IMB is good: the majority of them have publications in both international and national journals, thus reaching the international standards for PhDs.

Overall weaknesses:

Some of the departments have a lower publication rate as well as a low number of publications with impact factor. This might affect the generally very good scientific level of the Institute. Although the IMB is overall successful in obtaining international grants, EU funding is still not very frequent. The scientific research might include more applied objectives. Industrial interactions are minor till now and intensifying these would help to focus on the application of the Institute's results.

Specific Panel recommendations:

The Panel recommends the Institute to focus on the development of the most promising projects with the aim to further increase the scientific level and to reach international leadership. It is suggested to identify the reasons why some departments have a lower publication output (in terms of number and impact factor) and to develop a strategy as to how to improve the situation internally. It is recommended to routinely up-date IMB's website both with general information as well as with scientific information. The Panel also suggests the Institute to advertise and promote via the website and other means the latest developments concerning the proteomic and genomic center, i.e. present technical info, organise technical courses and provide contact information.

Evaluation Summary

IMB was founded in 1960 as a Central Biochemical Laboratory. The long tradition of the IMB as a research Institute as well as its national and international importance is recognized. IMB hosts the National Specialized Scientific Council of Molecular Biology, Biophysics and Biochemistry belonging to the Bulgarian Higher Testimonial Commission at the Council of Ministers of Republic of Bulgaria. Moreover, one of IMB's staff members serves as a national contact point in Area 2 of Framework Programme 7 (Food, Agriculture and Fishery, and Biotechnology). Some staff members are outstanding and have prospects of international recognition. Taken together, this makes the IMB internationally competitive.

(a) Quality and Productivity

Quality

Strengths:

IMB as a whole is highly visible internationally and has published almost 100 papers in international journals. Certainly, the innovative potential has benefited from the recent acquisition of new technologies (and equipments) as well as from the integration of the Institute's scientists in international collaborations and programs. The rate of young scientists is very high, and one of the best among the life science Institutes of BAS, thus increasing its innovation potential and scientific motivation as a whole. Scientists from the IMB are nearly always in relevant positions (first or last authors or both) on the main publications in international journals with impact factors (IF). These publications are also highly cited. Despite only 1% of funding from EU programs up to now, the IMB has other foreign funding sources such as the Wellcome Trust (around 10% of the full budget). The supervision of PhD students at the IMB is good: the majority of PhD students have publications in both international and national journals, thereby reaching the international standards for PhDs. The recent set-up of the centers for proteomics and genomics is crucial to further increase the recognition of IMB's research. These centers will be accessible to other Bulgarian Institutes and will consequently lead to collaborations and higher national and international visibility.

Weaknesses:

Some of the departments have a lower publication rate and a low number of publications with IF. This might affect the generally very good scientific level of the Institute. It is thus suggested to identify the underlying causes of this situation and to develop a strategy for improvement, possibly reorganising these departments internally. If adequate steps are taken, the international recognition of IMB – while already very good- might be heightened so that the Institute could become an international leader.

Productivity

Strengths:

While the majority of publications is still at the national level, those published in international journals are of very good quality. Enhancing the interactions with the international scientific community will no doubt increase the number of international publications. In particular Departments 1, 2 and 5 have a very good publication record with more than 15 articles in international journals of good level (IF around 4) in the last four years. The number of projects with possible practical application of their results is impressive and might in the future lead to both intellectual property application and novel tools for research.

Weaknesses:

Department 3 has a lower - but still good - publication record with 12 articles published in international journals during the last four years. International patenting is currently low.

Overall score for Quality and Productivity: "A" for "*work that is internationally competitive. The Institute has demonstrated important contributions to the field and is considered an international player.*"

(b) Socio-economic Impact

Strengths:

The relevance of the scientific projects and the socio-economic impact (such as teaching and PhD programs) is very good. The Institute is very active in teaching, and PhD and master students are very well supervised. This is possible because the IMB is directly involved in the education of students in molecular biology and related subjects at the Medical University in Sofia.
The publications have a good IF with respect to Bulgarian standards and in general, and their topics are of high biological interest.

IMB fulfils important services of national importance being the headquarter of the Council for Biological Defense at the Scientific Coordination Council to the Permanent Commission for Defense of Citizens against Disasters, Troubles, and Catastrophes at the Ministry Council of Republic of Bulgaria. Several members of IMB serve in expert panels for the Ministry of Health, Ministry Council.

Weaknesses:

Strategies for internationalization are currently not well developed. They would however be important to further increase the already high potential impact of the Institute's results.

Overall score for Socio-economic Impact: A - "*Highly relevant*"

(c) Prospects

Strengths:

The IMB is an Institute that has oriented itself already towards the international dimension. It has tried to increase the number of EU applications for funding, which shows IMB's intention to further raise its scientific level and its will to embrace new scientific challenges. The proportion of younger scientists to more senior scientists is one of the best among the life science Institutes in BAS. It was positively noted that the Institute has already recognized that new research directions (bioactive compounds, nanoparticles) will have to replace older, historically originated projects. Some young scientists within the IMB show leadership potential and high motivation. The IMB hosts a staff member who is the national contact point for Framework Programme 7 (area 2).

Weaknesses:

With several departmental Heads approaching retirement age, IMB needs to plan ahead in terms of rejuvenating its leadership positions for the future.

Overall score for Prospects: A - "*High prospects*"

Overall Strengths and Weaknesses

Overall Strengths:

The publications have a good IF with respect to Bulgarian standards and in general, and their scientific topics are of high biological interest. Scientists from IMB are nearly always in relevant positions (first or last authors, or both) on the main publications in international journals with IF. These publications are also highly cited. The Institute has already recognised that new research directions (bioactive compounds, nanoparticles) will have to replace older, historically originated projects. The proportion of young scientists to more senior scientists is one of the best among all life science Institutes of BAS. PhD students are well supervised at the IMB: the majority of them have publications in both international and national journals thus reaching the international standards for PhDs.

Overall Weaknesses:

Some of the departments have a lower publication rate and a low number of publications with IF. This might affect the generally very good level of the Institute. Although the IMB is overall successful in obtaining international grants, EU funding is still not very frequent. The scientific research might include more applied objectives. Industrial interactions are minor till now and intensifying these would help to focus on the application of the Institute's results.

Recommendations

General Panel recommendations are listed in the Panel Level Report.

Specific Panel recommendations:

- It is recommended to focus on the development of the most promising projects with the aim to further increase the scientific level and to reach international leadership. This might require an internal reorganisation of the small projects in order to have clearer directions.
- It is suggested to further invest in human resources at IMB and to offer a career plan. For instance, the scientists of the Laboratory for medical and biological research have a high potential to develop outstanding science. Supporting these scientists to better develop their careers will on the long term represent a win-win situation for the recognition of the international leadership of the IMB.
- It is suggested to identify the reasons why some departments have a lower publications output (in terms of number and IF) and to develop a strategy as to how to improve the situation internally. This will be important for reaching international leadership in the field.
- It is recommended to routinely up-date IMB's website both with general information as well as with scientific information. This will contribute to improving the Institute's visibility from outside of Bulgaria.
- The Panel also suggests the Institute to advertise and promote via the website and other means the latest developments concerning the proteomic and genomic center, i.e. present technical info, organise technical courses and provide contact information

Institute of Neurobiology (INB) - 402

Executive Summary

INB is clearly recognized at the international level, and it appears among the best ones of the Biological Institutes of the Bulgarian Academy of Science (Quality/Productivity score A). The Institute's research targets very important scientific questions in relation to brain functions and is therefore highly relevant. The Institute has convincing teaching and educational programs (e.g. post-graduate training and specialization courses) at different institutions of higher education (Socio-economic Impact score A). On the other hand, the plans for future developments are rather vague and general. The number of young scientists and their success in obtaining a PhD is low. Overall the prospects are moderate (Prospects score B).

Overall strengths:

- The fact that the Institute conducted a self-evaluation in 2006.
- A reasonable rate of scientific publications in international journals, with adequate external citation of the work.
- The special care on teaching programmes, with full lecture courses in seven Universities.
- A clear goal on the applied side of research on life and well-being, in both healthy and ill populations.
- Some of the research groups have ongoing collaborations with different research institutions, both nationally and internationally.

Overall weaknesses:

- The important changes to the Institute's structure in 2006 make it difficult to evaluate recent trends, mainly in terms of scientific outcomes.
- A decrease in the number of SCI publications from 2006 to 2008.
- The different research groups present a considerable number of publications but, with some exceptions, the majority of the papers are still in journals with moderate or low-impact factor.
- The number of scientists in the range of 40-50 years of age is low.

Specific Panel recommendations:

- To publish in journals with good impact factor in order to increase the Institute's international visibility.
- To encourage all research groups to increase their scientific productivity, in terms of quantity and quality.
- To maintain, and increase, the level of collaborations, both at a national and international level.
- To concentrate research efforts on a well-defined number of scientific projects and finding better financial support for these.

- The whole Institute is advised to put efforts into increasing financial support through grants from abroad, companies, etc.
- To patent the outcomes of the technical studies.
- To attract well-established scientist to run some of the laboratories after retirement of the current leaders.

Evaluation Summary

Since its foundation in 1947, the Institute has been redefined and renamed several times. In 2006, it received its present name, INB. This latest name indicates the new scope of the centre and its scientific topics in the Neurosciences. Nevertheless, the Institute incorporated its previous formation and experience from the Physiology, Pharmacology and Biochemistry areas.

The main trends of the scientific research are based on fundamental and applied work on six aims, following the priorities of the Bulgarian Academy of Sciences (BAS): i) to study the regulation of neurobiological mechanisms of vital life processes in the organism; ii) to create new methods for processing and analysing bioelectric brain signals in normal and pathological conditions; iii) to find out the cellular and integrative mechanisms of neurodegenerative diseases with serious health and social impact; iv) to establish the influence of biologically active substances to optimize life functions upon their application in humans; v) to model the physiological processes and pathological deviations which influence the quality of life; and vi) to create scientific products and equipment, as well as their practical application in clinical investigations.

INB is organized in six Departments with 15 Research Teams. The Governing body includes one Director, one Deputy-Director and one Scientific Secretary, while the Scientific Board has 25 members, including a Chairperson, a Deputy-Chairperson, and a Secretary.

After the substantial restructuring process in 2006, the Institute demonstrated flexibility and the courage to face new challenges. This ambition is expressed in the description of future plans and strategies that include the extension of international co-operations, the increase of external funding, and the flexible adjustment of research activities and overall scientific developments. Special attention is paid to the development of young scientists in the new scientific goals.

(a) Quality and Productivity

Quality

Strengths:

- The Institute pursues interesting research activities. Many of them are clearly oriented towards human clinical research, and towards the improvement of quality of life and well-being in both healthy and ill population.
- Researchers are actively involved in national and international Scientific Commissions and Institutions (governmental and non-governmental institutions, foundations, etc.). During the reporting period, the Institute has

hosted several international scientific activities (meetings, courses, etc.), which is a very good start for future collaborations.

- Several of the Institute's scientists have also been reviewing papers from various journals and are on Editorial Boards. Although the number of all of these activities is still small, the Panel was pleased to see that the Institute's staff members start to be involved in them, with the perspective of benefiting from newly initiated relationships with other groups, learning from foreign scientists, and facilitating the dissemination of the Institute's achievements.
- The standard measures for science quality reveal that the INB maintains a very good level. In the past five years, it had around 2.500 citations of its publications (mainly from foreign scientists) and the best five papers received a total of 266 citations (75, 72, 49, 36, and 34, respectively). Moreover, four papers received more than a 100 citations and the Hirsh-index calculated from 1976 to 2009 is 37, which is the highest value amongst the life science institutes of the BAS.

Weakness:

- The proportion of work published in Bulgarian journals is too high and hence it is difficult to disseminate the results to the international Neuroscience community.

Productivity

Strengths:

- It is remarkable that the Institute has obtained 55 grants from International Organizations programmes, from bilateral agreements between the Academia and other Institutes, or from projects/contracts from outsourcers. This picture highlights the international reputation of the Institute; with the numerous international contacts leading to positive scientific results.
- The level of the scientific publications is remarkable in some cases, and the majority of them are the result of fruitful external collaborations maintained over the last years.
- Over the past five years, the Institute published 161 papers, some of them in very good-rated journals in terms of impact factor (*Brain, Cerebral Cortex, Learning and Memory*). Nevertheless, the majority of papers was published in low-medium rated journals.

Weaknesses:

- The total amount of funds obtained by each research group varies (mainly in relation to the number of researchers). While in many cases the grants have been very small, a change in funding policy has been noted towards a more generous and internationally more competitive funding system.
- The total number of SCI papers has decreased over the last three years, possibly due to the reorganizing of the Institute.
- Differences in productivity and quality of scientific output have been noticed across research groups and departments.

Overall score for Quality and Productivity: "A" for "*work that is internationally competitive. The Institute has demonstrated important contributions to the field and is considered an international player.*"

(b) Socio-economic Impact

- The Institute wishes to focus its research on the understanding of some brain disorders, with the goal to contribute to the optimisation of treatment and cure, which ultimately will lead to benefits for society at large and economic growth. Some steps have already been taken in this direction. Apart from the collaborations with other BAS Institutes and the University of Sofia, a bilateral cooperation contract has been signed with the Medical University of Varna, and a clinically-oriented Centre has been created together with the "Acad. Pashev" specialized Ophthalmic Hospital in Sofia. Both collaborations will ideally increase opportunities for transfer of knowledge and experimental technologies.
- The Institute has contacts with other Institutes of the BAS, and with Bulgarian Universities and Hospitals, and it assumes responsibility in advising and informing many organizations and institutes in Bulgaria. The acceptance by the various Universities is obviously very positive and there is a vivid exchange of information. The Institute has produced some remarkable achievements. The idea of combining basic research (mainly to develop animal models) with applied research (working together with medical doctors) gives an added value to the work that is pursued in the Institute. For instance, experimental samples created in the Institute in collaboration with other external groups led to a patent and a special mention in an International Exhibition. This example clearly illustrates the efficiency of this type of collaboration.
- Some of the research groups have been working in the same field for several years and have generated important results, published in international journals in the field. They maintain close and long-lasting collaborations, and run grants that allow them to continue the experiments and the training of young scientists.
- The Institute has convincing teaching (lectures and specialized classes, practices and seminars) and educational programs (e.g. post-graduate training and specialization courses) at different institutions of higher education. The Institute's scientists also attend to and supervise the students preparing their Bachelor or Master Theses.
- The Institute has been successful in obtaining international research grants (COST, Copernicus, Wellcome Trust).

Overall score for Socio-economic Impact: A - "*Highly relevant*"

(c) Prospects

Strengths:

- One of the principal aims of the Institute is to encourage and to support the scientific development of the younger generation of scientists. It seems that the scientific and research work of the PhD students is supported financially by the Institute's budget and by scientific grants, as well as by some PhD student fellowships. During the interview, the Panel learnt that 14 new young scientists joined the Institute this July.
- A positive development in the Institute's funding situation has been noted, namely that the budget has increased up to a 32% for the 2004 to 2008 period. With this positive trend in mind, it would be beneficial to develop the future research plans of the Institute further. The latter requires the various groups to strengthen their strategies in order to increase their chances of receiving support from potential funders abroad.
- To obtain a senior researcher position, 50 papers are required. This is considered good level if the papers are visible to the international Neuroscience community.

Weaknesses:

- The plans for future projects and developments have been presented vaguely and in a rather general way. In some cases, they can be predicted from the achievements reached in recent years. It is important that each department establishes its plans for the future in a more concrete manner.
- No clear career plan has been worked out for those researchers who would like to join the Institute after their postdoctoral training abroad. This would be desirable since the Institute would benefit from the experiences scientists acquired abroad.
- The number of international grants decreased over the last five years.
- The number of PhD students joining the Institute per year is low. The Institute should design a clear strategy how to tackle this issue and to revert this tendency.
- A low percentage of scientific staff has a PhD degree. Finishing the doctoral thesis should be considered a priority for all scientists of the Institute.
- The Institute might possibly face a problem in the near future with respect to the next generation of leaders, since the proportion of scientists between 40-50 years is fairly low. A special programme should be designed to attract well-established scientists, with good curricula, and with interests in the priority fields of the Institute since its last reorganization.

Overall score for Prospects: B-"*Moderate*."

Overall Strengths and Weaknesses

Overall Strengths:

INB's capability of dealing with the recent reorganization and to follow the suggestions proposed during its self-evaluation in 2006 can be seen as an assurance that its scientists will try to improve the research level of the Institute in general. The scientists present a very reasonable rate of publications in international journals with an excellent external citation of their work. The number of papers per researcher and the number of citations per researcher in the last five years is above the mean values for similar Bulgarian Institutes in terms of number of scientists and financial support. Some of the groups have started very fruitful collaborations with other research establishments. The Institute has a well-defined goal on the applied side of research on life and well-being, in both healthy and ill populations.

Overall weaknesses:

The important changes to the Institute's structure make it difficult to evaluate the recent scientific outcomes and goals. These changes could also be the reason for a decrease in SCI publications between 2006 and 2008. In this sense, a longer time period has to pass in order to have a better understanding of the potential impact of the recent results. The number of papers in Bulgarian journals represents a high percentage of the total number of publications. This reduces the international visibility of the Institute's work. The Institute might face a leadership problem in the near future because of the low proportion of scientists between 40-50 years of age.

Recommendations

General Panel recommendations are listed in the Panel Level Report.

Specific recommendations:

- Some departments as well as some research groups perform better than others. The Institute should identify the reasons for these differences and encourage all research groups to increase their scientific productivity, in terms of quantity and quality.
- The Institute should attract well-established scientist to run some of the laboratories after the retirement of the leadership. This is particularly important since the proportion of scientists in the range of 40-50 years of age is low.
- It is important to maintain the level of collaboration, both at a national and an international level. The exchange of scientists and students between research centres is extremely enriching.
- The Institute should encourage and support the participation of its scientists in international meetings, the organization of national and international events, the preparation of international grants, etc.. In brief, exercise all efforts to improve knowledge and scientific abilities of its staff.

- The Institute should concentrate its research efforts on a well-defined number of scientific projects and find better financial support for these. The whole Institute should put efforts into increasing financial support through grants from abroad, companies, etc.
- It is important to take measures towards increasing the number of patents as outcome of the more technical studies.
- To perform an experiment consumes a lot of time, as well as to analyse the collected results, and to prepare the manuscript to be published. Researchers should aim to publish in the journals that they deem as well placed in terms of impact and visibility to the broad science community.
- The website of INB is well-presented and useful for scientist from outside to find information about the Institute's researchers, topics of interests, publications, etc.. It should continue being used as a main tool for internal and external scientific exchange, and it therefore has to be frequently upgraded.

Institute of Biophysics (IBP) - 403

Executive Summary

IBP is clearly a leading Institute in basic science in the BAS with a significant international visibility, being competitive on an international level (Quality/Productivity score A). The IBP concentrates its research on areas that are scientifically important, and their application is highly relevant. The scientific relevance is also evident from its strong interactions within BAS as well as with institutes in foreign countries (Socio-economic Impact score A). The Institute has active co-operations in Bulgaria and abroad, which helps to achieve its research targets. The future plans mostly claim the continuation of present studies without identifying significant new areas, and have not been elaborated sufficiently. In addition, the number of young scientists is low. The overall prospects are therefore moderate (Prospects score B).

Overall strengths:

The Institute has been producing results very constantly during the reporting period and it is to be expected that this will continue in the future. The high number of international publications indicates competitiveness and international recognition. The IBP has a leading position in the Bulgarian academic system, with active co-operations with many other BAS Institutes and Bulgarian Universities, as well as with foreign scientific organizations. The publication output and citation figures are among the best three life science institutes of BAS. The Institute is also visible internationally and has a significant position in the fields of biophysics, biochemistry, cellular biology, motor control and muscle electrophysiology.

Overall weaknesses:

At present, young scientists are not easily recruited. Interactions with the Universities where BAS delivers a significant teaching load might need to be improved. In spite of its scientific potential, the Institute has not attracted sufficient funding from international sources. As is the case for other BAS Institutes, the unfavorable age distribution resulting from the poor financial support of scientists could create problems for the mid-term future when the now 50-65 years old scientists retire.

Specific Panel recommendations:

- The Panel recommends that future research directions be developed more precisely, taking into account where new opportunities are seen and how these can be realized. The Institute should concentrate its efforts on important scientific targets that attract significant funding. At the same time, it is advisable to decrease its involvement in the large number of diverse topics, which often receive minor funding.
- The IBP should increase efforts to recruit young and well established scientists, in order to maintain and raise scientific productivity in the future.

- The Institute may consider obtaining patents to protect its scientific products and ideas for Bulgarian science.

Evaluation Summary

The Institute was founded in 1967 as a central laboratory. In 1994 it became the IBP. The IBP is a well established basic research institute in the fields of biophysics, biochemistry, cellular biology, motor control and muscle electrophysiology. The IBP employs ca. 45 scientists, whose number fluctuated somewhat during the reporting period. The average age of the scientists is quite high, 39 senior scientists are 40 years and older and 25 'junior' scientists are between 26 and 40 years of age. The scientific work of IBP is organized into six departments: Lipid Protein Interactions; Excitable Structures; Photoexcitable Membranes; Biophysics of Proteins; Physical Chemistry of Biosurfaces; Electro-induced Effects in Biomembranes.

(a) Quality and Productivity

Quality

Strengths:

The Institute's international recognition is reflected in longterm collaborations with partners from leading international Universities and academic Institutes, which contribute to the maintenance and development of a high scientific level in IBP. Five out of six departments have collaborations with German colleagues and three former scholarship fellows of the Alexander von Humboldt foundation work at the IBP. Collaborations were supported by the Alexander von Humboldt foundation and the DFG or bi-lateral agreement between BAS and DFG; joint international symposia were organized as well. Some foreign collaborators are "foreign members" of the BAS. The collaboration with French scientific institutions is also a tradition for IBP. In addition, IBP has connections to Institutes in England, Poland, Spain, Canada, USA, India, Turkey, and Australia. Finally, bi-lateral projects exist for exchange between BAS and HAS.

The IPB publishes most scientific papers (> 82 %) in international journals.

The Institute's activities provide a coherent basis to stimulate co-operations between the departments. The projects are of general interest and meet international standards. The research areas are approved by several national programs and are in frame with priority topics in EU research policies. Scientific expertise is used to develop technologies for medical treatments, e.g., electrochemotherapy or transcranial magnetic stimulation. Furthermore methods of protein purification were improved, theoretical models for neuromuscular diseases were developed, and ideas for engineered plants with improved resistance to stress factors were put forward. A significant number of projects were performed in national and international collaborations, and many contacts exist with other Institutes in Bulgaria as well as abroad. This supports the impression that the research projects are recognized nationally and internationally as important and innovative contributions to advance scientific knowledge.

Weaknesses:

External funding is comparatively modest.

No income from patent-licenses.

Productivity

Strengths:

Results of about 70 projects have lead to a significant number of publications in international journals. The selected best publications appeared in good journals of the field with impact factors (IF) ranging from 2-4.5 (cumulative IF≈ 29). The contribution of IBP's researchers to these papers is significant, representing >60 % of all authors, and 90 % of the first and last authors. This shows that the researchers played a major role in the studies. IBP's researchers have published actively, with 145 papers in SCI journals abroad and some papers were published in very good journals (*Biophysical Journal*). A member of staff (working in a laboratory abroad) was co-author on a paper in *Science*. 92 papers were published in Bulgaria, additional 37 conference proceedings (13 abroad and 24 in Bulgaria), and 8 book chapters. This output is good at the Bulgarian level in general, and it is also positive that the results are mainly published in international journals.

These data are taken as a clear indication that IBP's research is internationally competitive and has innovative potential. The Institute as a whole is well visible internationally. The self-evaluation report lists 2218 citations for the period of 2004-2008, out of which 2167 can be found in the Web of Science database. The Web of Science database also shows that the Hirsh index of the whole Institute is 30 (for the period of 1976-2008). The Institute has published three papers that have received over 100 citations in total. During the reporting period, the Institute's best five publications received 49-169 citations. These are very good numbers and place IBP among the three best-cited life science institutes of BAS.

Weakness:

As compared to some other life sciences Institutes of BAS, the IBP has a low representation of its scientists (45) at international meetings: 13 conference proceedings for five years.

Overall score for Quality and Productivity: "A" - internationally competitive, *for "work that is internationally competitive. The Institute has demonstrated important contributions to the field and is considered an international player".*

(b) Socio-economic Impact

Strengths:

The IBP concentrates its research on areas that are scientifically important, and their application is highly relevant. High quality basic research and teaching of modern scientific knowledge is the essential basis for the education of excellent young scientists and has therefore high social impact. The researchers of the Institute are actively involved in teaching at Universities. This activity involved five individuals covering ca. 90 hours of lecturing, and seven individuals covering 450 hours of seminars/practices in average per academic year. Compared to the size of the Institute this activity is significant. IBP hosted 21 PhD students during the reporting period, of which ten have obtained a PhD degree. These numbers are not very high, but better than for other BAS institutes.

Weaknesses:
In spite of the social impact of teaching, IBP is not too active in other areas of direct with socio-economic potential. There were no patents obtained from the results of their research activity. Although IBP has many bilateral international cooperation their participation in collaborative EU projects is so far limited. Although they have members in Supreme Certifying Board at the Council of Ministers the activity of IBP regarding services of particular national importance is limited.

Overall score for Socio-economic Impact: B - "*Moderately relevant*"

(c) Prospects

Strengths:

The Institute has active co-operations in Bulgaria and abroad (mainly in Europe, but also in the USA and Canada), which helps to achieve their research targets. The report and the visit have given the impression that there is a strong desire to keep up the high level of the scientific activities and to improve the quality of the projects. These goals are realistic since many excellent co-operations exist between the various scientists within the IBP as well as with other BAS Institutes. There appears to be a healthy, co-operative team spirit that will lead the Institute to take on new challenging tasks. During the visits new project developments, new equipment, and innovation attempts were presented. Furthermore, the prospects are clearly strengthened by the recent successful NSF grant applications. The IBP has also obtained new structural funds from the EU (for Human Resources) that help to improve communication, connectivity and relationship between industry and research. In 2009, IBP has been very successful in securing substantial financial support (mainly from NSF) for several projects, which certainly will strengthen the position and development of the Institute.

Weaknesses:

The lack of young scientists is currently seen as the most serious problem. This may be transient and can possibly be overcome with an increased and stable funding situation in the next years. Better funding will help to recruit a sufficient number of young scientists and to provide attractive job opportunities.

Overall score for Prospects: A -"*High*"

Overall Strengths and Weaknesses

Overall Strength:

Over the years, the IBP has produced constantly new and significant results in basic research in the fields of biophysics, biochemistry, cellular biology, motor control and muscle electrophysiology. The Institute has a leading position in Bulgaria and is clearly visible internationally.

Overall Weakness:

The number of previous projects was rather high, possibly as a result of the fragmented funding policy of the state. The present age structure may be unfavorable as regards meeting future challenges.

Recommendations

- *General Panel recommendations are listed in the Panel Level Report.*

Specific Panel recommendations:

- Future research directions should be developed more precisely, taking into account where new opportunities are seen and how these can be realized. Along these lines, the Institute should consider reducing the total number of projects and to bundle resources in order to tackle the selected and most important projects as efficiently as possible.
- The Institute should concentrate its efforts on important scientific targets that attract significant funding. At the same time, it is advisable to decrease IBP's involvement in the large number of diverse topics, which often receive minor funding. Considering the current financial situation, the future of the Institute will depend increasingly on additional "external" and international funding. In this respect, clearly structured plans for the future development of the Institute would be helpful.
- Recruiting talented young people for science is very important and should be a high priority for the Institute. The IBP should increase efforts to recruit young and well established scientists, in order to maintain and raise scientific productivity in the future.
- The data and results generated at IBP may lead to patents or scientific products. The Institute may consider obtaining patents to protect scientific products and ideas for Bulgarian science.

Institute of Plant Physiology (IPP) - 404

Executive Summary

IPP is a very good Institute in the field of plant sciences in Bulgaria, and an internationally visible and competitive research unit (Quality/Productivity score A). Researchers from the IPP target scientific questions, which are highly relevant in terms of scientific and socio-economic impact, and are included in priorities of BAS and Framework Programmes of the EU (Socio-economic Impact score A). The capacity of fund raising, and attraction of students and future researchers appear to be moderate, and the plans for future developments may not be sufficient to revert these trends. Overall, the Institute's prospects are moderate (Prospects score B).

Overall Strengths:

The potential of IPP for basic and applied research is very high and the scientific output of the IPP is among the best five of the life science institutes belonging to BAS. The Institute has clear views of their strengths, as well as the problems they face, which is an important step in planning for the future.

Overall Weaknesses:

Although the Institute has successfully recruited young researchers, only a few scientists are in the age group of 41 to 55 years. This might create problems in the mid-term future as regards maintaining and further improving the Institute's current scientific output. Plans for future scientific developments are often too general and lack a clear focus. This situation is partly due to the unpredictable granting situation in Bulgaria and the large competition for basic research oriented funds in the European system.

Specific Panel recommendations:

The Panel recommends raising the quality of the Institute's journal (*General and Applied Plant Physiology*) in order to be accepted as SCI journal with impact factor. The Institute should work out clearer scientific directions for the future, concentrate its efforts on important topics and decrease its involvement in the large number of diverse projects, which often receive minor funding. The Panel recommends that IPP works on improving its infrastructure to be able to increase further the already high value of the research that has been carried out in the past. Furthermore, with a well operating infrastructure the Institute could serve as reference centre for training and transfer of knowledge in Bulgaria. Efforts should also be made to improve transfer of basic scientific knowledge to practical applications, in order to enhance the fund-raising capacity of researchers. The website should be modernized and regularly up-dated with both general and scientific information to improve the attractiveness and visibility of the Institute.

Evaluation Summary

IPP is one of the oldest biological institutes of the Bulgarian Academy of Sciences. It has currently 119 employees, among which are 51 scientists and 68 research supporting staff, including 51 individuals with university degree. The qualification of the scientists is high, with over 90 % holding a PhD or DSC degree. However, when all research personnel with University degree is concerned the ratio of PhD holders is only 40 %. The scientific work of IPP is organized into five departments: Experimental algology, Photosynthesis, Plant mineral nutrition and water relations, Plant stress molecular biology, Regulation of plant growth and development.

(a) Quality and Productivity

Quality

Strengths:

The Institute as a whole is clearly visible internationally, and the recognition of its researchers' activities is very good. During the reporting period of 2004-2008, 1773 citations appeared, of which 1351 are listed by the Web of Science database, whereas the rest (23 % of all) is in non-SCI publications. According to the Web of Science statistics, the number of citations has been gradually increasing over the last 15 years from 50 citations/year in 1990 to 300 citations/year in 2008. The Institute has published two papers that received over 100 citations in total, and the Hirsh index of the total output of the Institute since 1976 has been 24. These figures are very good at the Bulgarian level, and good at the international level, considering the size of the IPP.

The selected best ten publications are in good and top quality journals in the field, with a cumulative impact factor (IF) of 69. The IPP authors act as first author in 70 % of the selected publications, highlighting their important and significant contribution to the work.

Some of the researchers are personally well known at an international level and have a noteworthy citation level (>500), indicating that their research has a considerable impact on the international community. Some original and innovative fields of research have been initiated like the study of secondary metabolites and the investigation of transcriptomics during developmental processes. These studies are potentially suitable for applications such as improving plant productivity, resistance to stresses, and adaptation to climate change.

Weaknesses:

A weakness is the relatively high number of publications in lower impact journals, which results in ca. 1.5 IF per international publication. Although this figure is good in comparison with other life science Institutes of BAS, it reflects the difficulties the Institute faces in targeting the higher impact journals in the plant physiology field.

Productivity

Strength:

IPP's researchers published actively during the reporting period (2004-2008) as illustrated by the total number of publications, with 166 papers published abroad (133 of them in SCI journals), and 133 papers in scientific journals in Bulgaria. This can be further broken up in 2,63 publication per researcher in five years or 0,53 publications per researcher per year. This is relatively low according to international standards, but among the best results if compared to the scores of other BAS Institutes active in plant biology. This Institute has clearly a high scientific productivity, mostly deriving from international collaborations with very good laboratories and research centres.

Weakness:

A weakness regarding scientific output is the relatively high proportion of papers in Bulgarian journals, which have no impact factor and/or are not visible via internet accessible public databases, and therefore have little impact on the international scientific community. The contribution of the five departments to the scientific output in terms of high quality publications is rather uneven, with Departments of Photosynthesis, Plant Mineral Nutrition and Water Relations being the main contributors.

Overall score for Quality and Productivity: "A" for **"***work that is internationally competitive. The Institute has demonstrated important contributions to the field and is considered an international player***."**

(b) Socio-economic Impact

IPP's research targets important questions of plant physiology, which are at the forefront of the current international research (e.g., role of volatile compounds, mechanisms of plant stress tolerance, role of reactive oxygen species). An important socio-economic aspect of the Institute's activities is the education of graduate students and the training of highly qualified scientists. The research performed has a high innovation potential, for example, regarding the improvement of stress tolerance and productivity of agronomically important plants, utilization of large scale alga cultures. However, in the reporting period no patents were obtained. Although IBP has many bilateral international cooperation projects their participation in collaborative EU projects is so far limited.

Overall score for Socio-economic Impact: B - "*Moderately Relevant*".

(c) Prospects

Strengths:

The Institute plans to develop research in the fields of biodiversity and climate change, biotechnology and agrobiology. As for other BAS Institutes, it appears that planning of current and future work is difficult, due to the large dependence on external funding. The productivity of the IPP was stable during the reporting period,

accompanied with a steeply increasing international recognition, as shown by the dynamics of recent citations. Thus the Institute has a solid background for the successful completion of research planned for the coming years as far as the expertise and scientific background is concerned. Importantly, the Institute has recognized its problems with the ageing scientific personnel, and has already successfully recruited young scientists. The IPP has also presented to the Panel a balanced SWOT analysis of its current situation and future prospects, which will help to shape its future activities.

Weaknesses:

The ability of the Institute to attract funding from sources outside the BAS and NSF is very low. It had no support from government, other Bulgarian agencies, or industry. Support from foreign sources (EU) was also rather limited. This situation should be improved in the future if the IPP wants to remain competitive at the international level.

Overall score for Prospects: B - "*Moderate*".

Overall Strengths and Weaknesses

Strengths:

The IPP is an important national player and at the same time an internationally visible and competitive research unit in the field of plant sciences. The potential of IPP for basic and applied research is very high and the scientific output of the IPP is among the best five life science institutes belonging to BAS. The leadership of the Institute has clear views of IPP's strengths, as well as the problems it faces, which is an important step in planning for the future.

Weaknesses:

Research is fragmented into many small projects due to the fact that the Institute depends mainly on NSF funding, which has been low. Plans for future scientific developments are often too general and also lack clear focus. This situation is partly due to the unpredictable granting situation in Bulgaria, and the large competition for basic research oriented funds in the European system. Although the Institute has been successful in recruiting young researchers, only a few scientists are in the age group of 41 to 55 years. This might create problems in the mid-term future as regards maintaining and further developing the Institute's current scientific output. The Institute seems to have difficulties in attracting research support from Bulgaria (other than from BAS) and abroad.

Recommendations

- *General Panel recommendations are listed in the Panel Level Report.*

Specific Panel recommendations:

- It is advised to raise the quality of the Institute's journal (*General and Applied Plant Physiology*) in order to be accepted as SCI journal with impact factor.
- The Institute should work out clearer scientific directions for the future, concentrate its efforts on important topics and decrease its involvement in the large number of diverse projects, which often receive minor funding.
- The Panel recommends that IPP works on improving its infrastructure to be able to increase further the already high value of the research that has been carried out in the past. Furthermore, with a well operating infrastructure the Institute could serve as reference centre for training and transfer of knowledge in Bulgaria.
- Efforts should also be made to improve transfer of basic scientific knowledge to practical applications, in order to enhance the fund-raising capacity of researchers.
- The website should be modernized and regularly up-dated with both general and scientific information to improve the attractiveness and visibility of the Institute.

Institute of Genetics (IG) - 405

Executive Summary

IG is a good Institute at the national level. It is clearly internationally visible, but does not reach the scientific output of the best life science institutes of BAS (Quality/Productivity score B). The research targets scientific questions that are highly relevant as regards their scientific and socio-economic impact, and they are also included in priorities of BAS and Framework Programmes of the EU. The results of the Institute include patented plant varieties besides achievements in basic science (Socio-economic Impact score A). The IG has a relatively low number of qualified scientists (PhD and DSci) in its research personnel, a low number of PhD students and recently obtained PhD degrees, as well as limited success in obtaining international grant support. Overall, this situation constrains the Institute's ability to increase its scientific output to the level of the best life science institutes of the BAS. Taken together, the overall prospects are low (Prospects score C).

Overall strengths:

The IG has good synergies with other BAS Institutes and Bulgarian Universities, as well as with foreign institutions. Research activities cover basic modern trends in genetics, in which specific experimental approaches and tools are being utilized in an attempt to successfully realise scientific goals. The large FAO/IAEA project, which is coordinated by the Institute with the aim to evaluate genetic diversity in cereals in South Eastern and Central Europe, is especially important. The fact that this Institute has already several patents in the plant field is also strength.

Overall weaknesses:

The current international impact of the Institute's scientific output (publications, citations) is not very high. The Institute's researchers were significantly more productive in terms of high quality and highly cited publications in the mid-nineties than during the reporting period. The number of PhD students is low, and their success in obtaining the PhD degree is limited, which decreases the potential of the IG in improving its scientific output. In spite of the high relevance of its research, the IG's research efforts lack a clear focus, as exemplified by the very different topics ranging from cancer research to plant biotechnology with field trials. Success in obtaining international grant support is also limited for the IG as a whole, since it amounts to only 2.4 % of the total budget of the Institute.

Specific Panel recommendations:

IG is advised to improve the quality of published research. The Panel recommends the Institute to raise the quality of the journal published by the Institute (*Genetics and Breading*) in order to be accepted as SCI journal with impact factor. The timeliness of the journal should also be improved (the last issue appeared in 2006 according to the website). It is strongly recommended that the Institute works out

clearer scientific directions for the future concentrates its efforts on important topics and decreases its involvement in the large number of diverse projects, which often receive minor funding. Efforts should also be exercised to improve transfer of basic scientific knowledge to practical applications, in order to enhance the fund-raising capacity of researchers.

Evaluation Summary

IG is the successor of the Central Agricultural Research Institute (1910), the Institute of Applied Biology and Development of Organisms (1947), and the Institute of Agrobiology (1952), which were transformed in several steps to the current institute in 1966. The IG is currently one of the largest life science Institutes of the BAS system. The Institute has four departments as main research units: Molecular Genetics, Cytogenetics, Plant Biotechnology, and Applied Genetics. The departments' research activities cover basic modern trends in genetics, in which specific experimental approaches and tools are being utilized in an attempt to successfully realise scientific goals.

(a) Quality and Productivity

Quality

Strengths:

The Institute as a whole is visible internationally. The self evaluation report claims 1095 citations for the reporting period of 2004-2008. Although the list of citations is not provided in the report, 814 citations can be found in the Web of Science database, which shows that only a smaller fraction (20 %) of the citations appeared in local sources. The Web of Science database also shows that the Hirsh index of the whole Institute is 30 (for the period of 1976-2008), which is a good value by national standards. The Institute has published five papers that received over 100 citations in total. During the reporting period these figures range from 35-86, which is also good.

The IG is among the few life science Institutes of BAS whose research leads to protected results in the form of patents. During the reporting period five patents were awarded and an additional four patent applications filed.

Weaknesses:

The impact of the research efforts appears to be low, with only a few reports published in high quality international journals. The well appreciated and highly cited papers of the Institute were published in the early to mid-nineties and in 2000. The selected ten best publications of the reporting period appeared in good, but not top quality journals, as shown by their average impact factor reaching only 2.14 per paper. The contribution of the Institute's researchers to these papers is significant, but not leading, since they represent 50 % of all authors, and 60 % of the first/last authors in these publications.

Exploitation of the results is restricted mainly to one plant (tomato). This is surprising, given that the innovative potential of the research of this Institute is good

also in other areas like wheat research, and that practical applications of the scientific findings are rather straightforward. Revenues from the patents have not yet been realized.

Productivity

Strengths:

The Institute's researchers publish actively as reflected in the total number of publications, with 112 papers published abroad, 125 papers in scientific journals in Bulgaria, plus additional 51 conference proceedings abroad and 59 in Bulgaria for the 2004-2008 period. This output is certainly good at the Bulgarian level. The Institute covers key research fields with multiple and very important applications for human health and plant breeding.

The research units were reorganized at the beginning of 2008. Based on the actuality and significance of the research activity, the staff structure, national and international integration, the number of departments was decreased to four, which are: Molecular Genetics, Cytogenetics, Plant Biotechnology, and Applied Genetics.

Weaknesses:

Articles are missing in leading journals of the field. Only 73 papers of the Institute's total publications can be found in the Web of Science database. This accounts for 1.6 SCI paper per researcher for a 5 year period, or 0.3 paper/year/researcher, which is rather low. According to the Web of Science statistics, the number of publications and of the received citations is lower in the reporting period as compared to the figures ten years ago. This is clearly a declining tendency, which is not characteristic for the other good life science Institutes of BAS. The contribution of the four departments to the scientific output in terms of quality publications (with impact factor) is rather uneven, with the Departments of Molecular Genetics and Cytogenetics being the main contributors.

During the reporting period, the IG was involved in quite a high number of research projects (107 in total), which received ca. 835,000 BGN grant support for the whole period, or ca. 167,000 BGN (83,500 EUR)/year. This amounts to 3900 EUR/project showing largely fragmented research support. Such a situation is rather unfortunate since it does not allow for the concentration of resources to important research targets. The Panel is aware that the funding policy of NSF has been changing in the recent years towards more concentrated support. This is a very positive development and should be continued.

Overall score for Quality and Productivity: "B" for **"***Work that is internationally visible. The Institute has made valuable international contributions in the field***."**

(b) Socio-economic Impact

Strengths:

The Institute carries out research with potentially very strong scientific and socio-economic impact both in Bulgaria and the international arena, and includes both animal and plant sciences. The specific fields explored are important and may have relevant applications e.g. for breeding programs of cultivated plants or for elucidating genetic bases of resistance to diseases. The Institute carries out important services, such as the selection of cultivars of practical agronomic interests, which are adequately developed into collaborations with other academic institutions. The research performed at IG has important innovation potential as regards improvement of agronomically important crop plants. The Institute has been exploiting this potential by obtaining five patents for tomato varieties, with an additional four patent applications filed.

Weaknesses:

The interactions with e.g. agro-industrial firms, public agricultural offices and institutions do not appear to be developed to the same extent as with some other academic institutions. While the research topics of the Institute cover both plant and animal genomics, the translation of the obtained results into application is only realized in the plant field, and mainly in one species (tomato). Likewise, it was also noted that the results obtained in the field of the otherwise strong wheat research area of the Institute are not being utilized.

Overall score for Socio-economic Impact: A - "*Highly relevant*."

(c) Prospects

Strengths:

The Institute is planning new developments that may improve its vitality and the ability to address key scientific questions. The joint BAS-Sofia University initiative of a Genomic Center with NSF funding is particularly valuable. Transfer of knowledge and collaborations with other institutions, in Bulgaria and abroad, is well outlined. However, the Panel feels that the Institute should strengthen its position by preferentially focusing on building up solid in-house research quality.

The many collaborations of the Institute are also strengthening its scientific position.

Weaknesses:

The topics under investigation cover a wide array of hardly connected areas, ranging from cancer research to plant biotechnology. This situation hampers the Institute's possibility of being successful in a well defined area and place itself at the forefront of its research field. The Institute's research plans for the future are very general and mostly propose the continuation of present studies, or list currently fashionable areas. The overall qualification of the scientific personnel appears to be low, since only 60 % of the scientists (not considered in this number are the specialists with

higher education) have PhD degrees or DSci. This is significantly lower than the ca. 90 % ratio of qualified scientists in some other BAS Institutes.

The current rate of 0.25 PhD students per researcher is very low and reveals that the Institute has difficulties in attracting students. This is especially problematic since almost half of the researchers is older than 55 years. Only three PhD students have defended their theses during the reporting period. This is a very low number and indicates problems with revitalizing the scientific staff not only in the senior age bracket, but also in the youngest age range. Rejuvenating staff is most important in order to ensure the continuity of research performed at the Institute.

The Panel was also surprised to see the high number of administrative personnel (35 people), whose salary amounts up to 20 % of the total salary expenditure of the Institute. (In case of other BAS Institutes in the life sciences field this ratio is around 10 % only.)

The Institute's researchers teach at the Universities. During the reporting period, this activity has involved about four individuals covering 80 hours of lecturing, plus two individuals covering 20 hours of seminars/practices in average per academic year. Compared to the size of the Institute this activity is not too extensive and could partly account for the difficulties in finding talented young people to refresh the scientific personnel of the Institute.

Overall score for Prospects: C - "*Low*".

Overall Strengths and Weaknesses

Strengths:

IG carries out research with potentially very strong scientific and socio-economic impacts both in Bulgaria and the international arena, and includes both animal and plant sciences. Research activities cover basic modern trends in genetics, in which specific experimental approaches and tools are being employed in an attempt to the successfully realise scientific goals. The large FAO/IAEA project, which is coordinated by the Institute, with the aim to evaluate genetic diversity in cereals in South Eastern and Central Europe, is especially important. The fact that this Institute has already several patents in the plant field is also strength. The IG has good synergies with other BAS Institutes and Bulgarian Universities, as well as with foreign institutions. The Institute is planning new developments that may improve its vitality and the ability to address key scientific questions. The joint BAS-Sofia University initiative of a Genomic Center with NSF funding is particularly valuable.

Weaknesses:

The current international impact of the Institute's scientific output (publications, citations) is not very high. The Institute's researchers were significantly more productive in terms of high quality and highly cited publications in the mid-nineties than during the reporting period. The number of PhD students is low, and their success in obtaining the PhD degree is limited, which together decreases the potential of the IG in improving its scientific output. In spite of the high relevance of

its research, the IG's research efforts lack a clear focus, as exemplified by the very different topics ranging from cancer research to plant biotechnology with field trials.

The Institute's research plans for the future are very general and mostly propose the continuation of present studies, or highlight currently fashionable areas. The number of PhD students is very low and reveals that the Institute has difficulties in attracting students. Success in obtaining international grant support is also limited for the IG as a whole, since it amounts to only 2.4 % of the total budget of the Institute.

Recommendations

- *General Panel recommendations are listed in Panel Level Report.*

Specific Panel recommendations:

- Despite the solid management, very timely research field, and good interaction with other academic institutions, IG has to improve the quality of published research.
- It is suggested to raise the quality of the journal published by the Institute (*Genetics and Breading*) in order to be accepted as SCI journal with an impact factor. The timeliness of the journal should also be improved (the last issue appeared in 2006 according to the website). As it currently stands, it will be hard to attract valuable articles from outside of the BAS institutes.
- The Institute is advised to work out clearer future scientific directions, concentrate its efforts on important topics and decrease its involvement in the large number of diverse topics, which often receive minor funding. In brief, a strategy needs to be developed to concentrate efforts on the most important and promising research lines.
- Efforts should be exercised to improve transfer of basic scientific knowledge to practical applications, in order to enhance the fund-raising capacity of researchers.
- The website should be modernized and regularly up-dated with both general and scientific information to improve the attractiveness and visibility of the Institute.

Stephan Angeloff Institute of Microbiology (SAIM) - 406

Executive Summary

SAIM was founded in 1947. It is clearly recognized at the international level and appears as one of the best ones of the biological Institutes of the Bulgarian Academy of Science for the quality of its scientific production (Quality/Productivity score A). The research conducted at SAIM is highly relevant for both fundamental and applied science projects (Socio-economic Impact score A). Given the Institute's very successful acquisition of research funds, its strong integration at the European level and its good age structure, the prospects of SAIM are high (Prospects score A).

Overall Strengths:

The Institute as a whole is internationally highly visible. SAIM has been associated to the Parisian Institute Pasteur since 2004 and is also member of the International Network of the Pasteur Institutes (RIIP). During the 2004-2008 reporting period, SIAM has made significant advances in virology, bacteriology and immunology. SAIM develops several projects that might have industrial or medical applications. Furthermore, products have already been developed and are ready to be implemented in industry; patent licenses have been obtained as well. SAIM has an impressive publication record with articles preferentially published in international journals with impact factor (IF). Remarkably, SAIM occupied the second place among the Institutes of RIIP when looking at the total number of scientific publications for the period 2001-2006. The age structure is good. Young scientists who went abroad for their PhD or post-doctoral training and who have an excellent scientific level do already play an active role in the Institute.

Overall Weaknesses:

The productivity/quality is heterogeneous across the Institute's departments. The presence of the scientists at international meetings is low. Despite the innovation potential of several projects, no patent has been obtained and the patent-licenses have not yet resulted in income.

Specific Panel recommendations:

The Panel recommends that the Institute identifies the reasons for the difference in productivity across departments and develop a strategy for improvement. In general terms, SAIM could either focus its research on the most productive projects or encourage all departments to increase their scientific productivity, in terms of quantity and quality. The Institute is advised to encourage and to support the participation of its scientists in international meetings. Efforts should be made to ensure that the younger scientists obtain the PhD degree. The Panel also recommends that the Institute fosters the collaboration with industry in order to increase innovative research and patent activity. SAIM is also advised to improve its infrastructure. It was felt crucial that the Institute has its own Level 3 culture

laboratory to deal with human pathogens. The web site of the Institute should be modernized to render the Institute more attractive and more visible.

Evaluation Summary

SAIM conducts both basic and applied research. The areas of expertise are: morphology and ultrastructure, genetics, biochemistry, physiology and ecology of microorganisms, mycology, virology, infectious microbiology and immunology. The staff includes 76 researchers of which 57 hold a PhD (one Academician, 6 Professors, 30 Associate Professors, 19 researchers). 25 % of the scientific staff are research scientists below the age of 40 years.

(a) Quality and Productivity

Quality

Strengths:

- One major strength and feature of SAIM is its association with the prestigious Institut Pasteur of Paris, an international leader in microbiology. Since 2004, SAIM has also been a member of the International Network of the Pasteur Institutes (RIIP). This is a strong recognition of its scientific quality and international presence. This association has provided new opportunities in terms of scientific collaborations, training of young scientists and funding. Since 2004, five projects have been supported by programs of Institut Pasteur (Paris) and RIIP. Because of this association, the quality of research conducted at SAIM is regularly evaluated, which is one of the prerequisites to ensure its future scientific quality. It is also noteworthy that SAIM has an international advisory council composed of top level scientists from foreign laboratories.
- Scientists of the Institute also collaborate with numerous teams in Bulgaria and central Europe. Long-term collaborations with laboratories in Europe, UK and USA have been established on projects in Infectious Microbiology, Virology, Immunology and General and Applied Microbiology. More than 100 foreign scientists have visited the research unit between 2004 and 2008.
- From 2004 to 2008, SAIM's teams obtained an impressive number of European and International grants (NATO, UNESCO, Foundation Howard Hughes), representing a total sum of about 1 Million BGL.
- The Institute's activities in the field of antiviral research are especially recognized. Consequently, the next meeting of *The International Society for Antiviral Research* will be held in Sofia in 2011.
- Young scientists at SAIM have obtained international grants (four) for young scientists and have won six awards for their presentations at international and national meetings.
- SAIM develops a high number of projects that might have industrial or medical applications (vaccines, detection of food-borne pathogens, microbicides and antimicrobial agents, immunomodulators, new technologies for production of biologically active substances, new methods for water and

soil purification). Eight products are ready to be implemented in industry and successful collaborations, mainly with firms from Germany, have been set-up in the field of antiviral drugs development.

Weaknesses:

- The presence of the Institute's scientists at international meetings is low, with only 37 international conference proceedings in five years for around 80 scientists.
- Despite its high innovation potential, the Institute has not succeeded in increasing income through licenses.

Productivity

Strengths:

- The scientific output of the Institute is among the best ones of the biological Institutes of BAS. SAIM has an excellent publication record with significantly more papers published in international journals (254) than in Bulgarian journals (66). The number of publications/year has regularly increased since 1990. The H index is high (26) and is within the top five of the biological Institutes of the Bulgarian Academy of Sciences.
- The selected major ten publications of the 2004-2008 reporting period correspond to articles published in microbiology journals with very good or good impact factor (IF). The contribution of SAIM's researchers to the publications is significant, given that they represent 50 % of all authors, and 80 % of the first and last authors.
- The number of citations during the reporting period is high (2863). Among the biological Institutes of BAS, SAIM occupies the second place for the total number of citations. Likewise, it is on the first position with respect to publication productivity (no. of SCI papers/researchers) and, importantly, second among the institutes of RIIP with respect to the total number of scientific publications for the period 2001 – 2006, which is a remarkable achievement.

Weaknesses:

- The articles are essentially published in journals with IF <5 (although a few outstanding examples are present) and only one paper is cited more than 100 times. SAIM is a large Institute (162 personnel, 84 scientific researchers) - even if the general quality of publications is very high, more publications in the top ten quality journals could be expected.
- The productivity is heterogeneous across departments/topics (e.g. six publications at the Department of Microbial Ecology vs. 63 publications at the Department of Microbial Biosynthesis and Biotechnology). Even if one takes into account the number of researchers per department, the differences in productivity remain.

Overall score for Quality and Productivity: "A" for "*work that is internationally competitive. The Institute has demonstrated important contributions to the field and is considered an international player*."

(b) Socio-economic Impact

The Institute's activities are also highly relevant in terms of public health, national security and microbial biotechnologies. The teams work on pathogens that are responsible for major diseases in human and animals as well as on immune-related diseases. SAIM's research areas and topics are included in the research priorities of BAS and in the current framework program for research and development of the EU. The institute is very active in European level cooperations and participated in 3 EU FP6 projects.
SAIM collaborates with numerous Institutes of BAS as well as with Universities and research centers. SAIM is the headquarter of the Council for Biological Defense and the Scientific Coordination Council to the Permanent Commission for Defense of Citizens against Disasters, Troubles, and Catastrophes at the Ministry Council of Republic of Bulgaria.. Researchers of the Institute also provide expert services to the Ministry of Health in various health related issues. SAIM initiated and organised the establishment of the Balkan Society for Microbiology (BSM) in 1999.

Scientists at SAIM are strongly involved in teaching and training activities (48 hours of post-graduate training and 2963 hours of specialization courses during the reporting period 2004 - 2008).

Overall score for Socio-economic Impact: A - "*Highly Relevant*."

(c) Prospects

The perspectives of SAIM are excellent. Members of the direction have a clear and realistic view of the future. A scientific council including top level scientist from abroad was established in 2008 with the goal to guide the scientific policy of the Institute and facilitate the development of interdisciplinary projects.

The Institute has already initiated a reorganization in order to focus on major research directions (Infectious pathogens and anti-infectious agents, Immunopathology and autoimmunity, Microbiology and Microbial Ecology). This will clearly improve the coherence of research, facilitate scientific exchange within the Institute and increase the potential of the SAIM to tackle new scientific challenges.

As a member of the Institute Pasteur Network, SAIM is already present at the international level. Members of the Institute expressed a clear willingness to maintain and even reinforce their presence at the European level.

The age structure of the Institute is good. During recent years, a strategy to rejuvenate the research staff has been implemented. Consequently, 28% of the scientific personnel (including the specialists with higher education) are currently less than 35 years of age as compared to 5% in 1994. Noteworthy is the observation that young talented scientists who went abroad for their PhD or post-doctoral

training already play an important role in the Institute. Moreover, procedures to attract back Bulgarian brains from abroad are in progress. Due to the broad scope of its research, the Institute can select students from various sources, including those from faculty of sciences or from medical and veterinary schools. The Institute is appealing to PhD students. Three to four PhD applications/year are supported by the State. Seventeen theses (13 PhD and 4 DSc) have been defended during the 2004-2008 period. Programs are in place to improve the training of students (FEMS, IP, EU, UNESCO) and specific courses are organized by Institut Pasteur and SAIM (atelier Pasteur).

The infrastructure is very good and well adapted to the future scientific development of the Institute (sterile animal facilities, electron microscope, flow cytometer, confocal microscope).

The Institute has a very successful funding policy at the national and international level. EU funding has already been secured for the next four years

Overall score for Prospects: A - "*High prospects*."

Overall Strengths and Weaknesses

Overall Strengths:

The Institute as a whole is internationally highly visible. SAIM has been associated to the Parisian Institut Pasteur since 2004 and has also been a member of the International Network of the Pasteur Institutes (RIIP). During the 2004-2008 reporting period, SIAM has made significant advances in virology, bacteriology and immunology. SAIM develops several projects that might have industrial or medical applications. Eight products have been developed and are ready to be implemented in industry, and five patent licenses have been obtained. SAIM has an impressive publication record with 269 articles published in international journals and 66 in Bulgarian Journals, during the 2004-2008 period. SAIM occupied the second place among the Institutes of RIIP with respect to the total number of scientific publications for the period 2001-2006. The age structure is good. Young scientists who went abroad for their PhD or postdoctoral training and who have an excellent scientific level do already play an active role in the Institute.

Overall Weaknesses:

The scientific productivity/quality is heterogeneous across the Institute's departments. The presence of the SAIM's scientists at international meetings is low. Despite the innovation potential of several projects, no patent has been obtained and the patent-licenses have not yet resulted in income

Recommendations

- *General Panel recommendations* are listed in the Panel Level Report.

Specific Panel recommendations:

- The scientific productivity/quality is heterogeneous across the Institute's departments. The Institute is advised to identify the reasons for the difference in productivity across departments and develop a strategy for improvement. In general terms, the Institute could either focus its research on the most productive projects or encourage all departments to increase their scientific productivity, in terms of quantity and quality. A decision could be reached by taking into account on the one hand the new techniques and experimental approaches of the international scientific community, and on the other hand identifying niches in which SAIM's groups could play a better role, according to their experiences and technical capabilities.
- The Institute should encourage and support the participation of its scientists in international meetings.
- There are members of the scientific staff who do not hold a PhD degree. Efforts should be exercised that the younger researchers will reach the PhD level.
- The Institute should foster collaboration with industry in order to increase innovative research and patent activity.
- SAIM should also continue to improve its infrastructure. It was felt crucial that the Institute has its own Level 3 culture laboratory to deal with human pathogens.
- The website should be modernized and regularly up-dated with both general and scientific information to improve the attractiveness and visibility of the Institute.

Inst. of Experimental Morphology and Anthropology with Museum (IEMAM) - 407

Executive Summary

IEMAM is a nationally significant and internationally visible institution. The Institute presents some interesting results, mainly in terms of scientific outcomes and international collaboration. From a scientific point of view it is difficult to evaluate the Institute as a whole. Is seems to be made up of two clusters with largely different scientific quality and productivity, with one cluster focussing on morpho-functional areas and the other one being the Anthropological Department with the Museum (Quality/Productivity score B). The activities of the Institute are highly relevant in terms of scientific targets, maintenance of the Anthropological Museum, and education of young scientists (Socio-economic Impact score A). The proposed future activities are a continuation of the work pursued so far and no clear goals were presented for the improvement of the Departments and the Institute as a whole. The overall prospects of the Institute are moderate (Prospects score B).

Overall strengths:

- The Institute participates in a Research grant of the 7th EU Framework Programme.
- Scientists have succeeded in obtaining collaborative grants and short scientific visits for training abroad.
- Scientists are dealing with important issues, e.g., the use of animal models to understand the molecular mechanisms causing human diseases such as Multiple Sclerosis, Alzheimer's disease, or defects in spermatogenesis.
- Some Departments (e.g., Cell Differentiation) have a good level of productivity.
- The Anthropological Department and the Museum have a clear and important niche in BAS.

Overall weaknesses:

- The Institute has some particularities in its composition, showing an imbalance from a scientific point of view.
- The number of publications in Bulgarian Journals represents a high percentage of the total number of published papers.
- The different research groups present a considerable number of publications. However, with some exceptions, the majority of the papers are still published in low-impact factor journals; in particular those for which data was produced solely by the Institute.
- Two departments have a very low scientific production.
- The Museum in particular and the Department of Anthropology in general, have mainly local perspectives, and lack international visibility.

Specific Panel recommendations:

- To publish in journals with good impact factor with the aim to increase the visibility of the Institute's outcomes;
- To discuss and possibly reorganise the Institute's current structure in order to allow the groups in the different departments to strengthen their scientific position;
- To encourage all research groups to increase their scientific productivity, in terms of quantity and quality;
- To maintain, and increase, the level of collaboration, both nationally and internationally;
- To concentrate research efforts on a well-defined number of scientific projects with better financial support through grants from abroad, companies, etc.;
- To patent the outcomes of the technical studies;
- To attract well-establish scientist to run some of the laboratories after retirement of the current leaders;
- To increase the international visibility of the Department of Anthropology;
- The Institute's journal should be opened to a wider scientific community. This requires a strategic plan for the dissemination of the journal (Web page, etc.) and for the increase of its quality (SCI journal with impact factor).

Evaluation Summary

IEMAM was established in 1995 as successor of the Institute of Morphology that was created in 1953 from the Institute of Experimental Medicine (founded in 1947). In 2006, the centre received its present name, IEMAM at the Bulgarian Academy of Sciences (IEMAM-BAS). The Institute consists of four Departments, two General Laboratories, the National Anthropological Museum, and one Administrative Unit (including the accounts office, the library and the animal house). The Government body is composed of one Director, one Deputy Director, one Scientific Secretary and one Administrative Director. The Scientific Council consists of 21 members, and it has a major commitment in appointing Associative Professors, in promoting Assistant Professors, and in overlooking any type of research activity.

The Institute employs 39 scientists and about 38 % of the scientific staff is below the 35 years of age. Each department is made up by one or several research groups. Their research activities, PhD student projects, research directions and the quality of all of them are monitored and evaluated internally by the Scientific Council.

Although presented together, the structure, achievements and aims of the IEMAM-BAS can be clearly divided in two: those related to the experimental morphology and those related to the anthropology, including the Museum. The research areas and topics of the departments are closely related to some of the national priorities, such as the biotechnology, food and health, and the cultural and historical heritage and national identity.

The Institute has produced clear research achievements, but it is difficult to evaluate their impact in terms of scientific production. Research findings seem of great

importance on the national level and some of the group leaders maintain a fruitful collaboration with groups aboard. Teaching activities and young scientist training is part of the departmental program.

(a) Quality and Productivity

Quality

Strengths:

- The Institute has a number of achievements from the past years, mainly directed towards improvement of health care and the description of the anthropological landmarks of the ancient and recent Bulgarian population.
- The morpho-functional findings are mainly related to markers and procedures that allow the diagnosis of some illnesses.
- Some research groups have developed interesting techniques and treatments that can be applied in clinical studies.
- Two departments, and mainly the Department of Cell Differentiation, present a reasonable number of publications in good-rated international journals..

Weaknesses:

- The Museum, which started in 2007, is in the process of being established as a scientific and cultural institution for extending the knowledge on Bulgarian anthropology. The quality of the work done until now and the perspectives are unquestionable, although difficult to evaluate from a strict scientific point of view, because there are no clear international parameters for this type of activities.
- Two of the departments have been unproductive during the reporting period in terms of number of papers in international journals with good impact factor.
- In general, the number of national publications is still very high compared with those in international journals. In order to improve the dissemination of the results to the scientific community at large, it is advisable to put more efforts into their internationalisation and at the same time reduce the number of national publications to a minimum.

Productivity

Strengths:

- The Department of Anthropology has produced a bilingual monograph on the physical development of the Bulgarian population during the past century.
- Research groups have received a considerable number of grants from the BAS and the National Science Fund (NSF). More impressive is the number and quality of grants from EU programmes and other international organizations as well as from the Academy's bilateral agreements in the framework of institute-to-institute cooperation.
- Special mention deserves the participation of the Institute in the 7th European Framework Programme. This provides many opportunities for collaboration,

exchange of knowledge, and visibility of both the scientists and the Institute. Some of these collaborations have produced excellent papers and this should continue in the future (Institute to be mentioned in papers).
- The number of PhD students and those that have already defended their doctoral thesis is remarkable.

Weaknesses:

- The number of papers published in indexed journals with impact factor is low. The number of citations received in the past five years is lower than for the best life science institutes of BAS.
- Members of the Institute run the journal *Acta Morphologica et Anthropologica* (published in Bulgaria), in which Institute members publish a considerable number of articles per year. The journal is not yet listed in the SCI, and therefore the articles are not accessible to the international scientific community.
- The research related to neuromorphology has a long tradition in Bulgaria but has not been very productive in the last years. The field is very competitive, technically and conceptually, mainly due to the developments in molecular and cell biology.
- The Anthropological Department and the Museum have very interesting investigations and general activities. It is difficult to compare their scientific outcomes with the other sciences because of the added regional and social values on the one hand and the lower impact factor publications on the other hand.

Overall score for Quality and Productivity: "B", for "*Work that is internationally visible. The Institute has made valuable international contributions in the field.* **"**

(b) Socio-economic Impact

Strengths:

- The achievements of the Anthropological Department and Museum are unique because they deal with the anthropological evolution of the Bulgarian population. The researchers have been collecting data which they published in a bilingual monograph. The Director of the Institute, and Leader of the Anthropology Department, has been very active in writing articles in Bulgarian newspapers and magazines. The department, together with The National Anthropological Museum, contributes to the popularity of this field and to the implantation of anthropological studies in Bulgaria. This represents a high added value on a national level. However, their findings should be shared with scientists abroad, to enhance the general international knowledge in the field.
- The Institute has produced relevant results that have been applied in clinical work. This refers mainly to reproductive health and men fertility, and to finding biomarkers and protocols to improve diagnosis and evolution in different human disorders. These findings can be important at the national level.

- The data show progress and success of PhD education at the IEMAM-BAS. In the past five years, 19 PhD students have been educated and 13 were awarded the PhD degree.

Overall score for Socio-economic Impact: A - "*Highly relevant*".

(c) Prospects

Strengths:

- The Institute proposes interesting future plans, in terms of descriptive studies, for the area of Paleoanthropology. One of the major goals is the enlargement of the existing permanent anthropological exposition *Man in the Past* which seems to be very popular in Bulgaria. Moreover, the Anthropological Museum is well placed to convey biological knowledge to its visitors and to provide anthropological training to students in Bulgarian schools and Universities.
- The Anthropological Department has future plans to employ better and more modern methods for bone analysis, as well as for classification and storage of specimen.
- Current international collaborations and recent scientific outputs of some research groups (from the Morpho-functional areas) are a good basis for these groups to scientifically succeed in the near future.

Weaknesses:

- The present structure with two principal clusters (one cluster focussing on morpho-functional areas and the other one being the Anthropological Department with the Museum) does not seem to be ideal if the Institute wishes to develop a coherent strategy and increase its overall performance in the future.
- Proposals for future projects are clearly a continuation of the work pursued so far. As regards scientific research, the Institute proposes to follow the type of experiments performed in the past years. The Institute doesn't seem to have a clear vision as to how to improve its overall performance nor those of the individual scientists.
- The list of future strategies of the IEMAM-BAS lacks ambition, and in some cases the scope is vaguely expressed, for example, in relation of PhD recruitment and personal development. The main goal is to have funds for research, new equipment and for maintaining the journal *Acta Morphologica et Anthropologica*.
- While the Institute has lively and dynamic young people, no ambitious plans have been designed to attract extra financial support and to disseminate the Institute's achievements to the scientific community abroad.

Overall score for Prospects: B - "*Moderate prospects*".

Overall Strengths and Weaknesses

Strengths:

IEMAM-BAS clearly has very interesting outcomes. Those delivered by the Anthropological Department and the Museum can be considered unique in the world. Other scientists in the Institute also deal with important issues related to the molecular mechanisms that cause human diseases. In general, researchers have succeeded in getting collaborative grants and short visits for training abroad. Very remarkable is the fact that a group of the Institute is part of a research grant of the 7th EU FP. The Institute has its own journal and aims to internationalise the Editorial Board and to be accepted as SCI journal with impact factor.

Weaknesses:

IEMAN-BAS has a heterogeneous composition that might impede its overall prospects and performance. On one side, it hosts groups working on morphology, cell differentiation and cytology, which have different success in terms of number and quality of the published papers in international journals. On the other side, the Anthropological Department and the Museum have very interesting investigations and general activities. However, in this case the scientific outcomes are difficult to compare with other sciences because of the added regional and social values on one hand and the lower impact factor publications on the other hand. In general, the number of publications in Bulgarian journals represents a high percentage of the total number of papers, reducing the visibility of the work on an international level. Some of the research groups have a considerable number of publications but, with some exceptions, the majority of the papers are still in journals with low-impact factor.

Recommendations

General Panel recommendations are listed in the Panel Level Report.

Specific Panel recommendations:

- Taking into account the complex and mixed composition of the Institute in its present format, a new structure could be considered: i) to create a large Institute of Anthropology together with the Museum, including those research groups working in macroscopic skeletal morphology (i.e., experts in the analysis of collected samples); ii) the research groups in the other departments and which are enrolled in important collaborations abroad (e.g. the 7th EU Framework Programme) could join other Institutes (e.g. Institute of Biology and Immunology of Reproduction or IMB) in order to improve their scientific production and visibility; and iii) options need to be explored as to how to deal with the personnel not included in the above two categories.
- The Institute runs the Journal *Acta Morphologica et Anthropologica* (ISSN:1311-8773), published in Bulgaria. While the publishing of an Institute journal might be important, it is recommended to render the journal more

visible on an international level. Measures that could be easily implemented are: design of a journal website, inviting more members from abroad to join the Editorial Board as well as development of a strategic plan for the dissemination of the journal. Likewise, scientists from outside Bulgaria should be attracted to publish in the journal. To this end, it is desirable that the journal be accepted as SCI journal with impact factor.

- Some departments as well as some research groups perform better than others. The Institute should identify the underlying causes for these differences and encourage staff members to increase their scientific productivity, in terms of quantity and quality.
- It is important to maintain the level of collaboration, both at a national and an international level. The exchange of scientists and students between centres is very enriching.
- The Institute's scientists are advised to concentrate their efforts on a well-defined number of scientific projects and on finding better financial support for these (it seems that this started to happen in the last year). The whole Institute should put efforts into obtaining financial support from grants abroad, companies, etc., to complement funds from the national programms.
- To perform an experiment consumes a lot of time, as well as to analyse the collected results, and to prepare the manuscripts for publication. Researchers should aim to publish in journals that they deem well placed in terms of impact and visibility to the science community.
- The Institute is advised to make a special effort to obtain patents from their technical studies.
- The Institute should make efforts to attract well-establish scientists for running some of the laboratories after the leader retirement and to ensure researchers in all the cohort ages.
- The Institute should continue to encourage and support the participation of its scientists in international meetings. Likewise, it is advised to support the organization of national and international events, to prepare international grants, etc.. In brief, exercise all efforts to improve knowledge and scientific abilities of its staff.
- The Institute's website should be improved and regularly updated, since it is the main tool for scientists outside of Bulgaria to find information about staff members, topics of interest, publications, methods and techniques, etc. The website should be used as main tool for internal and external scientific exchange. The Museum deserves a website that is dedicated to public outreach, for non-scientific people interested in Anthropology.

Institute of Experimental Pathology and Parasitology (IEPP) - 408

Executive Summary

IEPP was created in 1995 on the basis of the Institute of General and Comparative Pathology and the Institute of Parasitology. This Institute is clearly a national player but is less visible internationally. IEPP's overall productivity is modest in terms of number of publications and number of citations (Quality/Productivity score C). IEPP is of high national importance for the area of parasitology and the development of alternative models of human pathologies. The Institute's scientists are also involved in the survey of animal infections in the country. The relevance of the research is therefore high (Socio-economic Impact score A). The Institute develops important projects concerning human parasites and has a strong innovation potential. The age structure is good and a significant number of young scientists are present at the Institute. However, IEPP is highly dependent on national funds and develops only a few solely basic research projects competitive at the European level. The overall prospects are moderate (Prospects score B).

Overall strengths:

For parasitology, the IEPP plays an important role in Bulgaria and the Institute is also active in the field of animal viruses and natural medicine. Moreover, IEPP has been very successful in developing cellular experimental models, which are highly valuable for the production of biological products or testing of drugs. Research areas pursued at IEPP are relevant in terms of public health and veterinary medicine, and are included in the priorities of BAS and Framework Programmes of the EC. IEPP develops several approaches that might have industrial, medical or veterinary applications.

Overall weaknesses:

IEPP is moderately recognized at the international level. The Institute publishes more papers in Bulgarian than in international journals; and the production is heterogeneous between the departments. Research projects in IEPP are almost exclusively funded by national grants.

Specific Panel recommendations:

- The Panel recommends that the Institute focuses its activities on the most productive projects, i.e biochemistry and epidemiology of parasites and development of alternative experimental models. Given its long standing expertise in the latter field, it could be envisioned that IEPP develops a facility to test bioactive molecules. Such a facility could also be open to other biological Institutes and research centres, thereby reinforcing IEPP's collaboration with other biomedical Institutes of BAS.
- The Panel recommends that the Institute identifies the causes underlying the differences in productivity across departments, with the aim to encourage all staff members to increase their scientific productivity, in terms of quantity

and quality. It is equally advisable to reconsider the publication policy: articles should be preferentially published in English, in international journals with impact factor (IF). An effort should also be made towards having the local institution journal accepted as SCI journal with IF.

- The Institute is advised to encourage and support the participation of its scientists in international meetings.
- There are members of the scientific staff who do not hold a PhD degree. For the youngest ones, efforts should be made to ensure their qualification to the PhD level.
- The Institute should foster the collaboration with industry in order to increase its innovative research and secure patents.
- The infrastructure and the implementation of modern techniques of molecular biology and cellular biology should continue to be improved and further strengthened.
- The website should be modernized in order to improve its attractiveness and the visibility of the Institute.

Evaluation Summary

IEPP was founded in 1995 on the basis of the Institute of General and Comparative Pathology (founded 1948) and the Institute of Parasitology (founded 1954). IEPP has five scientific departments: Biochemistry, Pathology, Fauna and Circulation of Parasites, Immunology, Oncovirology.

At present, the IEPP has a 78 staff members, of which 50 (64%) are scientific staff and 28 are technical and support staff. The age structure is good, with 55.3% of staff below the age of 40 years. 26 scientists received their Ph.D in immunology, animal pathology, parasitology & helminthology, virology and biochemistry. Technical and support staff include 15 specialists with higher education (research technicians, administration, engineer) and 13 with secondary education. The proportion of qualified scientists who hold a PhD (or higher) is only 55 % of all scientists. This is relatively low, especially when considering the low number of young scientists.

(a) Quality and Productivity

Quality

Strengths:

IEPP has established formal bilateral projects with research institutions in Romania, Lithuania, Latvia, Greece, Germany and Spain. IEPP participates in a multilateral international project supported by the European FP6 program (17 partners in 10 countries - Design of effective and sustainable control strategies for liver fluke in Europe. Dr I. Bankov, director of IEPP, is the coordinator for Bulgaria).

IEPP develops several approaches that might have industrial, medical or veterinary applications, and several of IEPP's research teams are partners for biotechnology companies. Two patent-licenses have been obtained.

IEPP collaborates with drug companies to check the pathology of acute, sub-acute and chronic toxicity of new developed drugs. IEPP has conducted the safety testing for cytotoxicity, carcinogenicity, teratogenicity and for antitumor activity of a lipid-lowering food supplement (Monascus composition MB 1000 BG) in collaboration with biopharmaceutical companies. IEPP has also established cell lines allowing to test drugs or to produce biological materials. As a result, IEPP established a new cell culture laboratory with equipment worth of 45 000 €.

Weaknesses:

The Institute received only a few international grants. The participation of the Institute's scientists in international meetings is quite low, with 34 international conference proceedings during five years for around 50 scientists.

No income from patent-licenses.

Productivity

Strengths:

During the 2004-2008 reporting period, the IEPP published 66 papers (53 found in Web of Science) in international journals, 138 papers in Bulgarian Journals, 34 papers in meeting proceedings abroad, 28 in meeting proceedings in Bulgaria, 2 text-books (in Bulgarian) and 2 books and brochures for the general public.

The selected major ten publications during 2004-2008 include one monograph and nine articles. Six articles are signed by members of the IEPP as first or last authors. The contribution of the IEPP's scientists is significant, representing 48 % of all authors, and 70 % of the first and last authors.

Probably due to the past funding policy of the Academy, the activities of the IEPP appear to be more in the fields of descriptive science rather than pure basic research, i.e. isolation and testing of compounds and collection of biological materials. However, the development of alternative experimental models is clearly a very important field. Efficient methods for the production of biological products like vaccines or recombinant proteins and for testing of drugs are becoming increasingly indispensable. The Institute could pursue such activities for instance on a large scale through the establishment of a dedicated facility. Along these lines, *in vitro, in vivo* and *in ovo* models have been generated to investigate the biological activity and safety of chemical and biological products such as immunomodulating, antitumor, antivirus and antiparasitic effects, cytotoxicity, genotoxicity, teratogenicity and carcinogenicity. Models of pancreatic cancer and brain injury have also been developed.

Weaknesses:

The global level of international publications is modest (66 articles for 102 projects); the Institute's articles are preferentially published in Bulgarian journals. Amongst the publications in international journals, the majority of articles are published in journals with IF <3.

The departments are heterogeneous in terms of international recognition and productivity. For instance, the Departments of Pathology, Fauna and Circulation of parasites and Oncovirology have low publication records in international journals.

Overall score for Quality and Productivity: "C", for *"Work that is solid and has added to our understanding and is in principle worthy of continuation. The institute is nationally visible."*

IEPP is clearly more visible at the national than at the international level. The Institute develops solid research in various aspects of parasitology; the research is nationally visible and worthy of support. Immunology and oncovirology projects are less recognized and competitive. Good publications are produced, but mainly by few scientists (very unequal publication activity between departments). The number of publications and citations in international journals are modest. With in addition only one grant from the EU, there is an overall need for improvement of research on an international level.

(b) Socio-economic Impact

Research performed at IEPP is relevant in terms of public health and veterinary medicine. The research areas of IEPP are included in the research priorities of BAS and in the thematic priorities of 6th and 7th Framework Programmes of the EU. However, only few international research grants have been obtained.

The Institute is especially active in parasitology, developing research on parasites infecting humans, animals and plants. IEPP is also active in the field of natural medicine by testing the immunomodulating activities of various natural products. In the field of pathology, the Institute's line of research includes studies of the pathological features of actual animal diseases, the evolution of the common ailments, as well as the newly emerging infections and diseases of non-infectious origin, which cause severe economic losses in the country. IEPP has also established a collection of cells, tumor lines and parasites that are valuable tools for other institutes. They obtained two patents, which show the socio-economic impact of their work.

IEPP collaborates with eight of the biological institutes of BAS, on the basis of joint projects funded by NSF. In these collaborations, IEPP essentially contributes by investigating the biological activities of molecules or by performing ultrastructure studies. IEPP also collaborates with five Universities and Research Centers in Bulgaria.

Scientists of the IEPP become members of "diagnostic teams" when the country faces outbreaks of devastating animal diseases.

The Institute has its own journal– *Experimental Pathology and Parasitology* – which releases issues three times a year. However, publication is very slow since the last issue which listed on the journal website is 2008/1.

IEPP is licensed by *The National Evaluation and Accreditation Agency* to educate and train PhD students in immunology, animal pathology, parasitology and

helminthology, virology and biochemistry. In general, scientists at the IEPP are heavily involved in teaching and training. For instance, between 2004 and 2008, they had 752 hours of teaching and training, 1175 hours of practical training/course and seminars, and 601 hours of post-doctoral training. The Institute's scientists supervised 11 MS students and organized schools (17 lecturers).

IEPP participates in the ERASMUS program through a bilateral agreement with the Institute of Animal Physiology in Munster University (Germany).

Several members of the Institute are part of specialized councils at the Bulgarian Government, such as scientific councils of veterinary Institutes. One scientist of IEPP is Vice-president of the Bulgarian Society for Parasitology.

Overall score for Socio-economic Impact: A - "*Highly relevant*".

(c) Prospects

The Institute's objectives for the next five years are the development of new diagnostics, therapeutics, cell lines and vaccines with potential application in practice. IEPP plans to develop only few basic research projects, which raises concerns about its ability to obtain international research grants. On the other hand, some applied projects have led to significant income for the Institute. IEPP is almost exclusively funded by BAS and national grants, and is therefore highly dependent on the national policy of research funding. Nevertheless, some of the projects are well defined (liver fluke) and results may lead to collaborations and mutual international exchange. Funding has been secured already for one EU project.

IEPP is well equipped with modern tools: Real-time PCR, HPLC, Fluorescence microscope, Spectrophotometer, ELISA Reader, PCR machines and an electron microscope in a fairly good condition.

The age structure is good. Only a few people are above the age of 60 years and a significant number of people (24) are below 45 years of age. However, only six PhD degrees have been awarded among 16 PhD students between 2004 and 2008, and a significant proportion of PhD students appear to have no publication in international journals. Grants have been obtained from the EU in order to support PhD students and post-docs.

Overall score for Prospects: B - "*Moderate*".

Overall Strengths and Weaknesses

Overall strengths:

In Bulgaria , the IEPP plays an important role in the area of parasitology and it is also active in the field of animal viruses and natural medicine. IEPP's research areas are relevant in terms of public health and veterinary medicine, and are included in the research priorities of the BAS and in the thematic priorities of 6th and 7th

Framework Programmes of the EU. IEPP develops several approaches that might have industrial, medical or veterinary applications. Four projects have been funded by private companies.

The significant number of young scientists suggests that the Institute has the possibility of improving in the near future.

Overall weaknesses:

The activities of IEPP appear to be more in the fields of descriptive science rather than pure basic research, i.e. isolation and testing of compounds and collection of biological materials.

IEPP is moderately recognized at the international level: only one project is funded with an international grant, and the leadership or collaborations for basic research projects are not clear. IEPP publishes more papers in Bulgarian than in international journals. In addition, the production is heterogeneous across departments, with some of them (Departments of Biochemistry, Immunology) having good publication records in international journals while other departments show average or low publication activity in international journals. Consequently, the H-index of the Institute is modest (9 for the period of 1976-2009).

The research projects are almost exclusively supported by national grants. IEPP develops only few solely basic research projects, which raises concerns about its ability to obtain international research grants.

Recommendations

General Panel recommendations are listed in the Panel Level Report.

Specific Panel recommendations:

- It is recommended that the Institute focuses on the most productive projects, i.e parasitology and development of alternative experimental models.
- The Institute should foster collaboration with industry in order to increase innovative research and secure patents.
- IEPP could envisage developing a drug testing facility open to other biological Institutes and research centres. As a first step in this direction, the IEPP could conduct an audit analysing whether such a facility would be useful for the other Institutes and how it could be organized.
- The implantation of modern techniques of molecular biology and cell biology should be continued and further strengthened.
- The Institute should reinforce its collaborations with other BAS Institutes working on pathogens.
- The scientific productivity/quality is heterogeneous across departments. The Institute should identify the underlying causes for these differences, with the aim to encourage all departments and staff members to increase their scientific productivity, in terms of quantity and quality. When developing a strategy for improvement, the IEPP should on the one hand take into account new techniques and experimental approaches of the international scientific community, and on

the other hand identify niches in which IEPP's research groups can build up a strong position, according to their experiences and technical capabilities.

- The Institute should reconsider its publication policy. Articles should be preferentially published in English, in international journals with IF. An effort should also be made towards having the local institution journal accepted as SCI journal with IF.
- The Institute should encourage and support the participation of its scientists in international meetings.
- There are members of the scientific staff (ca. 50 % of them) who do not hold a PhD degree. For the youngest ones, efforts should be made to ensure their qualification to the PhD level.
- The website should be modernized and regularly up-dated with both general and scientific information to improve the attractiveness and visibility of the Institute.

Institute of Biology and Immunology of Reproduction (IBIR) - 409

Executive Summary

"IBIR Acad K.Bratanov" is a solid Institute at the Bulgarian national level. While its scientific production is rather low at present, the Institute may, in the future, make a valuable contribution in the international landscape as well. As it stands, it can certainly be considered nationally visible and a national player (Quality/Productivity score C). The scientific impact of its activities is high, considering the Institute's involvement in teaching and PhD programs. The socio-economic impact is also high with respect to possible industrial implementation of findings and the important input in animal breeding (Socio-economic Impact score A). One of IBIR's priorities is the future development and application of biotechnologies in animal reproduction. A more focused application of the results in the field of animal breeding and cryopreservation methods may give rise to patents and to the exploitation of these results. Taken together, IBIR has a high potential to play an important role in the future in terms of both scientific and socio-economic aspects and with high prospects (Prospects score A).

Overall strengths:

IBIR has provided important input concerning the development of animal breeding and cryo-conservation (stem cells, spermatozoa) methods, in the past and up to now. As a consequence, 15 products are ready to be implemented in industry. A collaborative EU FP7 project (with Italy, France, Germany, Austria and England) has recently been secured, which aims to transform IBIR into a European Center for studies in the field of biology and immunology.

Overall weaknesses:

The majority of the publications are at the national level. Moreover, the productivity of SCI manuscripts is unequal across departments. The Institute's research is not always well focused. IBIR has not obtained a patent-license on the biotechnology for long-term storage and cryo-preservation of human and animals' germ cells and neither on the biotechnologies for artificial insemination and embryo transfer of various farm animals. IBIR is advised to attract young scientists and to avoid emigration, which is has been a main problem up to now.

Specific Panel recommendations:

The Panel recommends the Institute to better balance basic and applied research in terms
of priorities, as well as to make efforts to patent some of the applicative results at the international level. It is further suggested to offer training courses for the use of new equipment that are or will be established at IBIR, thereby allowing all scientists at IBIR to increase their technical skills.

Evaluation Summary

"IBIR Acad K.Bratanov" was founded in 1938. IBIR focuses mainly on fundamental and applied research in the field of animal and human reproductive biology and immunology; the main scientific program is defined as "studies on cellular and molecular mechanisms of biological recognition in reproduction". The research is performed in six departments: Immunobiology of reproduction, Molecular Immunology, Immunochemistry, Immunoneuro-endocrinology, Reproductive Biotechnologies and cryobiology of gametes, and Embryobiotechnology in animals.

In the past, and up to now, IBIR has suffered from the difficult Bulgarian funding situation (that is changing now) and the emigration problem of well trained Bulgarian scientists to better paid positions abroad. IBIR has prospects to solve these problems in the immediate future and to increase its recognition level internationally since it very recently secured European funds (IBIR is coordinator of an FP7 EU project)

(a) Quality and Productivity

Quality

Strengths:

During the 2004-2008 reporting period, IBIR had secured some grants from foreign institutions (even if most of them were for "mobility" only, like the Leonardo da Vinci or COST Action). Moreover, some IBIR members are on Editorial Boards of international journals. Despite the difficult financial situation in the past and up to now, IBIR has started to structurally "renovate" the Institute internally and as regards infrastructure/equipment. This can be regarded as a first step towards increasing the quality of the Institute's research in the future.

Weaknesses:

There are 60 listed publications in international journals; only some of these journals are of a sufficiently high level. With 138 listed publications in Bulgarian journals, the majority of publications are at the national level. Moreover, the productivity of SCI manuscripts is unequal across departments. Some of them (Departments of Immunology of Reproduction, Molecular immunology, Immunochemistry) produced 1-1.5 SCI papers/one researcher/five years, while others published much less (i.e. Department of Embryobiotechnology - only two publications/ten researchers/five years). The unequal performance among departments is also reflected in the diversity of research projects that appear to be too fractionated and not always well focused.

The Institute webpage is not up to date – (at the time of the review, the last update was done in 2007).

There is no international committee to advise on the scientific directions.

The innovation potential may benefit from the acquisition of new technologies (and equipment) as well as from collaborative efforts and local programs. It seems that

funding has been a major problem. Basic and applied science are not well balanced, and could be improved in terms of prioritization and focus.

Productivity

Strengths:

IBIR has certainly contributed importantly to animal breeding and cryo-conservation (stem cells, spermatozoa) methods in the past. Consequently, 15 products are ready to be implemented in industry. One of IBIR's priorities is the development and application of biotechnologies in animal reproduction. As the first ones in Bulgaria, IBIR has developed biotechnology for long-term storage and cryo-preservation of human and animals' germ cells and has implemented biotechnologies for artificial insemination and embryo transfer of various farm animals. Although much earlier than the reporting period (1986), scientists from IBIR were the first ones in Europe and second in the world to obtain the buffalo calf-transplant.

Weaknesses:

IBIR does not have a patent-license on the biotechnology for long-term storage and cryo-preservation of human and animals' germ cells and neither on the biotechnologies for artificial insemination and embryo transfer of various farm animals. This is not due to lack of initiative, but due to the budget restrictions that IBIR had to face up to now. Since the last decade the patenting initiative has virtually stopped in Bulgaria because of high taxes. Nevertheless, it should be pointed out that IBIR has been approached by two private firms to develop innovative products.

Overall score for Quality and Productivity: "C", for "*work that is solid and has added to our understanding and is in principle worthy of continuation. The institute is nationally visible.*"

(b) Socio-economic Impact

The relevance of the projects and the socio-economic impact are very good concerning the the possible industrial implementation and the important input in animal breeding. Researchers of the Istitute take part in preparation of directives and programs in the field of reproduction of animals as experts of the National Executive Agency for selection and reproduction in animal breeding, Ministry of Agriculture and Forests, the National Veterinary Service in Bulgaria, and the National Association for animal breeding and reproduction. In the future, IBIR may become an important Institution for Immunology of reproduction and implement biotechnology for long-term storage and cryo-preservation of human and animals' germ cells, and artificial insemination and embryo transfer of various farm animals.

Overall score for Socio-economic Impact: A - "*Highly Relevant*."

(c) Prospects

Strengths:

A recently submitted EU collaborative project with Italy, France, Germany, Austria and England (FP7-REGPOT 2009-1) has now been secured. The goal is to transform IBIR into an European Center for Studies in the field of biology and immunology of reproduction. There is no doubt that this opens new possibilities for IBIR at the international level. Moreover, IBIR will have the chance to create PhD and post-doc positions, thereby minimizing emigration of staff members.

IBIR has recently acquired new equipments (FACS, confocal microscopy station etc) and has started to re-structure some of the areas of the Institute.

Weaknesses:

Departure of young scientists to foreign laboratories (due to the poor financial conditions for science in Bulgaria) was seen as a major problem.

Overall score for Prospects: A - "*High prospects*."

Overall Strengths and Weaknesses

Overall strengths:

IBIR has given important input in animal breeding and cryo-conservation (stem cells, spermatozoa) methods. As a consequence, 15 products are ready to be implemented in industry. A collaborative EU FP7 project (with Italy, France, Germany, Austria and England) with the aim to transform IBIR into a European Center for studies in the field of biology and immunology has recently been accepted.

Overall weaknesses:

The majority of the Institute's publications are at the national level. Moreover, the productivity of SCI manuscripts is unequal across departments. There is no international committee to advise on the scientific directions. The IBIR's research is not always well focused. IBIR has not obtained a patent-license on the biotechnology for long-term storage and cryo-preservation of human and animals' germ cells, and neither on the biotechnologies for artificial insemination and embryo transfer of various farm animals. IBIR is advised to attract young scientists and to avoid emigration.

Recommendations

General Panel recommendations are listed in the Panel Level Report.

Specific Panel recommendations:

- It is recommended to focus on the development of the most promising projects, with the aim to increase the scientific level and to reach international leadership.

- It is suggested to increase the number of publications in international journals with IF.
- The Panel recommends the Institute to create a small panel composed of international experts to advise the Institute with regards to research focus and directions. This might ultimately increase possible interactions outside of Bulgaria, as well as the success rate of international project applications. The creation of such a panel should not be too difficult given that IBIR will coordinate an FP7 EU grant, providing for important international contacts which might help to better focus the research and to translate the data into applications.
- It is suggested to better balance basic and applied research in terms of priorities as well as to make efforts to patent some of the applicative results at the international level. The knowledge on animal breeding as well as some of the cryopreservation methods have high potential to become applications. IBIR should make use of this unique opportunity and try to protect this knowledge at the international level.
- It is further suggested to offer training courses for the use of new equipment that are or will be established at IBIR, thereby allowing all scientists of IBIR to increase their technical skills.
- It is recommended to routinely up-date the IBIR website both with general information as well as with scientific information. This will contribute to improving the Institute's visibility abroad.
- Now that IBIR has new EU funds, the Institute should ensure that it will be prominently visible on the EU-project specific website.

Institute of Botany (IB) -410

Executive Summary

IB of BAS covers a well defined research field that includes studies on biodiversity, palaeoecology and conservation, and biotechnological exploitation of medicinal plants. These research themes are very important and timely, although the focus on the study of global change impacts on biodiversity could be made more explicit.

The IB is an excellent Institute at the national level, and it is internationally visible. However, its publication record is not high enough taking into account the scientific level of the IB and its potential (Quality/Productivity score B). IB conducts highly relevant research, taking into consideration not only the science but also the broad spectrum of activities such as those done in the study and description of Bulgarian flora and nature conservation (Socio-economic Impact score A). The perspectives of IB are promising, looking at its attractiveness and training potential, but not so positive when the age structure of its personnel is considered. Therefore, the "Prospects" score cannot be higher than moderate (Prospects score B).

Overall strengths:

The IB attracts young scientists, conducts sound research, and disseminates results at very high level not only in Bulgaria, but also in the Balkans region. The Institute's atmosphere is excellent, warm and science-exciting, favouring the establishment of a new generation of young scientists.

Overall weaknesses:

IB could improve its performance if more emphasis would be placed on taking the lead in first-class scientific projects, i.e., first-authorship of international publications rather than being only co-authors. Likewise, the IB has not yet taken on leadership functions for European projects, in which it is involved. The visibility of IB can be mainly attributed to its participation in large international projects rather than to publications with high citation impact. The potential for basic and applied research is high and should be exploited better. The training and integration of young scientists seems to be achieved, but the problem of the Institute's age structure has to be solved.

Specific Panel recommendations:

The Panel warmly recommends the IB to follow its main directions, but to strongly focus on obtaining leadership in European collaborative projects and the resulting publications (already obtained by the "palaeo" group). The Institute should reconsider if the very large number of papers published in Bulgaria yields justifiable benefit in terms of visibility of the Institute and of the individual researchers. The Institute could also reconsider if it is worth keeping the current very high level of teaching activity, which most likely diverts considerable human resources from research. The Institute is advised look for a tighter cooperation with other research

institutions on themes regarding botany and on broader issues of regional and global relevance that nowadays should be addressed with a more interdisciplinary approach, including molecular and ecological tools. The impact of changing climate on the biodiversity of ecosystems is one good example along these lines.

Evaluation Summary

The scientific work of IB is organized into six departments: Flora and Florogenesis, Phytocoenology and Ecology, Applied Botany, Paleobotany and Pollen Analysis, Mycology, Laboratory for Plant Anatomy and Embryology. Most of the papers published in international scholarly journals are from the first three of these departments. The other departments need to improve their productivity in terms of scientific papers. The IB has well established scientific connections with many other institutes of BAS, and is a very active player in the Bulgarian scientific community. The researchers of IB are also active in international collaborations, particularly at the European level. Their presence is significant in the *Man and the Biosphere* (MAB) Program of UNESCO. In fact, during the reporting period, the IB was involved in 200 research projects, which shows a highly fragmented research. These projects were supported by 940 kEUR grant money in total, which is among the highest in the life science institutes of BAS. Additional 48 projects were conducted under bilateral and multilateral international agreements. However, the high number of projects doesn't allow to concentrate funds on promising large scale projects nor are they beneficial for obtaining better infrastructures.

The IB's researchers are actively involved in teaching at the Bulgarian Universities. This activity involved eight individuals covering ca. 100 hours of lecturing, and four individuals covering 800 hours of seminars/practices on average per academic year. Taking into account the size of the Institute, this activity is rather heavy and seems to require a considerable effort and time from the research staff (some scientists seem to be teaching much more than full-time university teaching staff).

(a) Quality and Productivity

Quality

Strengths:

The Institute as a whole is visible internationally, with research spanning from environmental studies to conservation and biodiversity assessment, with special emphasis on the latter. Very good research papers have been published in international top impact journals (e.g., *J. Chem. Ecol., Mol. Ecol.,* and *Science*). The IB has published one paper that has received over 100 citations in total. In the reporting period the best five publications received 18-97 citations, which is quite good considering the publication standards in the botanical field. The innovative potential of the research is good for current and future biotechnological applications.

Weaknesses:

The research quality within the IB is rather uneven, and besides the few high quality papers, a high number of publications were published in Bulgarian journals without impact factor.

Productivity

IB's researchers publish actively, but many papers are published in low impact journals or in Bulgaria. As a total, the IB published 241 papers abroad. Of those only 122 can be found in the Web of Science database, meaning that the others have been published in low visibility journals. An additional 286 papers were published in Bulgaria. The Institute itself publishes a scientific journal, "*Phytologia Balcanica*". In the five years subjected to review, each researcher has published about three papers. This is not a very good score according to international standards, but a good score when compared to other BAS Institutes and among the best when compared to BAS Institutes active in plant biology. It also suggests that the scientific output of this Institute may further improve, especially if a more leading role in international collaborations is achieved. The editorial policy of the scientific home journal should aim at obtaining an impact factor. This will naturally lead to submission of more international papers from the botanists of the region and the scientific community at large.

Overall score for Quality and Productivity: "B", for "*Work that is internationally visible. The Institute has made valuable international contributions in the field*."

(b) Socio-economic Impact

Strengths:

The Institute carries out research with strong socio-economic impact concerning biotechnological applications, bio-monitoring and climate change research (palaeo group included). The socio-economic impact is also shown by the success of the Institute in obtaining European grants. Members of the IB-BAS staff are chairing (chairperson and secretary) the National Committee of The Man and the Biosphere (MAB) Program of UNESCO.

Weaknesses:

Only one patent application has been reported for the evaluation period (2004-2008). The research themes studied are not unique to the IB and could be tackled using a cooperative approach together with other BAS Institutes. For instance, this could also include the joint use of new analytical tools and modern infrastructures. A suggestion in this direction will be addressed to the BAS by this evaluation panel.

Overall score for Socio-economic Impact: A - "*Highly relevant*."

(c) Prospects

Strengths:

- The future prospects of the IB are fairly good. The IB attracts young scientists, mainly because of the presence of good scientists at the Institute and of a very stimulating atmosphere.
- The "maintenance" of a high scientific level is one of the Institute's important objectives for the future.

Weaknesses:

- The research plans for the future remain rather undefined, representing often a continuation of present studies without identifying concrete new research goals, or significant new research targets. Improving research infrastructures and qualification of personnel will be vital for the IB. Training of young students is also important for the future potential of the Institute.
- The current rate of PhD students per researcher should be improved. Transfer of knowledge and collaborations with other parties, in Bulgaria and abroad, is also beneficial. However, the Institute has to focus on building up solid in-house research quality, as noted above.

Overall score for Prospects: B - "Moderate."

Overall Strengths and Weaknesses

Strengths:

The Institute has a well defined role in the BAS system. It is a high-level, active and attractive (for young generations of scientists) Institute in the Bulgarian academic system, with highly active cooperation with other BAS Institutes and with Universities, as well as with foreign scientific organizations. The Institute acts as a reference institution for botanical studies in Bulgaria and should build on this unique trait. The Institute has a good capacity and potential to attract science funding but, as financial resources are apparently a problem, industrial and pharmaceutical exploitations of the scientific findings could be further implemented.

Weaknesses:

During the five year reporting period, the Institute was involved in a very high number of research projects (>200). Their successful completion is probably only possible with a descriptive type of work. It is possible that this funding policy accounts for over 60 % of IB's results being published in Bulgarian journals, which have very low/no impact at the international level. The Panel has noted and is pleased to see that NSF has changed its funding policy towards larger projects and support for equipment, which is a prerequisite for Bulgarian scientists to become leaders in their field.

As in the case of other BAS Institutes, the unfavourable age distribution could create problems in mid-term future when the now >55 years old scientists will retire. Recruiting and training young scientist needs to be more successful.

The teaching load seems to be exaggerated when compared to the size and the other activities of the Institute.

Recommendations

General Panel recommendations are listed in the Panel Level Report.

Specific Panel recommendations

- The Panel warmly recommends the IB to follow its main directions, but to strongly focus on obtaining leadership in European collaborative projects and the resulting publications (already obtained by the "palaeo" group).
- The Institute should concentrate efforts on important scientific targets and decrease its involvement in the large number of diverse topics, which often receive minor funding.
- The Institute and the BAS should reconsider if the very large number of papers published in Bulgaria yields justifiable benefit in terms of visibility of the Institute and of the individual researchers.
- The Institute could also reconsider if it is worth keeping the current very high level of teaching activity which most likely diverts considerable human resources from research.
- The Institute is advised to look for a tighter cooperation with other research institutions on themes regarding botany and on broader issues of regional and global relevance that nowadays have to be addressed with a more interdisciplinary approach, including molecular and ecological tools. The impact of changing climate on the biodiversity of ecosystems is one good example along these lines.

Institute of Zoology (IZ) - 411

Executive Summary

IZ is a relatively large research institution, devoted primarily to the study of Bulgarian fauna, animal communities and their conservation. The five departments are similar in size with somewhat different level of research output, which can be partly attributed to the differences of the research topics. IZ is involved in numerous scientific and applied collaborations on a national level, for example with other BAS Institutes, Universities and it also works for Ministries and other administrative units. IZ provides important services for the society of Bulgaria, partly because of the EU legislation. The IZ also educates students, and as Zoology Institute, it is responsible for high level zoological research in Bulgaria. It complements the work of the National Museum of Natural History on several basic inventory projects. The science is also relevant, as it deals with several internationally recognised priority topics. Overall, the Institute's activities are highly relevant (Socio-economic Impact score A). It covers a wide range of research topics, most of which are classical in nature, and/or realised in a classical way, like inventories or taxonomy. Others are applied, like the development of monitoring schemes, and a few are internationally advanced and published in prominent journals. The scientific output according to cumulative impact factors and number of citations on Web of Science is moderate, while the number of papers is high when compared to other life science institutions of BAS. The Institute publishes key monographs for Bulgaria. However, considering the size of the research staff, the publication of monographs and services to Bulgaria did not fully compensate for the moderate internationally visible scientific output. The Institute's national activities, projects and visibility are rather high, its international activities, e.g., EU FP projects, organisation of large conferences still lack behind. Good steps are the organisation of specialised international meetings. Taken together the Institute is internationally visible (Quality/Productivity score B).

The Institute shows promising initiatives to render it more productive (e.g., performance-based salary increase). What is further needed is a more competitive research environment (which is currently not the case, according to the age structure) and the realisation of plans aimed at supporting young researchers. The overall prospects are moderate (Prospects score B).

Specific Panel recommendations:

The Panel recommends the Institute to increase the Institute's international recognition, via

- international publications in journals with high impact factor. Results on national projects should also be published in English for the international scientific community
- starting and/or developing advanced research topics (e.g., global change, GMO debate) to high international standards,
- organising large, disciplinary conferences,

- participating as consortium partner and/or work package leader or coordinator in large EU research projects.
- While the infrastructural development is ongoing, it is overall important to revise the Institute's current research priorities according to international trends.

Evaluation Summary

IZ was founded in 1947 based on the Department of Zoology of the Royal Bulgarian Natural History Institute. The nearly forty research staff study basic and applied zoology questions, with special emphasis on the Balkans and Bulgaria. The Institute has now five departments: Taxonomy, Faunistics and Zoogeography; Biology and Ecology of Terrestrial Animals; Hydrobiology; Experimental Zoology; and Protozoology. The IZ hosts the Bulgarian Ornithological Centre, and has field stations and a noteworthy library. Its journal (*Acta Zoologica Bulgarica*) was recently included in the Web of Science.

(a) Quality and Productivity

Quality

Strengths:

- The structure of the IZ is good, although „classical" (e.g., departments of hydrology, terrestrial, experimental science). Five departments cover the activity areas with a more or less balanced number of researchers (5-8). There was no obvious large overlap of the five departments' activities. The number of researchers including specialists on various groups of animals is over 60 (40 with PhD and 22 with diploma working as researcher). This number is fairly high compared to some other European zoology research institutions, and thus can be considered as an excellent resource to perform high level research.
- The Institute has a number of field stations, which is an important prerequisite to conduct long term studies. In many parts of Europe, field stations were closed due to difficulties in their financing.
- The IZ collaborates in joint projects or education with at least ten other BAS institutions, Universities, and NGOs in Bulgaria. The rising number of visiting foreign scientists indicates an increased international recognition of the Institute. Several international collaborations are listed, which can significantly add to the innovation potential by importing knowledge, and participating in projects, e.g. in FP7 or Life+ applications.
- The IZ organised several international meetings, mainly on specialised themes, like arachnology or on invasive mussels.
- The educational activity is rather high, mostly at Bulgarian Universities and institutions. The number of PhD students (7 awarded, 18 started) is low compared to the number of qualified researchers.

Weaknesses:

- Research: the work pursued at the Institute lacks experimental approaches and newer technologies of biological research, and hence, is largely descriptive in nature. While the latter is important, it doesn't take the Institute sufficiently close to cutting edge science.
- Structure: the Institute hosts a small team working on cancer. It has only a few publications and it is not clear why this team is in IZ.
- Cooperation: considering that biodiversity does not recognise administrative borders and considering Bulgaria's geographic position, the Institute should extend its transboundary collaborations (beyond that with Romania).
- Education: the Institute devotes a lot if not too much time and energy to teaching. Some of the staff has ca. five hours/week, which is a normal load for a University professor. This situation decreases the overall time available for research and hence might negatively impact the Institute's scientific production.
- International meeting organisation: while the IZ is experienced in organisating symposia, no large general meeting was organised during the reporting period. Hosting larger meetings is an excellent opportunity to enhance the Institute's visibility on an international level (like European or international ecological congress, entomology congress, ornithological congress).
- International recognition: while many IZ scientists are active in different committees and expert groups in Bulgaria, they largely lack similar positions at the international level. The membership in international societies reflects the taxonomic preferences, such as memberships in lepidopterologist, coleopterologist etc societies. A lack of membership in discipline-oriented societies was noted, like ecological, ethological, evolutionary, or conservation societies.
- Editorship: the participation of IZ staff in Editorial Boards of international journals is rather low. Only one leading international journal (*Acta Protozoologica*) has a researcher from IZ on its Editorial Board.

Productivity

Strengths:

- The IZ has some high-value activities at the international scale. For instance, the participation in an international project on high mountain lakes with 15 other European countries has resulted already in papers in SCI journals. Birds are always a flagship group for zoology and conservation. Thus, publications in SCI journals and as invited author in the Handbook of the Birds of the World are highly appreciated.
- Some of the Institute's publications are important for Bulgaria (e.g., monographs on the fauna), but are unfortunately not visible internationally. The distribution of journal papers and books between foreign and Bulgarian fora is nearly 50-50% (227+10 abroad, 217+16 in Bulgaria). The Institute is implicated in high impact factor papers, and in some of them IZ staff is lead

author. The papers have been published in a balanced manner in a range of journals, with only few papers having been published in the same journal (except *Acta Zool Bulg).* The Institute lists publications in some prominent journals like *Journal of Biogeography* (IF=3.5), and one multidisciplinary very prestigious journal, *Phil. Trans. Roy. Soc. B.*

- All of the five departments publish papers in internationally highly recognised journals, although there is variation according to discipline. For instance, *Zootaxa* is a major international taxonomy journal with IF=0.671, while *Environmental Pollution,* a forum often used by staff at the Experimental Zoology Department, has an IF=2.769.

Weaknesses:

- Research topic: While it is appreciated that the book "*Tumours as a general biological problem*" by Pensoft publisher was listed as one of the most important achievements of IZ, it illustrates at the same time that this line of research is not well placed in a zoological Institute.
- At the international level, IZ's output is rather moderate in relation to other BAS life science institutions. Compared to the size and capacity of IZ, the number of (ca. 100) non Bulgarian papers in SCI journals, the cumulative impact factor, the H index (18 for 1976-2009), citations on Web of Science (ca. 700), all citations (ca. 2000) and lead authorship are rather weak. *Acta zool bulg* is the Institute's own forum. Staff might feel inclined to publish in this journal instead of high impact factor (IF) journals, which might lead to a decrease of publication level.
- Departments: While the Experimental Zoology Department has a relatively low number of research staff (five), it is noteworthy that it produced the highest number of papers (35) in non-Bulgarian IF journals, with the highest cumulative IF (42.556). This is in contrast with the Taxonomy Department, with seven research staff, seven papers (non-Bulgarian with IF), and a cumulative IF of 3.012. This discrepancy is partly the result of the differences of disciplines. However, the disciplines do not account for everything (e.g., low number of papers in non-Bulgarian IF journals at the Taxonomy Department).

Overall score for Quality and Productivity: "B", for "*Work that is internationally visible. The Institute has made valuable international contributions in the field*."

(b) Socio-economic Impact

Strengths:

- No doubt, the IZ is one of the leading zoological institutions in the Balkans and has a crucial position to play as regards the study of regional richness of various animals, to better understand their regulatory factors, and to protect wildlife. The IZ provides some essential services for Bulgaria, like data provision for reporting duties of the Ministry of Environment, participating in the compilation of the *Red Data Book* (according to IUCN criteria), and assessing impacts within *Natura2000* sites. Such data are needed by the EU

and other international bodies. The provision of reliable data can rank the country highly in the EU. Other ongoing research belongs more to basic science.
- Several of the IZ's studies also have a link to society. For instance, the reintroduction of an attractive species generates widespread interest in the media, or the invasive species issue (e.g., emergence of new pest) can have a strong link to economy (e.g., agriculture), or even human health (allergy).

Weaknesses:

- Concerning IZ's involvement in important and controversial topics, such as GMO research, it is vital to develop a clear strategy (including business) in terms of a careful design of research projects and media communication.

Overall score for Socio-economic Impact: A - "*Highly relevant*."

(c) Prospects

Strengths:

- Several research areas belong to priority areas of international scientific interest (conservation, restoration, invasion). The very good taxonomists working at the IZ are the necessary prerequisite to study the wide range of problems concerning biology of animals. The scientific collection of biological material makes up a very important part of IZ's everyday work. The wide cooperation network, with some leading institutions in UK and Sweden, brings the IZ close to cutting edge research, thus giving the Institute the opportunity to join (or lead) new scientific challenges. The personnel policy of evaluating the staff every three years and providing additional support for outstanding researchers is very positive and can serve as an example to other institutes. The amount in salary change should be ± 10 %. The recruitment policy according to which a PhD degree is a requirement for newly appointed scientific staff and to attract the neighbouring countries' students as a regional centre is also good. The Institute starts to enjoy an increase in its number of PhD students.
- The long term strategy presents the topics of taxonomy, but also includes new methods in taxonomy (e.g., molecular and genetical methods). The research on pathogens is a key topic, considering the avian flu, west Nile virus and other threats on human health. The step to build a GIS lab is necessary for any further landscape and national level monitoring or other ecological work. The goal to be a major player as *The Balkanian Biodiversity Centre* is good, ambitious and achievable.
- The involvement of IZ in activities related to EU directives (WFD BD, HD) is desirable.
- The Institute has obtained considerable project funds beyond the BAS support, namely from Bulgarian NSF and Ministries.
- The journal, *Acta Zoologica Bulgarica,* has a perspective to become the leading journal for description and study of biodiversity on the Balkan

Peninsula. It is internationally peer reviewed and has been included into the Web of Science recently (SCIexpanded).

- The Ornithological Centre is an important part of the IZ. Partly, birds are the „best selling" organisms towards the public, and so they should be used in public relation activities. Partly, there are several important basic and applied scientific problems for which birds are the best objects. The field stations may provide a valuable basis for long term research and for international collaborations.

Weaknesses:

- More young people with international experience are needed (i.e., post-docs from abroad) - they will bring experimental approaches and newly developed methods for diversity description (e.g., the so-called "omics" approaches). For example, only a limited number of taxonomic studies have so far used methods of molecular taxonomy. Even if the new technologies are now part of infrastructural projects (e.g. DNA analysis lab), it is not clear how to find and attract people to run these projects. Furthermore, there is no senior researcher or associate professor younger than 46 years.
- The evaluation of the staff is conducted internally. It is desirable to change this, for example by introducing an independent international scientific council.
- The future strategy is aimed at continuing the ongoing research with more taxa, and gives priority to taxonomy, even though this is done in parallel at the National Museum of Natural History. The lack of research topics such as ecosystem functions, conservation biology, landscape ecology and climate change effects from the long term strategic plan is considered a weakness.
- The IZ participates only in a few international projects, and only marginally (subcontractors).
- There are several projects listed in the GMO debate (tomato, alfalfa, potato). The budget is rather limited given that GMO is a top-level policy issue in the EU.
- The age structure is balanced across age groups. It indicates that there are only limited possibilities to select the best amongst the young researchers, because most of them stay at IZ after their PhD (i.e. there is no competition for the job and selection of the best candidate). Nine individuals (23%) are above 60 years old. If these older colleagues are active in science, and, for example, networking, then they would be a big help for young scientists.
- Education: the School for Ornithology does currently not sufficiently reach out to foreign participants, despite its potential high attractiveness. The IZ homepage needs continuous updating and an improved design, according to the standards of the best zoology institutes.

Overall score for Prospects: B - "Moderate."

Overall Strengths and Weaknesses

The IZ is a key player in Bulgaria, with a lot of services to society and to stakeholders. There have been promising steps in the recent past, but a more target oriented, specialised profile is needed to avoid overlap e.g. in taxonomic research with the Museum and other BAS institutes. Internationally the scientific merit is rather modest, and publications, positions, collaborations all need improvement. Institutes of zoology are usually important parts of Academies since they focus on the study of biology of wild animals, which are an essential part of the environment. The researchers at such institutions should study the evolutionary and ecological mechanisms in wildlife, while collections of faunistic data, and taxonomy should mainly be done in museums, and partly at nature protection organizations. From this point of view, there is slight overlap between the IZ and other parts of BAS (mainly the Museum and IB). There seems to be some other overlap (e.g., Laboratory of Limnology with similar Laboratory in Central Laboratory of General Ecology). The fundamental research at IZ (which should form a significant part of its activities) could employ more advanced approaches (experimental, modelling, GIS) adopted from or in cooperation with other institutions in BAS.

Recommendations

General Panel recommendations are listed in the Panel Level Report.

Specific Panel recommendations:

The main points are about increasing the Institute's international recognition:

- It is advised to increase the scientific output on the short term. The IZ has the potential (experience, staff size) to publish more in international journals, and should therefore make efforts to increase the number of papers in SCI journals, to publish in higher impact factor journals and to be the lead author (first, last or corresponding) of the respective papers.
- Further, IZ should encourage its staff to publish in international journals and not in its own journal, *Acta Zool Bulg* even if this might be easier. Still, *Acta Zool Bulg* might reach eventually a high international level, since the inclusion in SCI will increase foreign submissions. This could be further improved if the journal receives an impact factor.
- Consider to modify research priorities, focus on priority topics like climate change, biodiversity crisis (2010), GMO research, behavioural ecology, population genetics, landscape ecology. Modelling should also be developed, because it has relatively low research cost, but still can be at the highest level. These topics are widely studied internationally, but are currently not investigated intensively in Bulgaria. Along these lines, it is advisable to concentrate on a few prospective areas (e.g., in which the Institute has key experience, data, no overlap with other institute, good feasibility, possibility of getting first hand data from leading European institution via, e.g., returning young scientist) and to conduct more focused research at IZ. This would also fit the new funding policy of NSF (i.e., larger, but overall fewer projects).

- IZ was involved in several applied projects (*Natura2000, Red Data* etc). Some aspects of these projects (methodology, main results, simple analysis on e.g., the threatened species lists compared to IUCN and Habitat and Bird directives lists) can and should be published in conservation biology journals. For example, the simple analysis of a survey on European monitoring programs resulted in papers in the best journals (e.g., *CONSERV BIOL* 23: 307-316 (2009), *CONSERV BIOL* 22: 593-601 (2008)), highlighting that not only primary research results can be published. In general, the European conservation biology lacks information on conservation activities and studies in the new EU countries, because these projects are not published in SCI journals. If IZ would embark on this it could increase its international visibility in a straightforward manner.
- Increase IZ's attractiveness among PhD candidates by offering them to work on cutting-edge research topics, international travel (e.g., conferences), and a dynamic research environment with enthusiastic staff. It is further advised to provide promising students and early career researchers the possibility and resources to start their own line of research, if significant.
- Cancer research at IZ seems misplaced and is invisible. It might be better placed in one of the other BAS Institutes, and resources at the IZ could be used to improve a key zoology research topic.
- The Panel has noted the existence of several parallel collections in BAS institutions, and Universities. It cannot make a specific recommendation that can be implemented in the near future, as the real solution seems to be rather ambitious, and it is not familiar enough with the Bulgarian situation. However, the Panel can express its view that on the long term, a well planned and defined pooling of the most important collections (e.g. moving the experts and the collections from other BAS institutions and from Universities to NMNH) would create an internationally excellent, visible, larger and stronger museum. The Panel expects that the pooling of collections with the related faunistics, floristics, palaeontology, taxonomy etc. research will have ca. 4 million items, and a research staff around 40. This museum would be a strong player at the European level. Obviously, it would also need one large, attractive and impressive building, high-tech storage, unified public-available database, and exhibition hardware. Then, the overlap would be smaller with descriptive aims, i.e. taxonomy, faunistics and floristics, being based at the Museum, while other, evolutionary, ecological and conservation biology research stays at the other institutes, where the load of maintaining collections will be ceased.
- The experience obtained through the organization of small meetings should be used to run a bid for a large international meeting, such as Intecol, International Ornithological Congress, Eureco, or European Congress of Conservation Biology. Such a meeting may attract 1000-3000 participants, raise the Institute's visibility and boost IZ's reputation and the respective discipline in Bulgaria. In addition, such a meeting may generate income and easily attract the media, providing links to society, again potentially improving the reputation of IZ and BAS in Bulgaria.
- It seems that IZ has pursued too many small projects. These are usually not very effective and don't offer a lot of possibilities to innovate (e.g., to buy new

equipments like SEM or cars, and to hire new staff). The policy should change to larger, more focussed projects. This is the international trend and, as the Panel learned, is also the recent trend at NSF. Even larger grants are available from international funds, like EU FP, Life+, cohesion fund etc. IZ should run for EU projects as consortium partner (not subcontractor), and sooner or later as coordinator. This is an important resource to considerably develop infrastructure, to hire staff and to conduct internationally leading science.

- There is probably large amount of data available from the field stations. A strategy is required on how to coordinate research and long term monitoring in these stations, and how to publish the results. A coordination effort for the use of all field stations is also needed (e.g., those which belong to the Central Laboratory of General Ecology, Forest Research Institute). This could be regarded a breakout point, since permanent research stations are relatively rare in Europe. More importantly, hundreds of student groups from west European Universities travel for field courses to exotic countries of Africa and other continents. BAS could make use of this educational need by developing the infrastructure of its field stations such that with an appropriate management, they will attract considerable European interest. This should be feasible considering Bulgaria's natural values, its "exotic" status at the European level, and the lower travel costs. It may also attract international researchers to conduct studies in semi-natural environment and possibly generate income for IZ. See for example: http://www.zbs.bialowieza.pl/bioseb/
- IZ serves the society in several ways: as experts in scientific developments, like Natura2000, Water Framework Directive, environmental impact assessments. While it is highly desirable to keep such expert work in scientific hands, it may on the other hand also take away resources (e.g., time of researchers) from research and writing papers. Possibly, the set-up of a spin off company could be considered, which scientifically is based at IZ but would run the "business work", and also generate income for IZ.

Forest Research Institute (FRI) - 412

Executive Summary

FRI of the BAS is of high relevance (Socio-economic Impact score A). FRI covers one of the areas of currently major importance in biology and global change research: forest ecosystems, which are central in energy and matter cycles, and play a key role to effectively mitigate harmful effects of climate change. Environmental data, such as those collected by the FRI, are of fundamental, vital value for future research and instrumental to develop strategies for the sustainable management of Bulgarian terrestrial ecosystems. Therefore, FRI's scientific activities are of high relevance for the Bulgarian society, as shown by the high visibility, very successful national fund-raising, and consulting service of FRI as consultant institution for forest and, more broadly, environmental problems in the country.

On the other hand, the research carried out by the Institute does not reach international standards, and is one of the weakest among the life science Institutes of BAS (Quality/Productivity score C). Unfortunately the FRI has not been showing actual signals of improvement in the recent past. The plan for future developments is not sufficiently worked out nor is it ambitious; it should face current and future challenges. There is no plan to improve the Institute's publication activity to reach international level (Prospects score C).

Specific Panel recommendations:

The Institute needs a rather strong re-organization aimed at setting timely and innovative scientific goals in forest science; measures that probably cannot be completed by the current staff alone. The Panel recommends putting more focus on the science of forest ecology and on the understanding of the response processes of forest ecosystems to future and ongoing environmental changes. This thematic refocusing would also open up opportunities to increase the number of international publications. FRI's current results are based on long-term monitoring data and field work. They are of great value for the Bulgarian society and should be published also in English in international journals (not really yet done by FRI), as well as disseminated in Bulgarian (as is already done by FRI). Training and transfer of knowledge to young researchers with a strong scientific and interdisciplinary background is needed to render the Institute more visible in the international scientific arena. This is of course a rather long process, but could be facilitated through cooperation with international institutions.

Evaluation Summary

FRI was established in 1928 as Forest Experimental Service within the Ministry of Agriculture and State Properties. Its aim was to study forest resources in Bulgaria in order to develop management strategies for their utilisation. Since 1954, the FRI has been a part of the BAS. Its research activities are of major importance for forest management in Bulgaria, and are mainly of applied nature. Out of the 95 employees, 43 are scientific staff (1 academician, 1 corresponding member, 3 professors, 18 associate professors, 6 with a DSc degree, 29 with a PhD degree). The scientific work of the FRI is structured in seven departments.

(a) Quality and Productivity

Quality

Strengths:

Research at the FRI is almost exclusively of applied nature. The Institute has many collaborations with Ministries, municipalities and other stakeholders and end-users. It clearly acts as counsellor for forestry issues and obtains enough funds showing that FRI's activities are of great relevance. While these activities are very important they should be integrated with more scientific research. At the international level, the Institute has participated in many COST Actions, again confirming the very applied focus of research.

Weaknesses:

The international recognition of the Institute appears to be low. The Institute lacks a strong international dimension and an adequate innovation potential. This is reflected by the very low number of publications that originate from joint research with international partners, and by the mainly local-interest achievements of the past years, dealing mostly with monitoring and inventories. Looking at the publication records, forest protection is the main area in which the Institute has presented a few innovative studies; the only department that published its results in international peer-reviewed scholarly journals.

Productivity

Strengths:

Highly productive on a national level, the FRI carries out excellent applied research which is of great value, of high national interest in terms of reports, mapping, and services across the country. Examples are forest vegetation and ecosystem monitoring, breeding, plantations, afforestation, hydrogeological protection projects, all of which are of outstanding value. FRI's activities and products are of significant

level when compared with benchmarking institutes in Europe, and are thus of high value internationally.

Weaknesses:

However, research at this Institute has delivered only very few international SCI publications during the period subjected to this evaluation. The publication rate of FRI is very low amongst the biological Institutes of BAS, and very low in comparison with other European research Institutes. It is advised to increase the number of publications in journals with impact factor in order to be competitive on an international level. Moreover, the number of international publications appears to decrease since the more recent years. At an international level, FRI does not have a sufficient scientific productivity. This is partly due to its own journals: researchers publish in these, instead of in competitive international journals.

Overall score for Quality and Productivity: "C", for "*Work that is solid and has added to our understanding and is in principle worthy of continuation. The institute is nationally visible*."

(b) Socio-economic Impact

While pure science has not been highlighted amongst the past activities of this Institute, the same activities seemingly have had a highly relevant socio-economic impact. Examples are: Manuals and best practice for forest management in view of mitigation of stressful constraints, or pathogen attacks, and monitoring activities, even breeding and varieties' selection activities have undoubtedly a value for policy makers, natural parks, foresters, forest agencies, and other end-users. The Institute takes part in several decision-making processes for the National Assembly and Ministries. It also participates in regional national parks' and forestry board activities. As far as forestry issues are concerned, the Institute is a national expert center for Bulgaria. The FRI has direct links to industry via the many use of forest resources, from timber to honey.

The work done in several of the departments is rather difficult to evaluate in the absence of clear criteria for these more service-oriented activities. Several research areas of the Institute fit to many of the priorities of national and international bodies, but there is no clear indication as to how far they have been realized. For example, the sustainable use of forests is one of the priorities amongst FRI's research activities, but the list of papers published has very few records on this topic.

Overall score for Socio-economic Impact: A - "*Highly Relevant*."

(c) Prospects

The planning of future activities should take into account the development of strategies aimed at publishing FRI's results at an international level. In the recent

past, FRI seems to have already established broad interactions with other Institutes of BAS and cooperation with other academic institutions in Bulgaria. Increasing scientific cooperation on an international level is now needed. This would be a wise step, since the current potential for scientific research is rather low at the FRI, yet it is of major importance to be in the BAS system. Collaborations should be established at international level, aimed at training personnel mainly in innovative science rather than only in management. Emphasis should also be placed on training young scientists at an international level, as the FRI is appealing for students, i.e. the number of trained PhD students during the reporting period is higher than for other BAS Institutes (0.44 student per researcher). However, training cannot be improved without adequate improvement of the scientific quality of the research, including a considerable increase of staff with a scientific degree. In the recent past, training has focussed in particular on management issues, which is not sufficient to form a new generation of scientists able to suitably address the future scientific challenges.

Overall score for Prospects: C - "Low."

Overall Strengths and Weaknesses

Strengths:

The Institute covers an area that is increasingly strategic due to the expansion of forests in Bulgaria and to the worldwide importance of forest resources for environmental and productive reasons (e.g., Kyoto protocol for mitigation purposes, biofuel and biomass).

The Institute has a fairly good capacity of attracting young scientists and training them.

Nationally, the connections with ministries and other end-users seem to have a large return in terms of funding.

Weaknesses:

The Institute should have a much higher scientific profile to be competitive at a BAS, national and international level on these very timely issues.

Transfer of knowledge other than in management and monitoring is currently undervalued.

The scientific international fund-raising capacity is also very low, which is probably in part a consequence of the relatively low scientific impact of the Institute, at least at an international level.

Recommendations

General Panel recommendations are listed in the Panel Level Report.

Specific Panel recommendations:

- The Institute needs a rather strong re-organization aimed at setting timely and innovative scientific goals in forest science. A new class of researchers able to effectively tackle these goals should be trained. For FRI, recruiting non-forestry (e.g. botanist, wildlife biologist, and economist) students is highly advisable to broaden the Institute's profile. Expanding collaborations and transfer of knowledge with international academic institutions will certainly help in attaining these scopes. Departments could be merged into a more efficient structure that encourages cooperative and interdisciplinary integrated work spanning, e.g., from genetics to ecology, on high-tech issues such as forest phenotyping and genotyping, or on themes that are central to the exploitation of forests such the impact of biomass plantations on the ecological balance of the territory.
- The web site should be revised to be more user-friendly and attractive.
- Of most importance, the number of international publications should be strongly enhanced and that can only occur if a deep and basic refocusing of research aims is put on more forest ecological themes such as entomological, pathological and biogeochemical-cycles related processes in a more analysis-based on sound scientific avenues.

Central Laboratory for General Ecology (CLGE) - 413

Executive Summary

CLGE is an autonomous research institution of BAS, whose activities are mainly focussed on ecosystem ecology and biodiversity research, especially dealing with conservation of biodiversity, functional ecology and bioindication. The main aims correspond to three current departments of CLGE. While of importance, it was noted that these activities are not (yet) reflected in a sufficient scientific production. Scientometric indicators per year and researcher are rather low. The papers are mostly descriptive and no paper is published in the first 20 ranked journals in the field of Ecology. Overall, the CLGE is nationally visible in terms of science quality and productivity (score C).

Science performed at CLGE is both basic (e.g. description of biodiversity) and applied (e.g. biomonitoring of environmental stress), and highly relevant. The CLGE participates in advanced European level policy work and seems to be open and keen to be part of large international projects. Ten FP7 projects were submitted, of which four were selected (Socio-economic Impact score A). CLGE is very successful in attracting large project funds. Currently, the largest of them are mainly for infrastructure, and not directly for research. It should be noted however that the generation of a functional infrastructure is one of the first steps required to reach scientific excellence. The age structure and current tendencies in managing young researchers put the Institute in a very good position to increase its scientific productivity in the near future. Some researchers have very good international visibility. However more intense collaboration of all departments with ecological institutions abroad (and e.g. attracting and employment of young post-docs from other European Universities) would be surely beneficial. Overall the prospects are high (score A).

Overall strengths:

CLGE has been increasing the number of young researchers below 35 years of age. This trend will continue mainly due to the well-defined strategy for PhD studies and a performance-based salary increase for the best junior researchers. CLGE is a reference point for consultancy by Ministries and stakeholders and has several national and international collaborations with academies and private enterprises, many of which are formalized by common projects. These activities are a very important source of funding, even if they don't raise the Institute's scientific visibility through an increased publication activity in scientific journals.

Overall weaknesses:

The scientific impact of the CLGE is very unbalanced across departments and should be improved. It is especially important to employ well qualified young researchers at the departments with low productivity.

Specific Panel recommendations:

- To increase publication of findings in international journals (especially those departments that have a low productivity).
- To use the hypothesis-testing approach and advanced methods in ecological research (not only descriptive, which is currently prevailing).
- To continue with the very good approaches taken with respect to PhD training, attracting junior researchers from abroad and development of infrastructure (new technical equipment etc.).
- The Panel recommends that the Central Laboratory be transformed into an Institute of BAS.

Evaluation Summary

CLGE was established in 1996 as an autonomous small research institution of BAS whose activities are mainly focussed on ecosystem ecology and biodiversity research, especially dealing with conservation of biodiversity, functional ecology and bioindication (the main aims correspond to three current departments of CLGE). The current activities cover a broad range of natural ecosystems - freshwater, marine, terrestrial as well as man-made ecosystems. To achieve the aims, the researchers use a combination of classical (which still prevail) and more modern (i.e. genetic) methods.

The fundamental scientific research is focussed on the structure and functions of ecosystems (including the role of biodiversity) using mainly descriptive tools, while general ecological processes are studied less intensively. CLGE has been increasing the number of young researchers below the age of 35 years. This trend is expected to continue, mainly due to the well-defined strategy for PhD studies and a performance-based salary increase for the best junior researchers.

Many of the scientific activities are currently dedicated to applied ecology, specifically to:

- Providing a scientific basis (i.e. collecting and analysing primary data) for nature conservation policy and management
- Elaborating methods supporting environmentally-friendly business projects
- Dissemination of ecological knowledge via specific (not really scientific) publications, books and multimedia products
- Creation and maintenance of databases of national importance

CLGE is a reference point for consultancy by Ministries and stakeholders and has several national and international collaborations with academies and private enterprises, many of which are formalized by common projects. These activities represent a very important source of funding, even if they don't raise the Institute's scientific visibility through an increased publication activity in scientific journals.

(a) Quality and Productivity

Quality

Strengths:

CLGE is surely a national player in ecosystem research. It produces high quality services mainly for institutions involved in the protection of environment. Some researchers are top specialists on selected groups of organisms, especially in their taxonomy and ecology (mainly helminths). The CLGE appears to be a dynamic research centre with scientific goals spanning primarily biodiversity assessment and bio-monitoring. Its involvement in several national activities (creating evidence for decision makers, Environmental Impact Assessment, etc.) provides for the potential for direct applications of research results within the country.

CLGE collaborates with other BAS Institutes, for example the National Museum and IZ. Important collaborative projects (coordinated principally by CLGE) include e.g. the *Red Data Book* of Bulgaria, *Natura2000* development for Bulgaria, or the large infrastructural project supporting biodiversity research (CEBDER). CLGE has good cooperation also with higher education institutions. Several EU research projects (FP5, FP6) were realised with wide international partnership. The Lab was invited to 10 FP7 proposal applications (sic!), which indicates a good international recognition. The researchers of CLGE are members of Editorial Boards on eight international journals, focussed mainly on parasitology research (and this number gradually increased in last years).

CLGE organised international events, like the European Carabidologists' meeting, and several project meetings. Educational activities are strong: nine PhD theses were defended in five years. About half of the PhDs remain at CLGE for further work. This results in a well educated, familiar and young group of researchers, being well positioned to develop innovative new research directions.

The CLGE is composed of only a few departments. This is seen as an advantage, since they can join forces to advance scientific projects, which may not be achieved with small one or two person departments. The working groups are good sub-departmental units (even if some of them are extremely small, e.g. Environmental Microbiology research "group" is composed solely by a Group Leader - according to CLGE's homepage). CLGE's proposed partial reorganization will be surely beneficial for finishing the large infrastructural projects and to transform the "Central Laboratory" into an "Institute" of BAS.

Weaknesses:

Even if scientists at CLGE have published 125 scientific papers in international journals during 2004-2008, these are mostly descriptive and there is no paper published in the first 20 ranked journals in the field of Ecology (Journal Citation Reports 2007). Because the institution would like to be transformed to a research institute focussing on general ecology ("Institute of Ecology"), the scientists should adopt the hypothesis testing methodology, experimental approaches, advanced modelling and generalization of results.

CLGE has previously organised small, specialised international meetings. While this has been a good initiative, such meetings took place only twice in five years. Likewise, no large international meetings have been organised, which could increase the CLGE's visibility and its research.

Productivity

Strengths:

- The researchers of CLGE are very successful in securing funds from various national sources, as well as from international science organisations (EU, NATO, US Science Foundation etc.). The international standing of CLGE is good as it has been invited to join several FP projects.
- CLGE has numerous scientific results in applied science that are directly used in conservation management (for example the "IUCN compatible" *Red Data Book* is a great achievement). Other findings/activities are related to EU directives, like the *Natura 2000* implementation (Bird and Habitat Directives), and the Water Framework Directive. Therefore, all these directives, and also other important activities (wetland inventory, transport infrastructure and habitat fragmentation, etc.) are science-based outputs obtained in close cooperation with other BAS institutions. Important scientific achievements are the descriptions of new species, especially ecologically important helminths, for which CLGE's researchers are international leaders in some taxonomic groups.

Weaknesses:

- The number of papers published in scientific journals is rather low. According to the list of publications provided, 92 of them were published in journals registered in SCI (or not registered but having impact factor) during 2004-2008. This translates into 2.79 publications per researcher in five years, or 0.56 publications per researcher per year. This is an indicator revealing rather low publication efficiency at international level, with no peak publication in a top-ranking journal. The total number of citations of these papers is also rather low (352 citations, but only 252 found on Web of Science) for the five year reporting period: for 33 researchers it is only 2.1 citations per year per person).
- The scientific productivity differs significantly between research groups. Even if the number of researchers is not so different between scientific departments (14 in Biodiversity, 10 in Bioindication, 8 in Functional Ecology; based on CLGE´s homepage), the majority of ISI publications was produced in one department only (i.e. 77 papers in Dept. Biodiversity, 9 in Dept. Bioindication, 6 in Dept. Functional Ecology). Especially surprising is the rather low output of the Functional Ecology group, which does mainly fundamental research. The Department of Bioindication is focussed mainly on applied science and it is therefore difficult to compare it directly with others using the scientometric criteria only.
- A lot of work is often descriptive and published in local journals. The main findings are the result of cooperative, large projects. Only a few of these have international recognition, because the collaborations involved mainly

Bulgarian institutions. This situation is regretful: "Ecology" is a very attractive international scientific discipline with good publication potential.

Overall score for Quality and Productivity: "C", for "*Work that is solid and has added to our understanding and is in principle worthy of continuation. The institute is nationally visible*."

(b) Socio-economic Impact

Strengths:

CLGE's research activities have high socio-economic impact. Most projects focus mainly on regional problems associated with the protection of biodiversity and environment. CLGE is partner in several EU projects, in which it mainly provides important local data and it is probably the most respected institution in ecosystem ecology research and environmental risk analysis in Bulgaria. The applied results mostly deal with conservation of biodiversity and management of water bodies, i.e. two issues of large socio-economic impact that often are also scientifically very relevant. The CLGE conducts Environmental Impact Assessments, and therefore has direct influence on industry. The CLGE participates in several ministerial tasks as advisor or expert, including even the Ministry for Economics and Ministry of Foreign Affairs. Therefore, it can have impact at high decision making levels. The description of large-scale diversity of some animal groups (e.g. cestodes) is a necessary prerequisite for testing general hypotheses on factors affecting the distribution of biological diversity. Because many of the model groups of helminths are parasites, this research can lead to important outcomes in terms of understanding general ecological patterns as well as applications in agriculture and veterinary and human medicine.

Weaknesses:

A stronger focus on general research (and less descriptive and applied) could probably be useful in scientific Institutes of such organizations like BAS.

At least some of the tests for measuring environmental stress could be directly patented and further used by private companies.

Overall score for Socio-economic Impact: A - "*Highly relevant*."

(c) Prospects

Strengths:

The CLGE seems to have a very good potential to become an internationally competitive institute in some key and interdisciplinary ecological fields (ecosystem ecology, the role of diversity, etc.). However, this potential will only be realized by a strong increase of scientific outputs and by attaining a solid international standing through improved research quality. The proposed transformation of CLGE to a

research Institute of Ecology will certainly help accelerate the processes. The ongoing large infrastructural projects coordinated by CLGE will surely contribute to reach the methodological level that is standard in similar well developed laboratories abroad. The plans to further intensify PhD training and international research cooperation are surely good measures along the way. Also the performance-based salary increase is a prospective and positive step towards increasing output.

The basis of the CLGE's research strategy is clever, stating that this is the only "general" discipline (other BAS Institutes are for zoology, botany, forestry – i.e. specialised) of the environment research using an ecosystem (holistic) approach. The urban ecology topic is very important, and probably not covered by other institutions (on the contrary, e.g. the evaluation of protected areas is studied also elsewhere).

The education activity is high, a considerable number of undergraduate and graduate students are supervised in the Lab (28 students). The short term goals of increasing conservation biology research, hiring postdocs (through FP-7 projects) and upgrading facilities are very good points for the development of the Institute in the near future. The fund-raising activity is strong, and has generated significant income for CLGE. The Laboratory was also very successful in obtaining funding for research projects from National Science Foundation in the last year. If these trends continue, CLGE can become indeed an internationally competitive ecological institute in a very short time.

Weaknesses:

It would be beneficial not only to employ former PhD students from CLGE (which is now a frequent strategy), but also to try to attract post-docs (including Bulgarians) from abroad.

Possible overlaps with other institutions of BAS (especially with IZ) should be minimized (e.g. Department of Hydroecology at planned IE vs. Department of Hydrobiology at IZ). Even if CLGE underlines the positive cooperation with other institutions, some structural rearrangements within BAS (e.g. inclusion of ecosystem researchers as staff of the planned Institute of Ecology) would create a more logical structure with scientifically stronger research groups.

The CLGE establishes research priorities for itself. However, they are only worked out internally, lacking input and advice from external and international experts. The holistic approach used and promoted by CLGE is not reflected in the publication's titles. The word "ecosystem" is used only in a few symposia title, but it does not seem to be the main research direction according to the titles of the published articles.

Overall score for Prospects: A - "High prospects."

Overall Strengths and Weaknesses

The Institute focuses primarily on ecological research which is an important part of a research academic network such as BAS. The presence of specialists on various groups of organisms is necessary to understand and to evaluate ecological processes

forming current biota. CLGE is clearly successful in fund-raising and in interacting with other research and ministerial institutions and private parties, at national and international level. It covers a number of interesting scientific issues, many of which have a largely applied character for nature conservation, bioindication and for understanding the basis of adaptation/resistance of living organisms. This large effort at the level of organization and management is not met by an adequate scientific productivity, which is still rather weak in term of publications, citations and other international activities (e.g. meeting organisation).

The strategy for future activities envisions work on a number of very timely topics, also including urban ecology and sustainable management of protected areas. Emphasis is especially placed on conservation biology and on plans for partnership with several Institutions, in Bulgaria and internationally.

There is a potential overlap with IZ and the National Museum of Natural History concerning studies describing species diversity. Even if the description of biodiversity (especially of less studied taxonomic groups) is very important in many geographical areas, the scientific work performed at the Academy of Sciences could be more experimental than descriptive.

It seems that the Lab has already developed a good plan for its future directions, with projects and infrastructural developments. The strategy for the acquisition of new instrumentation is well described. The personnel strategy is very good, including salary compensation for productive researchers, and other proposed changes.

Recommendations

General Panel recommendations are listed in the Panel Level Report.

Specific Panel recommendations:

- The CLGE could exploit better the large number of collaborative projects in which it is involved, in order to improve the scientific output of its research. A higher standard of publications should be obtained. This is certainly possible in view of the very interesting and timely research subjects explored by CLGE.
- The Panel strongly recommends BAS to change the status of the CLGE to the one of an Institute, "Institute of Ecology". As a standard research institute, CLGE will become also more visible to the international scientific community.
- A competitive recruitment and evaluation system is needed, which rewards international scientific output with higher salary, permanent employment, leader position etc. For example, occasional recruitment of new group leaders or post-docs coming (back) from abroad can make CLGE even more dynamic.
- Increasing the use of experimental ecological (e.g. in Functional ecology) and evolutionary (e.g. in Biodiversity) approaches would surely be advantageous. Hopefully, the new large infrastructural projects coordinated by CLGE will help in that respect.
- The website should be modernized and regularly up-dated with both general and scientific information, in order to improve the attractiveness and visibility of the Institute abroad.

Center of Biomedical Engineering (CBME) - 414

Executive Summary

The Institute was constituted in 1994 and was named Center of Biomedical Engineering in 2004. CBME is clearly a national player and internationally visible. The Quality/Productivity score B is largely based on publication/citation records. The values are somewhat lower than those obtained by a few other institutes of the BAS, but they are still good. The Institute provides many services (teaching, transfer of technology, computer assisted modelling etc.) to other organizations, which is very valuable and of highest socio-economic value. The socio-economic impact is high as reflected in fundamental research that provides the basis for new technological developments (Socio-economic Impact score A). The prospects appear very good considering the fact that several projects have led to products of potential commercial value. The age structure of the Institute, on the other hand, seems unfavorable (as in many other Institutes), a point that may be solved with the recently improved funding conditions. Future plans/priorities are only vaguely addressed and require further elaboration. The products developed so far have to prove their commercial competitiveness. The overall prospects are moderate (Prospects score B).

Overall strengths:

The Institute is strong in the development of technological tools in biomedicine and demonstrates the successful transfer of technology to institutes of the BAS, Universities, and commercial companies, and to clinics. Successful grant-applications has increased local funding considerably since 2008. Some external funds come from collaborations with commercial companies. The Institute is also heavily implicated in teaching, education, and training of students. In fact, of the 13 PhD students who started their course during the period 2004-2008, 11 finished with a PhD degree; this represents a very high efficiency. The good team spirit supports overall CBME's activities. The Institute is ready to take on new challenges with regard to re-structuring. The CBME has presented a good report and set of achievements.

Overall weaknesses:

Too many activities have been initiated in the past years. It is rather unrealistic to pursue so many different projects with the same success-oriented intensity. This situation will probably improve with better continuous financial support from the government. Some departments publish predominantly in Bulgarian journals or journals that are not recognized by searches in the Web of Science.

Specific Panel recommendations:

Purely technical processes should be transferred to industrially oriented companies. Since the CBME is predominantly specializing in bioinstrumentation, patenting of products or collaborations with industrial companies should be intensified (as already done in the case of Schiller A.G.). In this respect, it might be an advantage to

have the support of a centralized "innovation office", specialized in the transfer of results from basic science to economically useful products. The Institute's publication policy should strongly recommend the publication of scientific articles in internationally visible SCI journals with impact factor. The English version of the Web page contains still pages that are in Bulgarian and should be updated on a regular basis.

Evaluation Summary

CBME has five departments covering the following research areas:

- Analysis and processing of biomedical signals and data
- Analysis and modeling of excitability of biological structures
- Biomedical informatics
- Molecular modeling
- Modeling and optimization of bioprocess systems

Currently, 39 scientists are employed consisting of 33 scientists that hold a doctoral degree. This is a very good ratio. The age distribution, however, is unfavorable with 24 scientists being 40 years or older whereas only 15 are between 26 and 40 years of age.

(a) Quality and Productivity

Quality

Strengths:

The CBME's international reputation is reflected by numerous co-operations with institutes outside of Bulgaria, the participation in scientific societies as well as in international scientific activities. The Institute has contributed to international projects supported by European FP6 and FP7 programs. CBME has contracts with foreign contractors from France and Switzerland, and receives international, although moderate, financial support.

It has been recognized that the efficiency of future activities would strongly benefit from close interactions with the theoretical (mathematical/computer) sciences, engineering, and applied sciences (e.g. healthcare organizations) or basic sciences (e.g. the interaction with IBP). Plans have been developed to strengthen these interactions in order to bundle existing human resources and to increase the staff. These developments shed a very positive light on the outlook of the future and may even lead to new structural research units. Successful cooperation with international companies are maintained, which has led in one case to the establishment of a subsidiary in Sofia. This is an excellent example for successful technology transfer. The activities are in interesting areas of complementary research and are at the state-of-the-art level (e.g. the implementation of the open source AMMOS program in the internet). Contemporary approaches are applied to tackle problems, by interacting with Universities as well as technological companies. A project on *Development of Process Control Systems* started in 2008. Some of the Institute's young scientists received national awards for their scientific achievements.

Weaknesses:

Funding through EU programs or other international sources is moderate.

The income from products developed for commercial use is moderate.

Productivity

Strengths:

The research projects are primarily designed to answer basic questions of science in order to develop new methodological and technical approaches for medical treatments or the analysis of biological processes. A major effort is put into the implementation of new software and hardware. Major applications include methods, algorithms and devices for cardiac electrostimulation, devices for electrochemotherapy, software package Weaning MV to control, e.g., the state of anesthetized patients, AMMOS (Automated Molecular Mechanics Optimization tool for in silico screening), controller for fermentation processes.

The selected ten best publications (2004-2008) appeared in journals of the field with impact factors (IF) ranging from 2.3-4.4 (cumulative IF≈ 18). The contribution of CBME's researchers is significant, representing 72 % of all authors, and 100 % of the first and last authors. This demonstrates that the Institute's researchers had leading roles in the studies. In summary, this further shows that the Institute is internationally visible and well recognized and accepted as competent and innovative partner.

Weaknesses:

The publication records of the departments are rather heterogeneous and they are not as high as in a few other institutes of the BAS. One reason may be that applied science data are less well published in journals specialised in basic research.

The Institute claimed 239 papers published and 3657 citations during the past five years. This number is higher than the number of papers (109) and the number of citations (1374) found using the Web of Science searches. This may reflect that a significant number of the citations originates from congress reports or contributions published in Bulgarian journals or journals that are not recognized in the Web of Science searches and are therefore not accessible for an internationally valid evaluation.

Overall score for Quality and Productivity: "B", for "*Work that is internationally visible. The Institute has made valuable international contributions in the field*."

The research at CMBE is devoted to the analysis of biological signals, informatics, design, and modelling. Significantly increased local funding has been obtained just recently in 2008, which clearly underlines the importance of the Institute on the

national level. CMBE has increased external funding by co-operating with external partners and this trend is expected to continue in the coming years. This also indicates that the projects and the putative commercial products are competitive and innovative.

On the other side, external funding by international societies or the EU is still relatively low and should be increased. The commercial value of some products has to be proven by increased income, e.g., from patent licenses and international acceptance of the developed products.

(b) Socio-economic Impact

Strengths:

CBME has contacts with many Institutes of the BAS and to Universities and hospitals. The Institute performs a highly valuable advisory function for many different organizations and Institutes in Bulgaria and is recognized for that at an international level. Important services are provided for the operation of national, state, and government institutions. The services of CBME (teaching/technical support/ computer assisted modeling, etc.) to other organizations are very valuable and of high socio-economic value. The Institute's staff members have offered many lectures, seminars, and practical courses to Universities and they are also very much interested in improving the transfer of their expertise to BAS institutes as well external organizations. In this respect, the Institute's services for national organizations, hospitals, Universities, state offices appear highly valuable and deserve strong support.

Weaknesses:

The number of students educated at CBME is moderate. Acceptance by the Universities is insufficient (remark taken from the self-evaluation report). The co-operation between BAS and Universities needs to be improved to facilitate transfer of scientific expertise and teaching capacities.

Overall score for Socio-economic Impact: A - "*Highly relevant*."

(c) Prospects

Strengths:

The Institute has a good control over research progress reports and supervision of doctoral theses. Its research activities are clearly structured. Directions and financial support are discussed by the general assembly of scientists. Significant funding has been obtained in 2008. CBME's future expectancies appear excellent considering the fact that several projects have led to products of potential commercial value.

Weaknesses:

The Institute generates results in fundamental research that provide the basis for new technological developments and it has also produced several devices. The impact on therapeutical applications or commercial value, however, has to be substantiated. For instance, the cardiological appliances have to prove that they are commercially competitive because of their improved technology. Likewise, the usefulness of models for decision-making processes have to be proven in hospitals, or treatment of diseases has to be approved in clinical tests.

The age structure of the Institute appears unfavorable, meaning that new researchers have to be recruited to guarantee a successful continuation of the ongoing work and to improve scientific standards regarding quality and productivity. Future strategies and priorities have to be elaborated more precisely.

Overall score for Prospects: B - "Moderate prospects."

Overall Strengths and Weaknesses

Overall strengths:

CMBE is a national player in Bulgaria in biomedical engineering and is clearly visible internationally, as shown by successful interactions with international firms and contributions to EU programs FP6 and FP7. A significant increase in recent local funding and the development of more than four different products of medical, industrial as well as scientific application have been noted as very positive achievements. Important services are provided for the operation of national, state, and government institutions. The services of the Institute (teaching/technical support/ computer assisted modeling, etc.) to other organizations are very valuable and of high socio-economic value.

Overall weaknesses:

The research at CMBE is devoted to the analysis of biological signals, informatics, design, and modeling. At present, it is not clear whether these activities will attract sufficient external funding from international organisations that support fundamental research. Clear strategies for new research projects in basic science are not specified.

Recommendations

General Panel recommendations are listed in the Panel Level Report.

Specific Panel recommendations:

- The Institute should reconsider its publication policy. Articles should be preferentially published in English, in journals with impact factor.

- The co-operation between BAS and Universities should be further improved. Attempts should be undertaken to obtain the accreditation not only for Informatics, but also for Biophysics, and Artificial Intelligence Systems, and hopefully for a new scientific area in Bulgaria, for Biomedical Engineering.
- One might want to reappraise whether a research Institute should construct technical appliances that are produced worldwide, probably by many different companies. If the CBME continues along these lines it is essential to ensure that the products are cheaper, have better technology or improved functions to already existing products.
- When developing new products it should be clearly decided, which activities are part of research projects and what should be transferred to industrially specialized organizations or companies.
- The proportion of scientists with background in biological and chemical sciences is very low compared to those trained in technical sciences. The integration of the former could propel some of the more technically oriented scientific projects. At the same time, interactions with the theoretical (mathematical/computer) sciences, engineering, and applied sciences (e.g., healthcare organizations) or basic sciences should be continued and strengthened.
- Most experiments are related to bioinstrumentation. The list of products could be extended, e.g., including orthopedic bioengineering.
- It is important to establish more links to hospitals (clinical tests) and industrial companies (patents).

National Museum of Natural History (NMNHS) - 415

Executive Summary

The Museum is the largest natural history collection in the Balkans with a history of 120 years. It has a unique role as regards building, maintaining and researching the national natural history collections, and a unique opportunity to reach the society via exhibition activities. These two axes should give the priorities for development, as these are the specialties of a museum. The Museum provides essential services to Bulgaria (Socio-economic Impact score A), (i) in the form of survey and description of, e.g. the fauna or the palaeofauna, (ii) publishing on Bulgarian natural treasures (e.g., Biodiversity of Bulgaria series), and (iii) presenting these to the wider public in the exhibitions. The recent development of the permanent exhibitions and the introduction of frequently changing temporary exhibitions increase the reputation of the Museum in the society. While a wide range of collaborations exists with other BAS institutions and nature conservation authorities, international cooperation is less well developed. The number of research staff is small (13), but given its size the output is considerable. Taxonomy is published in prominent taxonomy journals, some with impact factor; a few of the works were published in leading journals (with an impact factor higher than two). Several monographs describing biodiversity in Bulgaria were published, partly in English. Overall the Museum is internationally visible (Quality/Productivity score B).

Although favourable changes have recently taken place by re-structuring the Museum's departments and although the team is enthusiastic and has a favourable age structure, it is rather difficult for the Museum to scientifically improve and further develop. The underlying reasons are the very poor research, storage and exhibition infrastructure and the small number of overloaded scientific staff (who have to work as researcher, curator and exhibitor). The Prospects score is therefore C.

Overall Strengths and Weaknesses:

The Museum has the duty of handling Bulgaria's national collections on natural history. This makes it different from the other BAS Institutes. Its independency is justified, since no other BAS Institute covers all its collections (animals, plants, geos). In addition, the Museum has a high outreach to the public through its exhibitions. It appropriately belongs to the Biology Division of BAS, since the Earth science part is small, and overlaps with biology, at least on palaeobiology.

Specific Panel recommendations:

The Panel recommends that the Museum increases its publication activity (mainly in international scholarly journals with impact factors) and develops timely and interesting research topics to attract PhD students and postdocs. On the long-term, BAS should consider the Museum as a window to society, as unique opportunity to present to the widest public not only natural history, but also other scientific discoveries relevant for Bulgaria.

Evaluation Summary

The Museum was established in 1889 as the Royal Prince's Natural History Museum, and opened its first exhibition in 1907. After several re-organisations, the present Museum has now four research departments (Invertebrate Zoology, Vertebrate Zoology, Botany, and Geology & Paleontology), and an Exhibitions Department. The Geology & Paleontology Department has its exhibitions in Assenovgrad. The mission of the Museum is to promote natural history knowledge on fauna, flora, fossils, minerals and rocks of Bulgaria and other countries through research, education, exhibitions and popular literature. The number of staff is small, with high proportion of young professionals. Some of them are internationally highly recognised expert in taxonomy or paleontology.

(a) Quality and Productivity

Quality

Strengths:

- The Museum (NMNHS) is the largest natural history collection in the Balkans. Thus it is a regional centre for natural history research, mainly focussing on taxonomic, faunistic/floristic, palaeontological and conservation biology studies. Biospelaeology, archaeozoology and palaeontology of vertebrates, bat studies and invertebrate taxonomy are highly developed at the NMNHS. The institution can be regarded as centre of knowledge on these issues in the country. The Museum has existed for 120 years, and was able to build a collection of one million specimens of plant, animal, mineral and fossil records during that time. The Museum has a well-designed website (http://www.nmnhs.com/), which seems to be professional, attractive and "living" (up-to-date).
- The Museum has several collaborations within the BAS (four BAS Institutes are listed), with other Bulgarian institutions like Universities, and with foreign institutions (especially other Museums). The cooperation network seems to work rather well given the small staff. The Museum doesn't have a Scientific Council on its own; rather the Councils of the Institutes of Zoology, Botany and Geology serve the Museum. This coordination is seen positive since it avoids (the otherwise considerable) overlaps and parallel or competing research activities. Likewise, it would be beneficial to have museologists in the Scientific Councils of the above-mentioned Institutes (if not implemented as yet). Due to the high number of applied projects and contracts from the Ministry, it seems that the Museum acts as an expert-base for the Ministry on conservation biology topics. It increases the reputation of the Museum, mainly in Bulgaria, but probably also at a more international level via international agreements.
- The Museum has international collaborations, for example as participant in international projects (e.g. Fauna Europaea, PASI, Eurobats programme). In

addition, the Museum hosted 88 foreign visiting scientists from 23 countries during 2004-2008.

- Education: Eight researchers habilitated, and are thus allowed to supervise students. The Museum as a part of BAS is a research institution devoted to research and in addition handles the collections. The training of PhD students is important, since they represent the next generation of potential young research candidates for the Museum or similar institutions, that can contribute to the production of scientific output (like papers). The Museum is involved in other educational activities such as lectures at different institutions in Bulgaria and for different types of audience, e.g. from researchers and experts to students and to children. These activities, however, may divert staff time away from research. It seems to be advisable to have additional personnel to guide the students and children in the exhibition, thus allowing the museologists to dedicate more time to research.
- The Museum's staff was involved in several non-research-related activities in Bulgaria, e.g. organising student competitions, translating books.
- The large number of projects listed in the SER is mainly related to travel support, and not to support of research projects. Nevertheless, the number of competitively won research projects from BAS' Foundation, Bulgarian NSF, Swiss, Dutch and international sources (UNDP and EC) is impressive. As indicated in the budget, research projects and contracts represented 23% of the total income in 2008. The number of large projects, the diversity of funders (national, international, other countries), and the increase of project-funds in the overall budget look promising for the future development of research.

Weaknesses:

- One of the main weaknesses of the Museum is its staff size, which makes it rather difficult to join research forces. The Museum has only 13 research staff (of 46 in total) and these include experts from diverse disciplines (zoology, botany, geology). The handling of the collections with 1 million specimens is a huge task and requires additional educated assistance. In their absence, the curator's time will be devoted to collection handling, thus distracting her/him from primary research work and paper writing. Because of its nature, the Museum cannot be considered a standard research institution of BAS and hence cannot be directly compared with other Institutes.
- Looking at the large number of applied projects and contracts funded by the Ministry, it seems that the Museum acts as an expert-base for the Ministry on conservation biology topics. While this is a valuable position, most of these projects do not lead to scientific publications, not even in local journals in Bulgarian. Therefore, this set-up probably works against scientific excellence. In addition, the Museum largely lacks Bulgarian NSF projects; neither does it coordinate larger projects – although it participates in a few.
- Personnel: The low number of PhD students is probably also related to the lack of new and exciting research work. Classical taxonomy of extinct and extant species is nowadays not very appealing yet it is one of the main research areas of the Museum. Many students are interested in projects that

are "trendy" and lead to practical outcomes, e.g., applied research in other fields like conservation biology. For example, the Museum's reserve design and species-management-plan studies could be used to attract more students.

- A weakness is that the museologists' international activity is low. In most projects museologists are participants, but do not seem to take the lead in coordinating large consortia projects, or work packages. Likewise, members of the Museum are active only on a few international boards and committee. Most entries relate to Bulgarian activities, or paid-for-memberships, or paper refereeing (probably, although not clarified in the annex). Conference visits amounted to 34 for five years and 13 researchers, which is fairly low (conference presentation in every 2nd year per person). Costs can justify some of this low attendance rate, but not all considering the Museum's increase in income. On the other hand, the number of institutional visits is higher (16 under bilateral agreements, 13 under Synthesys, and many more under other sources).

Productivity

Strengths:

- The Museum lists seven papers in the most important publications' list. All of these are published in IF journals, some with a rather high IF (>2), even one with an IF> 5. On five papers the lead author is from the Museum. The four monographs fit to the main activities of any national Museum: partly taxon specific and wide geographically, partly wide taxonomically, but concentrate on Bulgaria. The book published by Springer has to be mentioned as an outstanding example of Bulgarian work at an international level.
- The Museum is the publisher of four fora. The publication *Biodiversity* is highly valued, since it describes regions within Bulgaria. Such a task is well tailored to the Museum: searching for new species, creating fauna and flora lists. Two new monograph series were established in 2008; one rather specialized one on mites.
- The main publication activity is within Bulgaria (136 publications abroad, 259 Bulgaria). Considering the applied nature of several projects (like inventories, contracts with the Ministries) it is understandable that such project results are published for the Bulgarian conservation community.

Weaknesses:

- The list of the most important papers shows that the Invertebrate and the Palaeontology Departments have produced good work on an international level. On the other hand, the Vertebrate Department seems to be weaker, while the production of Botany is simply missing.
- The SCI publication activity can be improved. There are 29 papers in the additionally provided list (excluding *Acta Zool Bulg*, which is a recent ISI journal published by BAS). 29 papers in five years from 13 researchers is less than half paper per year per person. In addition, the impact factors are low even considering the discipline's character (although there are nice exceptions). The journals are usually not amongst the top journals of the

discipline (like *Zoology*; top journals are those in the upper 10% of Zoology journals listed by ISI - Journal Citation Reports; it is above IF=2).
- Citations: The number of ISI citations is low.
- Although the establishment of two new monograph series might overall be positive, there are some risks. They can die out due to lack of money for printing or lack of manuscripts. In addition, they seem as a facilitator to publish work produced within the Museum. Staff might feel inclined to publish in these fora instead of high impact factor (IF) journals, which might lead to a decrease in publication level and international visibility.
- Among the Museum's important achievements are fauna lists, species by species, hundreds of species are listed. This is a great source of information and should be analysed in depths. It seems that the Museum has not yet exploited the collected data in terms of innovation and developing new hypothesis. If done adequately, such studies could be published in international high level journals.
- Interesting that the oldest humanoid in Europe was found in 2007 – and only a BAS News article was published. If this is really a big scientific achievement, which adds to the knowledge on humans in Europe, it is important to publish such findings in an international journal.

Overall score for Quality and Productivity: "B", for "*Work that is internationally visible. The Institute has made valuable international contributions in the field*."

(b) Socio-economic Impact

Strengths:

- The Museum is responsible for a part of Bulgaria's national treasure – the natural history collections. This is a unique task, combining scientific research in biodiversity and geology with exhibition activities. The Museum also has its own publications, which provide outreach to the Bulgarian readership, and there is a need to publish national-level research findings. The exhibitions provide a unique opportunity to have on impact the society and to educate the community.
- A second benefit for society is the Museum's participation in various nature conservation tasks. The faunistic and floristic research with practical recommendations to conservation management organizations are a primary aim of Museums in general. Its Staff was involved in nature conservation activities, like preparation of species management plans and protected area management plans, the design of *Natura2000* network (the protected area network of the EU). The Museum was also involved in the debate on the Struma highway construction.
- The pronounced cooperation with foreign institutes and Museums is a very positive point.

- The priorities of the Museum are internationally highly relevant (Biodiversity, Evolution, Conservation Biology, Anthropogenic Impact, Geological Heritage).
- The impact of the staff's activities seems to be strong within Bulgaria, since staff members are on several committees and expert boards (CITES, nature conservation activities, education, membership in several boards).

Weakness:

- The international scientific impact of the Museum is moderate, mainly related to local (i.e., Bulgarian) or narrow (taxon specific) topics. This situation should be improved by for example establishing more international cooperation projects.

Overall score for Socio-economic Impact: A - "*Highly relevant*."

(c) Prospects

Strengths:

- The new organisational structure is much better than the old one. The clear separation of the exhibition unit is very important. This clarifies responsibilities, and concentrates research efforts. The exhibition can run more efficiently, improving the Museum's visibility and the BAS in general. The attempts of building electronic databases of the collections are highly appreciated. The relatively young team and well managed plans provide clear and positive perspectives for NMNHS.
- The age structure of staff is good. Of the 13 researchers, three are younger than 35 years, and six are younger than 45 years. Almost all young researchers are established experts in their fields and contribute considerably to the scientific output and educational activities of NMNHS. The PhD students (even if now only two) are additional young personnel taking part in the research. The Museum has the potential to establish an active and enthusiastic young researcher community.
- Exhibition potential should be used not only for outreach and education, but also to promote other disciplines (possibility of the museum to collaborate with other BAS institutes), thereby promoting other institutions and finally the BAS. The Museum can be a key player in increasing the reputation and weight of the BAS for the public and decision makers, and can significantly contribute to a strategy aimed at promoting BAS to become Bulgaria's scientific advisor.
- Financial income: to have 40 % own income is rather good for an institution with no direct link to industry and business. The amount of funding from projects increased significantly in the last years and is still growing.

Weaknesses:

- The innovative potential of the Museum is hampered by the almost completely missing research infrastructure. For examples, the exhibition rooms are also storage areas for the collections. The palaeontological lab is in the basement of the building and does not seem to be an attractive working place (no light, no storage possibility, in the need of immediate renovation). Only one „state-of-the-art" microscope (Olympus with digital camera) is available, yet microscopes are the main equipment for taxonomists. There is no scanning electron microscope, no DNA lab for taxonomic and population genetic studies, no GIS lab for landscape ecology and conservation biology studies, and so on. Currently, only the continuation of the ongoing classical research is possible, with no chance to join cutting edge, modern research in taxonomy.
- Even if the future plans for technical and personnel staff are well designed, the main weakness is the lack of a real strategy to tackle new scientific challenges. Currently, it's not even possible to further develop existing research.
- There is an overlap with other BAS institutions and University departments on some topics (e.g. taxonomy), and with regard to the existence of the collections.

Overall score for Prospects: C - "Low."

Overall Strengths and Weaknesses

The Museum has the duty of handling Bulgaria's national collections on natural history. This makes it different from the other BAS institutions. Its independency is justified, since no other BAS Institute covers all its collections (animals, plants, geos). In addition, it has a high outreach to the public through its exhibitions. It appropriately belongs to the Biology Division of BAS, since the Earth science part is small, and overlaps with biology, at least on palaeobiology.

Recommendations

General Panel recommendations are listed in the Panel Level Report.

Specific Panel recommendations:

- The Panel has noted the existence of several parallel collections in BAS institutions, and Universities. It cannot make a specific recommendation that can be implemented in the near future, as the real solution seems to be rather ambitious, and it is not familiar enough with the Bulgarian situation. However, the Panel can express our view that on the long term, a well planned and defined pooling of the most important collections (e.g. moving the experts and the collections from other BAS institutions and from Universities to NMNH) would create an internationally excellent, visible, larger and stronger museum. The Panel expects that the pooling of collections

with the related faunistics, floristics, palaeontology, taxonomy etc. research will have ca. 4 million items, and a research staff around 40. This museum would be a strong player at the European level. Obviously, it would also need one large, attractive and impressive building, high-tech storage, unified public-available database, and exhibition hardware. Then, the overlap would be smaller with descriptive aims, i.e. taxonomy, faunistics and floristics, being based at the Museum, while other, evolutionary, ecological and conservation biology research stays at the other institutes, where the load of maintaining collections will be ceased.

- On the short term, it is advisable to increase the Museum's international visibility. An increase in publications in journals with impact factor (which will return in increased number of citations in such journals) will augment international recognition. Likewise, increased international activities such as conference participation, organisation of meetings (e.g., symposium at congresses), taking part in board of international societies etc. also boost visibility.
- The Museum needs to become more appealing to PhD candidates. This requires not only the development of new and exciting research topics, but also the possibility for international travels (e.g., conferences) and a dynamic research environment with enthusiastic staff, dedicated to the study and the preservation of Bulgaria's nature. Some of the ambitious students are able and would be glad to be involved in organisational tasks – these tasks can satisfy those who need more interactions and a more dynamic environment than a museum may usually provide.
- The development of electronic online databases of the collection material is highly appreciated. These databases require maintenances and updating, and funds should be provided to support them on the long-term.
- The museum was involved in several applied projects on *Natura2000*, and *Red Data*. Aspects of such projects (methodology, main results, simply analysis on, e.g., the threatened species lists compared to IUCN and Habitat and Bird directives lists) can, and should be published in conservation biology journals. For example, a simple analysis of a survey on European monitoring programs resulted in papers in the best journals (e.g. *CONSERV BIOL* 23: 307-316 (2009), *CONSERV BIOL* 22: 593-601 (2008)), highlighting that not only primary research results can be published. In general, the wider European conservation biology lacks information on conservation activities and studies in the new EU countries, since these projects are not published in SCI journals. The Panel feels that this is an excellent opportunity for the Museum to increase its visibility.

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