INTERNATIONAL BARCODE OF LIFE PROJECT (iBOL)
INTERNATIONAL CONSORTIUM INITIATIVE (ICI)
INTERIM REVIEW WRITTEN REPORT FORM

ASSESSMENT

1. RESEARCH PROGRESS

Progress against the original research plan is assessed as:

[X] Excellent [ ] Good [ ] Satisfactory [ ] Not Satisfactory

Please provide comments to justify your assessment. If there are significant variances in the progress of specific components of the ICI, provide specific comments by sub-project or activity while taking into account factors such as the:

- level of funding received to date;
- duration of the funding period;
- problems encountered;
- progress relative to other research groups working on similar projects; and,
- research team's responsiveness to advances in the field and/or availability of new technologies since the project's inception.

The level of funding has been adjusted by Genome Canada to accommodate for the not surprisingly uneven start of such a large enterprise. In view of that somewhat rocky start, the project has adjusted very well and has made progress in most fronts commensurate with the funding received. The Informatics team experienced significant problems with transfer of data from BOLD to GenBank, but those difficulties seem to have been largely overcome. It is hard to assess progress relative to other research groups working on similar projects, because there is so much overlap between specific barcoding campaigns and with CBOL. Plants continue to pose problems for iBOL because of the need for multiple gene regions, the need for more universal primers in matK, and the lack of resolution at the species levels for numerous groups. Fungi have not been incorporated into the barcoding stream yet, but there should be agreement soon on an appropriate barcode marker, probably part of ITS, and then barcoding in that group could take off. There are at least some other smaller research groups that do not appear to contribute barcode data directly to BOLD but rather to GenBank, and that data should be available for iBOL to use since it is freely accessible once posted there. iBOL does not intend to corner the market for barcodes but rather be the most productive center and largest repository for eukaryotic barcode data.

The iBOL team is obviously aware of advances in the field and is exploring use of next generation sequencing techniques, but mostly applied to environmental samples so far. It is nonetheless a legitimate question to pose whether NGS in the near to moderate future will be able to supplant the barcode premise of short, quick reads with much larger and

more informative ones without an exceedingly higher cost. If that is the case, one would hope that the significant investment in obtaining the samples and storing their extracted DNA will facilitate a higher level of effective barcoding in the future and that iBOL can continue to adapt and maintain a high profile in that endeavor.

2. CHANGES TO THE RESEARCH PLAN

If significant changes to the research plan have been made or are proposed for the future, what is your assessment of these changes?

[X]	Recommended as proposed	[ ]	Recommended with modifications	[ ]	Not recommended

Please provide comments to justify your recommendation. Provide details of any modifications or additional changes that you would recommend.
Most of the changes I saw to the research plan were not significant, but rather tweaking the targets or other project goals. Adjustments in the species targets of the working groups in Theme 1 reflect in part rates of progress over the first 18 months of the project and lessons learned from different working groups. Changes in plans for Theme 2 reflect needs to transmit experience gained from successful projects to other iBOL nodes (a methods blueprint for iBOL sequencing nodes, or help in launching new barcoding projects of entire biotas), to get more buy-in/participation from the museum community, and to be more successful in obtaining grant support for paleobarcoding activities. For Theme 3 (Informatics), the project has been active in adapting to the changing needs of the BOLD platform (increase in records, additional gene regions, and BIN generation), and they mainly foresee the need to facilitate and formalize the transfer of data and protocols to partners and depositories like GenBank. In Theme 4 (Applications), the main challenge is to keep abreast of developments in next generation sequencing technology and integrate this into both standard barcoding efforts as well as environmental barcoding, where strict barcode protocols may be relaxed. Mobile barcoding has now been relegated to possible development by industry, although iBOL has an important role in demonstrating the viability of such a device and in building up the library upon which the platform would ultimately be based. In Theme 5 (Administration), the project team acknowledges that it is now time to promote development of proper management and communications of iBOL nodes outside of Canada and the U.S. The GELS activities are covered in a subsequent section.

3. GE^{3}LS

The project leaders were asked to identify the ethical, environmental, economic, legal and social aspects (GE^{3}LS) arising from their proposed research and to develop and implement a plan to address them.

The progress towards achieving the goals of the GE^{3}LS subproject is assessed as:

	Excellent	X	Good		Satisfactory		Not Satisfactory		N/A

Please provide comments to justify your assessment including comments on the progress towards achieving the GE^{3}LS milestones and the research team in place. Please take into account factors such as the level of funding received to date, duration of the funding period and problems encountered.
iBOL was asked to submit a revised GELS proposal, and this new proposal was commented on by three external reviewers. The consensus assessment was a B (on an A-B-C scale), with a number of substantive issues raised. Activity 5 in particular was questioned by the reviewers as to its relevance and heavy dependence on an external assessment by TIP, which has already provided advice to iBOL. There was some concern about how well the GELS teams would interact and inform the core research teams through the life of the project. In my opinion, clear progress has been made on the GELS section, but further refinements could still be made.

4. ABILITY TO ACHIEVE THE OVERALL OBJECTIVES

Is the research team likely to achieve the overall objectives of the project?

X	Very likely	X	Possibly		Unlikely

Please provide comments to justify your response. In cases where you identify issues that would prevent the team from meeting their objectives, please state the issues and where possible, propose solutions.
A qualified “yes.” I have little doubt that the project is capable of generating five million barcode sequences, and it will probably exceed this goal, but it may be harder to achieve the goal of half a million species or BINS, as there is some clear imbalance in the accumulation of targets for different working groups. WG1.9 is considerably over-target, as well as heavily skewed towards Lepidoptera. That is no surprise, as this is Dan Janzen’s interest, and he alone may be largely responsible for this anomaly. I just wonder if this effort will be “reined in” to not overshoot its goal (which has been upscaled by 50%) or if it will continue to outpace the other working groups? Because of the partial lack of control of iBOL over the exact nature and provenance of samples sent to them from different countries, it may prove impossible to tweak the sampling to achieve a more even representation of taxonomic groups.

5. BENEFITS FOR CANADA

Based on progress to date and the future plans, please assess whether the anticipated results of the research are likely to, a) contribute to job creation and economic growth in Canada, b) social benefits c) improvements in the quality of life, health, and/or the environment, and d) contribute to the creation of new policies in these areas. If commercialization is proposed, please comment on the strategy for IP management and ownership, technology transfer and benefit sharing.

The progress towards realizing the Benefits for Canada is assessed as:

[X]	Excellent	[ ]	Good	[ ]	Satisfactory	[ ]	Not Satisfactory

Please provide comments to justify your assessment. Have any opportunities been missed?
In all respects mentioned above, the project continues to promise significant benefits to Canada. Commercialization remains a significant question mark in the iBOL enterprise, because the development of a mobile barcoding device is unsure, and if it is largely left to outside commercial ventures, it is unclear how the basic library data that would feed into it would be dealt with from an IP and monetary standpoint. Given the wide-ranging and complex geographical origins of the biological material that generates the barcode data, there are potentially complex legal and IP issues that will need to be addressed. These are, at least, the focus of one of the GELS team activities.

6. GOVERNANCE & MANAGEMENT

Are the established governance and management plans, processes, and structures appropriate and effective?

[ ]	Yes	[X]	Remediable Concerns	[ ]	No

Please provide comments to justify your assessment including comments on the:

- governance and management structures and processes;
- decision-making processes – do these ensure that critical decisions about the research direction can be made and provide the ability to respond to unanticipated difficulties?
- effectiveness of communication mechanisms within the project.

There is a fairly complex hierarchy of governance and management structures in place, and this is better evaluated by the Due Diligence review. The Due Diligence review found reason for concern in the management and organization plan for Years 1 and 2 “and possibly the future,” so follow-up on those points is warranted.

The Communications working group should be acting to guarantee effective communication channels are in place within the project as well as outside it, and that is specifically addressed in their activity plan.

7. HANDLING OF SCIENTIFIC DATA & RESOURCES

Are the plans for handling scientific data and sharing of data and resources created by the project appropriate and effective?

[ ] Yes [X] Remediable Concerns [ ] No

Please provide comments to justify your assessment and, where appropriate, make suggestions for the improvement of the plans.

I have some issues with the iBOL data release policy, as Phase II data release is supposedly contingent on manuscripts being submitted for publication. This may work for a rather limited subset of samples, but I suspect that the vast majority of sequences generated will not form part of a study leading to publication, at least within a several year time frame (that would be publications involving five million sequences over a five-year period). Likewise, for many specimens collected in the tropics or in difficult groups, the collector will not have the time or knowledge to attempt identification within any reasonable amount of time.

In general, the data release policy seems in accordance with “industry norms,” and it is intended to be as open-source as possible. I see some potential problems if specimens are submitted to iBOL with incomplete collection information yet barcode sequences are nonetheless generated, as these would technically not be compliant with the barcode standards. When perusing BOLD as a nonaffiliated visitor, it is difficult for me to evaluate if data is missing or if it is simply withheld for one reason or another. It would be very helpful if information that is not posted could be tagged as “withheld pending....” or as simply missing. If the latter, then mechanisms should be in place in QA/QC to obtain or recuperate the metadata before it is too late.

8. TRAINING, RECRUITMENT AND PROFESSIONAL DEVELOPMENT

Has the project team been and/or will they continue to be successful in training, recruiting, and professional development of highly qualified personnel?

[X] Yes [ ] Remediable Concerns [ ] No

Provide comments to justify your assessment and, where appropriate, suggest possible new approaches. Please comment on the responses to any challenges faced to date.
At least on the research side of the project, iBOL has been quite successful in these aspects. Besides scientists and technicians hired as part of the project, there were 16 graduate students and around 50 undergraduates trained to date at BIO. With the new facilities at Guelph, there must be a very active and vibrant community working to develop iBOL. On the managerial side, there is definite progress in filling key positions, although there were still some unfilled slots indicating further progress needs to be made.

9. PUBLIC OUTREACH & COMMUNICATION ACTIVITIES

Do the activities that have been undertaken or are planned ensure that the research is communicated to the public and other interested parties?

[X] Yes [ ] Remediable Concerns [ ] No

Please provide comments to justify your assessment and, where appropriate, make suggestions for improvement.
There is a working group (5.2) dedicated to this activity, and one of the new GELS activities (WG6.4) focuses on educational initiatives in Canada. A Communications Strategy document (Nov. 2009) by John Chenery was provided, but I did not see anything pertaining to a projected November 2010 evaluation that was mentioned in that report. There are many opportunities for communications and outreach in this project, both nationally and internationally, and much will depend on how effectively WG5.2 carries out its mandate. I was confused by the strategic priorities listed for WG5.1 (Project Management) and WG5.2 (Communications) in the main interim review document (p. 44). Obtaining funding for the Theme 1working groups appeared several times in the WG5.2 priorities list, but this kind of activity never appeared in John Chenery's vision document mentioned above. It should be clarified which group is likely to provide assistance in

fundraising activities, or if it will be an alliance between the Barcode library working groups themselves, Project management, and the Communications group to some degree.

One final issue that people inevitably stumble on is the confusion between iBOL and CBOL. The names are so close, and their missions as well, that there is always confusion about which one does what and how much they overlap. I feel that will continue to be somewhat of an impediment to iBOL unless the organizations can either be merged or else better differentiated.

10. FINANCIAL

Is the research progress commensurate with how funds have been spent to date?

X	Yes		Remediable Concerns		No

Please provide comments to justify your response. Include comments on the following:

- whether explanations for budget variances are reasonable in the context of research progress to date;
- the level of success in securing co-funding from other sources;
- if there is a co-funding shortfall, suggest alternate sources of co-funding and comment on how the shortfall will impact the research.

It is difficult for me to properly evaluate the financial details of the project so far, but for the overall amount of money expended to date, the research progress as measured by the number of barcoded specimens and putative species and other advances in BOLD and associated aspects of the project is certainly in line with stated goals, or even above expectations. Co-funding issues are even harder to assess, but there is evidence of support from other sources in Canada, and barcoding efforts are being funded in some of the partner countries. It still remains to be seen how much more co-funding will materialize within the lifetime of this project.

11. Progress towards addressing the issues raised at the time of the initial ICI review

X	Excellent	**X**	Good		Satisfactory		Not Satisfactory

Please comment specifically on the progress towards addressing the issues that were raised by the Expert Committee at the initial review listed below:

- the resolution of outstanding management, budget and co-funding issues;
- the revision of the GE^{3}LS component of the proposal;

- the establishment of a Technology Development Advisory Group (TDAG) and a Science Advisory Board (SAB);
- the implementation of a quality control/quality assurance monitoring system; and,
- the resolution of outstanding issues with the public release of data in the ***International Nucleotide Sequence Database Collaboration (INSDC);***

For the most part these issues have been suitably addressed, at least as outlined in the interim review report, and a revised GELS research plan was presented and approved by Genome Canada. However, the Due Diligence report had numerous observations regarding project management, budgets, and co-funding issues.

OVERALL RECOMMENDATION

[X] Further funding for the ICI is recommended

[ ] Further funding for the ICI is recommended with modifications

[ ] Further funding for the ICI is not recommended

Please provide a brief summary of the status of the project and a justification for your recommendation. Where issues have been identified, state whether these are major or minor, what actions should be taken (e.g., activities that should be reduced, abandoned or strengthened), alternate approaches to be considered and avenues to strengthen the project.

This is a very complex project with an ambitious agenda, and it is difficult to get all engines firing in synchrony from the start. iBOL has demonstrated the capacity to obtain and process a high volume of samples, and the pace should only grow as more international partnerships develop and become active. Nevertheless, some activities are ahead of target (WG1.9) while others are behind (WG1.2) or haven't yet begun (WG1.3). There is still time to bring all of the working groups activities to targeted levels, but the simplicity and utility of DNA barcoding will probably continue to be biased towards animal groups for which the single mitochondrial marker is particularly well suited and the BIN algorithm can be implemented. Many plant studies use an additional noncoding region (ITS or trnL-psbA), so there may need to be additional flexibility built into the barcoding protocols and the BOLD system to accommodate that option.

The first stage of the project under review has given iBOL the opportunity to consolidate its backbone activities in research and administration at the Ontario central node, and this is appropriate given the key funding provided by Canadian institutions. At this juncture in the project, the emphasis needs to shift to the broad international sphere, to demonstrate

that the iBOL model can be applied in other nodes and countries, and to provide knowledge and support to assist them in that task. All the while, a close eye needs to be kept on developing technologies, such that iBOL continues to be a leader in the field and does not become a white elephant.