Barcoding Europe
DNA barcoding is moving at warp speed

The chair of iBOL’s Science Advisory Board, Stephen O’Brien, has left the National Cancer Institute’s Laboratory of Genomic Diversity after 25 years to help jump-start a genome bioinformatics centre at St. Petersburg University in Russia.

O’Brien has been awarded a three-year, $5 million grant from the Russian Ministry of Education and Science. The so-called “megagrant” program started in 2010 to boost Russian science by attracting big-name researchers to work at least part-time in that country.

Though a cancer institute researcher, O’Brien had also concentrated on comparative genetic studies to understand the evolution and conservation of mammals. In 2009, he and two others started the Genome 10K project, a call for the sequencing of 10,000 vertebrates.

Over the coming three years, O’Brien will spend at least four months a year working at St. Petersburg the center, which is scheduled to open in May.
Barcoding Life Report Documents a Year of Progress:
Applications and Discoveries are Highlighted

The International Barcode of Life project (iBOL) and the Consortium for the Barcode of Life (CBOL) are pleased to announce the release of Barcoding Life – Highlights 2011.

The report describes a year of outstanding achievement for the global barcoding enterprise and includes sections on:

» Barcode-based Discoveries
» Helping Society and Science
» Building the Barcode Library
» The Biodiversity Challenge

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To order a print copy of Barcoding Life – Highlights 2011, send a message with the subject line “Highlights Report” to bulletin@iBOL.org. Remember to include your postal address.

German researchers working with the International Barcode of Life project (iBOL) have produced the first genetic evidence that an invasive and highly destructive fruit fly is now present in the southern state of Baden-Württemberg.

Researchers from the Bavarian State Collection in Munich used DNA barcoding to identify the spotted-wing Drosophila, Drosophila suzukii, native to East Asia but now a widespread and costly pest in North America and, more recently, in southern Europe. It causes massive damage to soft fruit and berry crops and can also infest vineyards.

Fly expert Dieter Doczkal, who found the specimen near Rastatt in Baden-Württemberg last fall, was collecting insects for the Barcoding Fauna Bavarica (BFB) project, an important collaborator of the International Barcoding of Life project (iBOL). iBOL is a global partnership of researchers dedicated to building a DNA barcode reference library for 500,000 animal, plant and fungal species by 2015, focusing on species of particular environmental and socio-economic significance.

Among the important applications of DNA barcode technology is the ability to make rapid and accurate identifications of invasive species with the potential to inflict huge losses on agriculture and forestry industries.

The results have been reported to the plant protection service in Baden-Württemberg and the Julius-Kühn Institute (for national and international plant health relations), which also found spotted wing Drosophila at three sites in southern Germany last fall.
Switzerland has taken the first steps towards becoming a node of the International Barcode of Life Project (iBOL). Researchers and government officials who attended a meeting at the University of Geneva last fall agreed to form SwissBOL, a coordinated network to barcode Swiss biodiversity.

SwissBOL will have five main objectives:

» To build up a comprehensive DNA barcode reference library of species present in Switzerland and/or preserved in Swiss collections;
» To create a Swiss biodiversity DNA bank, in which the DNA extracted from barcoded specimens will be deposited;
» To develop and stimulate projects that use DNA barcoding in biodiversity surveys and environmental risk assessment;
» To extend DNA barcoding to the multi-locus approaches necessary to identify cryptic species that have arisen in the past few million years and will be easily achievable with Next Generation Sequencing applications;
» To join iBOL as an official member and integrate SwissBOL projects within ECBOL and the iBOL framework.

The Swiss Federal Office for the Environment (FOEN) has expressed interest in the project and a funding proposal will be submitted once SwissBOL’s formal structure and organization have been established.

The Geneva meeting featured three guest speakers, iBOL Scientific Director Paul Hebert, Gerhard Haszpunar, of Barcoding Fauna Bavarica and Lorenzo Lombard, Coordinator of the European Consortium for the Barcode of Life (ECBOL). They were followed by presentations from six Swiss scientists who explained how they use barcoding in their research.

Only one Swiss institution, Agroscope Changins Wädenswil ACW, is currently involved in an international barcoding project – the EU-FP7 Quarantine Barcoding of Life project (QBOL). All other barcoding activity derives from individual research projects.

Although it is generally assumed that the biodiversity of Switzerland is well known and that most species are easily identified, genetic data are available for few well-studied taxonomic groups and very little is known about the genetic structure and diversity within most described species. Moreover, the ability to harness next-gen sequencing tools for landscape-level biomonitoring is severely constrained without a barcode reference library.

Barcoding species-rich collections – including a remarkable number of type specimens – preserved in Swiss museums and herbaria would add huge value to past and ongoing taxonomic research.
A high throughput DNA barcoding facility will be established in the molecular laboratory of Bonn’s Alexander Koenig Zoological Research Museum as part of a major expansion of barcoding activities by iBOL’s German node. A €5 million grant over 3.5 years from the Federal Ministry of Education and Research (BMBF), has catalyzed the creation of the German Barcode of Life (GBOL) network, which is now moving ahead on a wide-ranging strategy to expand laboratory and informatics infrastructure, accumulate barcode data sets, and build the image, voucher and molecular collections required for a comprehensive online species identification system for Germany’s biodiversity.

GBOL is a consortium of natural history museums and other research institutions that have agreed to provide their taxonomic expertise and existing infrastructure (e.g. dry and wet collections, frozen tissue and DNA collections, databases and laboratories) to barcode the German biodiversity inventory.

GBOL partners are assigned to subprojects according to their taxonomic expertise. Institutions involved in GBOL are:

**Zoology**
- Staatliches Museum für Naturkunde – Karlsruhe
- Staatliches Museum für Naturkunde – Stuttgart
- Zoologische Staatssammlung – München
- Zoologisches Forschungsmuseum Alexander Koenig

**Botany and Mycology**
- Botanischer Garten & Botanisches Museum – Berlin
- Nees-Institut – Universität Bonn
- Universität Göttingen
- Universität Münster

**Soil Organisms**
- Senckenberg Museum für Naturkunde Görlitz
- University Bielefeld

The institutions will cooperate towards maximum coverage of groups – in both species and specimen numbers – from fresh samples and museum collections. They will also establish a national network of professional taxonomists and qualified volunteers to collect and identify specimens. The molecular laboratory of the ZFMK will establish a “barcode factory” to enhance specimen throughput and efficiency.

The GBOL partners will undertake a number of test projects with industrial users of species information, where accurate and efficient identifications have important economic and ecological implications (e.g. water quality control, control of pest species in agriculture and forestry, fisheries and environmental sampling).

A GBOL web portal has been launched to facilitate internal coordination and targeted collecting, support networking and share barcode data generated in Germany with the international community. GBOL data will also flow into Barcode of Life Data Systems (BOLD) and GBIF.

This spring, citizen scientists with extensive knowledge of varied species will be invited to join professional researchers at regional workshops where they will learn standardized protocols for collecting and preserving specimens and submitting them for barcode analysis. Citizen scientists have a long tradition of solid taxonomic and faunistic work in Germany, and many groups would be difficult to tackle without their help.
FinBOL Gets Off to a Fast Start:
Expanding Its Network And Funding

Launches less than a year ago, Finland’s iBOL Node, the Finnish Barcode of Life initiative (FinBOL), has generated impressive momentum with a rapidly expanding network and funding success.

The FinBOL network now includes more than 130 experts and three major university museums – the Zoological Museum at University of Oulu, Finnish Museum of Natural History at University of Helsinki and the Zoological Museum at the University of Turku.

With the recent announcement by the Kone Foundation and the University of Oulu of $160,000 in grants for this year, FinBOL is positioned to make rapid progress in barcoding many groups of animals, plants and fungi.

FinBOL has set a goal of 5,000 species barcodes by the end of this year, a first step towards its goal of barcoding 30,000 specimens representing 15,000 species in four years, around 30 percent of the country’s estimated total diversity.

Node lead Marko Mutanen said that a barcode library for the country’s 2,600 species of Lepidoptera is almost complete and large-scale barcoding of many other groups – including fungi, bryophytes and other plants, beetles, freshwater insects, caddisflies, flies, spiders, true bugs and bees – is getting underway.

“With an estimated 50,000 species, the Finnish diversity is not comparable to that of tropical countries,” said Mutanen. “But expertise is abundant and the national fauna, flora and fungi are unusually well investigated. This provides an excellent starting point to barcode the life of Finland comprehensively in a relatively short time frame.”

The FinBOL network brings together both professional and amateur experts. “While museums with large collections and taxonomic specialists are vitally important for achieving our goals, we are also trying to barcode many private collections,” said Mutanen. “They have the important benefit of usually consisting of young specimens, highly useful for barcoding.”

ECBOL 3 Congress Set for Brussels:
Theme: Barcoding Organisms of Policy Concern

The third congress of the European Consortium for the Barcode of Life (ECBOL) – themed “Barcoding of organisms of policy concern” – will be held in Brussels from September 17-21.

ECBOL 3, co-sponsored by the Royal Flemish Academy of Belgium, the Royal Belgian Institute of Natural Sciences (RBINS) and the Royal Museum for Central Africa (RMCA), will take place in at the Royal Flemish Academy of Belgium for Sciences and the Arts.

The congress is being organized by the Joint Experimental Molecular Unit (JEMU), the shared DNA barcoding research team of RBINS and RMCA. Principal contacts for the organizing committee are Thierry Backeljau (RBINS) and Marc De Meyer (RMCA).

Financial support is being provided the Belgian Federal Science Policy Office (BELSPO) through JEMU, and the Fund for Scientific Research – Flanders (FWO), through the Belgian Network for DNA barcoding, a collaborative network of 21 Belgian research groups and laboratories that are involved in DNA barcoding. The congress will comprise a papers session, plenary speakers, and a poster session.
European researchers have begun building an online voucher-based DNA barcoding reference system for the continent’s freshwater fishes, molluscs and mayflies.

Covering an area from the Canary Islands and Portugal in the west to the Ural mountains in the east and using available and freshly collected material, the FREDIE project (Freshwater Diversity Identification for Europe) aims to:

» Create a DNA barcode reference library for Europe’s freshwater biodiversity based on multiple individuals per species covering all major European drainages. Only sequences linked to publically available voucher specimens, deposited in a network of collections and identified by profiled experts will be considered.

» Identify problematic taxa that cannot be identified unambiguously with the classical COI region and test alternative molecular markers for those species.

» Include associated morphological characters in the identification system to assist the identification process where applicable and necessary.

Along with the identification system, the FREDIE data portal will also feature links to new publications about European freshwater diversity and up-to-date checklists of valid species of European freshwater fishes (about 600 species), freshwater molluscs (except Hydrobiidae; about 260 species) and mayflies about 380 species).

FREDIE’s core partner institutes are Zoologisches Forschungsmuseum Koenig (ZFMK) in Bonn, Museum für Naturkunde (MFN) and Leibniz Institut für Gewässerökologie und Binnenfischerei (IGB), both in Berlin.

The project is coordinated by three ZFMK researchers Fabian Herder, Matthias Geiger and Jörg Freyhof.

Bernhard Misof and his team from the newly formed Zentrum für molekulare Biodiversitätsforschung (ZMB) at ZFMK will provide technical support for the project’s identification features.

Work package coordinators are:
**Fish:** Jörg Freyhof (ZFMK, IGB) and Matthias Geiger.
**Molluscs:** Matthias Glaubrecht, Thomas von Rintelen and Katharina Kurzrock.
**Mayflies:** Michael T. Monaghan and Sereina Rutschmann (IGB).

The FREDIE data portal will be maintained by ZFMK. New sequence data will be submitted to the International Nucleotide Sequence Database (INSDC) and integration with Barcode of Life Date Systems (BOLD) is planned.

Geo-referenced data will be made publically available through the BioFresh data portal to other initiatives such as GBIF, FaunaEuropea, LifeWatch, Fishbase and Encyclopedia of Life.

FREDIE is funded by the Leibniz Association Joint Initiative for Research and Innovation.
Dan Janzen Honoured with BBVA Foundation Award

Daniel Janzen, the eminent tropical ecologist and conservationist who became one of the earliest adopters and staunchest advocates of DNA barcoding and the International Barcode of Life project (iBOL), has received the 2011 BBVA Foundation Frontiers of Knowledge Award for Ecology and Conservation Biology.

Announcing the €400,000 award in Madrid, the BBVA Foundation jury cited Janzen’s “pioneering work in tropical ecology and the conservation of tropical ecosystems” that had “moved us from a merely descriptive knowledge of tropical ecosystems to an understanding of their function”.

In the words of the citation: “Daniel Janzen is a supreme example of the complete ecological scientist, combining expertise in natural history with scientific rigor and innovative thinking. He has applied his knowledge to the practical question of biodiversity conservation, and in the process shaped tropical ecology as we know it today.”

The citation describes Janzen as one of “the pioneers of the science of restoration ecology” who has guided the restoration and conservation of thousands of hectares of a formerly degraded landscape and continues to lead an innovative research program with an emphasis on the conservation of tropical biodiversity through its integration with local cultures.

Among his most inspirational ideas, the jury said, was the recruitment of local residents as “parataxonomists”, in effect training inhabitants to recognize a wide variety of species, and to participate in large-scale biodiversity inventories based on DNA barcoding techniques.

For 40 years, he has worked in Costa Rica, where his work has focused on caterpillars, including the plants they eat and the parasites that eat them. For several years, he has been a prodigious contributor to Barcode of Life Data Systems and iBOL, collaborating in the DNA barcoding of more than 12,000 species.

The jury’s citation describes the scale of Janzen’s achievement as the driving force behind the creation of Área de Conservación Guanacaste in Costa Rica. “It started as 10,000 hectares of degraded land and was expanded to 163,000 hectares of a restored, functional forest ecosystem. Now a UNESCO World Heritage Site, the ACG is the working model for the entire Costa Rican national park system.”

Reacting to news of the award, Janzen said: “This award helps me and my wife [ecologist Winnie Hallwachs] to feel that some part of the greater community of scientists and non-damaging users of biodiversity do appreciate what we are trying to do, and have been trying to do since 1985.

“We will use the prize money to finance multiple research projects in taxonomy, ecology, and biodiversity development that other members of the team have not been able to finance for themselves; projects that are integral parts of our efforts to conserve wildlands in the tropics.”
Efforts to promote DNA barcoding as a regulatory protocol have gained considerable traction following two recent developments. First, the US Food and Drug Administration (FDA) launched a barcode-based testing program to clamp down on seafood fraud. Then a Canadian seafood importer began barcode testing imports from China to guard against species substitution.

The FDA started pulling seafood samples from warehouses and distribution centres across the United States in November, putting into practice its new DNA barcode identification program aimed at reducing species substitution, mislabeling and other types of fraud.

The FDA Office of Regulatory Science has announced that nine labs are now set up to generate barcode sequences of seafood samples to determine if they are labeled correctly. Officials say they are targeting cod, grouper, snapper, tuna and other high-value species which are more likely to be substituted.

According to a report in Scientific American magazine, the FDA has been looking into DNA barcoding since 2007, when toxic puffer fish from China entered the country labeled as monkfish and sickened several people.

FDA scientists collaborated with researchers at the Canadian Centre for DNA Barcoding at the University of Guelph, the main sequencing facility for the FISH-BOL initiative to barcode all the world’s fish species.

The FDA worked with the Smithsonian Institution’s Laboratories for Analytical Biology and the Division of Fishes to establish its own fish barcode sequence reference library containing sequences for 250 species of frequently consumed fish, each identified by an expert using a reference specimen from the Smithsonian.

The public library went online November 1, just one week after a major exposé in the Boston Globe, using barcode data generated at CCDB, found that fish bought at Boston area restaurants was mislabeled about half the time.

FDA research biologist and project head Jonathan Deeds said that a DNA barcode test on a fish sample costs only $10 (not including labour and supplies) compared with tests for contaminants such as PCBs or PAHs, which can run as high as $1,000.

National Fisheries Institute spokesman Gavin Gibbons said the low cost of barcode testing could have a big impact on the enforcement of labeling rules. “If we get to a point where there are hundreds or thousands of samples flowing into FDA labs, [testing and enforcement] could have a substantial impact on fraud.”

The FDA is also developing a crustacean database covering species like shrimp, lobster and crab and Deeds says he expects the library to double in size in the next few months. The FDA is also considering using barcoding to detect other mislabeled products such as pet foods and wild game meat.
Meanwhile, the Victoria-based seafood importer Tradex Foods in December implemented DNA testing on fish imports, the Vancouver Sun reported.

Samples taken at processing facilities in China are flown to the United States and tested by a US sequencing and analysis company while the fish itself is in transit to North America by ship. Between 10 and 30 samples are analyzed each month at about $70 per sample.

“A big part of our business model is centred around eliminating fraud which is rampant in our industry,” said Tradex spokesperson Ryan McKay.

The Canadian Food Inspection Agency is currently conducting trials to determine whether it should follow the FDA’s lead and adopt DNA barcoding as a regulatory protocol for seafood. According to the Vancouver Sun report, the CFIA inspects 5,000 lots of imported fish each year from over 1,000 importers and also performs periodic inspections of fish retailers. The agency maintains that the vast majority of fish sampled and analyzed are accurately labelled.

But tests conducted at the CCDB say otherwise. A study published in the October, 2011 edition of the scientific journal Mitochondrial DNA found that 25 to 41 per cent of samples — submitted from across the country by news organizations including The Vancouver Sun between 2008 and 2010 — were mislabelled.

The authors compared the DNA analysis of the samples with the CFIA’s guide for interpreting “false, misleading or deceptive” names.

“High value species are most subject to substitution,” said lead author Dr. Robert Hanner, associate director of the Canadian Barcode of Life Network at the University of Guelph. “But we’ve seen substitution in all categories, wild-caught and aquaculture.”
Members of Pakistan’s DNA barcoding community have agreed to create a national focal point with the goal of engaging the country’s universities and researchers in DNA barcoding.

This was one of the important outcomes of a one-day symposium on DNA barcoding, attended by some 200 scientists, students, conservationists, community and business leaders and other stakeholders from Pakistan.

Participants also agreed to designate the National Institute for Biotechnology and Genetic Engineering (NIBGE), in Faisalabad as the national focal point coordinating DNA barcoding activities as part of the International Barcode of Life project (iBOL).

The symposium – held January 30 at NIBGE and entitled “DNA barcoding: a promising tool for species identification and biodiversity digitization” – was organized by Pakistan’s principal practitioner of DNA barcoding, Dr. Muhammad Ashfaq, of NIBGE Foreign Faculty, with support from iBOL, the Biodiversity Institute of Ontario (BIO) at the University of Guelph.

Dr. Ashfaq told the audience that during the last 20 months about 2,000 arthropod species have been barcoded under the NIBGE-BIO collaborative project “sequencing DNA barcodes of economically important insect species of Pakistan.”

Dr. Ejaz Ahmad, Deputy Director General, WWF, Pakistan highlighted the issues and constraints in biodiversity conservation in Pakistan and reiterated the need to document the endangered species using all the available means.

Other speakers included Dr. Sohail Hameed, Director, NIBGE; and Dr. Yusuf Zafar, Director General, Agriculture & Biotechnology, Pakistan Atomic Energy Commission, who emphasized the need for modern scientific tools such as DNA sequence data to resolve species identity issues.

The symposium featured two technical sessions with various speakers delivering presentations on various aspects of DNA barcoding:

» Dr. Sara Adamowicz, Director Collections, Biodiversity Institute of Ontario, Canada (via Skype) – The utility of DNA barcoding for biodiversity documentation, ecological research and environmental quality monitoring.

» Dr. Alex Borisenko, Curator, Biodiversity Institute of Ontario, Canada (via Skype) – Front-end processing of natural history collection specimens to facilitate DNA barcoding.

» Sujeevan Ratnasingham, Director Informatics iBOL/ Biodiversity Institute of Ontario, Canada (via Skype) – Barcode of Life Data Systems (BOLD).

» Dr. Muhammad Ashfaq, NIBGE, Faisalabad – DNA barcoding in Pakistan: progress, applications and prospects.

» Dr. Muhammad Mukhtar, Vector Control Specialist, Directorate of Malaria Control, Islamabad – Ecology and population dynamics of dengue vectors in Pakistan.

» Dr. Muhammad Rafique, Director, Pakistan Natural History Museum, Islamabad – Diversity, distributional patterns and importance of identification of freshwater fishes of Pakistan using DNA barcoding technique.

» Dr. Paul De Barro, Senior Principal Research Scientist, CSIRO, Australia (via Skype) – Mitochondrial COI and the Bemisia tabaci species debate.

» Ms. Zaib un Nisa, Graduate student, GC, University, Lahore – DNA barcoding at Lahore Botanical Garden.

» Dr. Mahmood ul Hassan, Associate Professor, Zoology, University of Agriculture, Faisalabad – DNA barcoding, a promising technique for the conservation of genetic resource of small mammals of Pakistan.

» Dr. Masroor E. Babar, Director, Biotechnology and Biochemistry, University of Veterinary and Animal Sciences, Lahore – DNA fingerprinting and barcoding for different species and breeds of livestock in Pakistan.