international BARCODE OF LIFE

BARCODE BULLETIN

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The newsletter of the International Barcode of Life project

Countdown to launch

iBOL's towering ambition: 5M barcodes in 5 years

The world's tallest tower will be the launch pad for the world's biggest biodiversity genomics project when the International Barcode of Life Consortium (iBOL) is officially activated at Toronto's CN Tower on Saturday, September 25.

The event marks the start of Phase 1 of the iBOL initiative – with the ambitious goals of assembling five million barcodes representing 500,000 species by September 2015.

Ontario's Minister for Research and Innovation, Glen Murray, will officially launch iBOL during a 340--metre high reception in the Tower's Horizons room. The event will be attended by federal, provincial and municipal leaders, heads of funding agencies and research partners, industry and media leaders and members of the iBOL Board of Directors.

Also there to celebrate this important milestone – fresh from two days of deliberations in nearby Guelph – will be members of the iBOL Scientific Steering Committee who will arrive from as far afield as Argentina, Australia, China and Kenya.

The official launch will be followed by a celebration dinner in the 360 Restaurant, which completes a full revolution every 72 minutes. ✤

iBOL steering committee holds second meeting

DNA barcoding experts from every region of the world are gathering in Guelph, Ontario September 23-26 for the second meeting of the iBOL Scientific Steering Committee (SSC).

"This year's SSC meeting has a dual purpose," said iBOL Executive Director Peter Freeman. "to celebrate the project's formal launch and to focus on the road ahead in meeting our deliverables over the next five years."

Delegates will review the current status of the project and then identify major goals, opportunities, challenges and strategies to be addressed within the iBOL structure of five program themes and 20 working groups.

These recommendations will then be incorporated into an overall roadmap for iBOL that also addresses the role of Central, Regional and National nodes in driving its ambitious agenda.

The meeting will culminate in a reception and dinner at Toronto's CN Tower to celebrate the official inaurugation of iBOL .

Section of DNA barcode for *Castor canadensis*

ECBOL 2 delegates see need for large-scale funding

Specimen collections in museums and other institutions could form the core of a major proposal for large-scale funding of DNA barcoding in Europe, according to participants at the second conference of the European Consortium for the Barcode of Life (ECBOL 2) held June 2-4 in Braga, Portugal.

The funding issue was highlighted during a discussion on the status of barcoding in Europe, during which delegates identified several problem areas:

- Relatively little involvement in global barcoding campaigns and no European-based campaigns except QBOL;
- Little focus on barcoding infrastructure despite EU collections networks such as CETAF, EDIT and Species2000; and
- A weak or undefined relationship with other funded biodiversity projects that generate collections.

ECBOL 2, coordinated by Filipe Costa of the University of Minho (and Portugal's representative on the iBOL Scientific Steering Committee), attracted almost 150 participants from 21 countries and featured nine invited speakers, 103 contributed presentations and 57 posters. The goal of the conference was to provide an opportunity for European barcoding groups to interact and receive updates on new technologies as well as commercial and scientific applications of barcoding.

Invited speakers included Bob Hanner, Director of External Relations with the International Barcode of Life (iBOL) Consortium, who presented an update on iBOL's progress towards official activation in Toronto on September 25, and Mehrdad Hajibabaei, the leader of iBOL Working Group 4.1 (Environmental Barcoding), who described advances in next generation sequencing technologies and their application to barcoding. ✤

The iBOL delegation to ECBOL 2 was led by Mehrdad Hajibabaei (left) and Bob Hanner.

PLoS launches marine barcoding collection

The first Public Library of Science collection dedicated to a DNA barcoding theme was launched June 28 with the inauguration of the PLoS One MarBOL collection.

The collection of papers presents research in the field of Marine Barcoding under the auspices of MarBOL, a joint effort of the Consortium for the Barcode of Life (CBOL) and the Census of Marine Life (CoML) to enhance the capacity to identify marine life using DNA barcoding.

The collection kicked off with five papers exploring such diverse topics as:

- Using barcodes to establish dissimilarity of species and forms of planktonic *Neocalanus* copepods;
- Exploring genetic diversity and evolution within an enigmatic phylum by barcoding arrow worms from three oceans;
- Revealing new clades and radiation patterns of Indo-Pacific sponges;
- Showing the genetic differences between the "bipolar" pteropod species *Limacina helicina* from the Arctic and Antarctic Oceans; and
- DNA-Based identifications for the ornamental fish trade.

The PLoS One Marbol Collection can be accessed at http://www.ploscollections.org/static/poneCollections.action ✤

Planning under way for Fourth International Barcode of Life Conference

Planning has begun for the Fourth International Barcode of Life Conference to be held in the second half of next year.

Nineteen organizations from 14 countries have expressed their interest in hosting the event. The Consortium for the Barcode of Life (CBOL) has sent all interested parties a set of conference guidelines and asked them to submit formal proposals by September 1. CBOL's Executive Committee will select the host organization by October 1.

Members of the global barcoding community have been getting together every two years, starting in London in February 2005, followed by Taipei in September 2007 and finally Mexico City last November.

The conference is one of the biggest undertakings on the CBOL work program and now the organizing team is looking for input from barcoders on how future events should unfold. The guidelines require that the conference:

- Be held at a scientifically interesting venue, not a hotel or conference center. Past conferences have taken place at a natural history museum, a research institute and an Academy of Sciences. What other type of venue would interest you?
- Be near a major international airport to keep travel expenses down. But should a more remote location be considered even if it costs more?
- Have a conference hall that can hold at least 350 people. Should the conference be as large as possible or should it be kept to a more manageable size?
- Offer opportunities for cultural events and field excursions before and after the conference. Is this important to you? If biological field trips were organized, would you be interested in participating?

Log in to the Connect Barcode of Life Community Network (www.connect.barcodeoflife.net), go to the discussion forum called Wishlist for the next International Barcode of Life Conference and have your say about what you liked and didn't like about past conferences and what you'd like to see at the next one.

And watch upcoming issues of the Barcode Bulletin for more updates on the Fourth International Barcode of Life Conference. ✤

Barcode Safari

Researchers head for South Africa's biodiversity hotspots

A fleet of 10 Toyota Hilux pickups carrying South African and Canadian researchers set out from the University of Johannesberg September 20 on a 17-day expedition to document South Africa's animal and plant species in three biodiversity hotspots.

The Toyota Enviro Outreach Team is taking scientists and students from the University of Johannesburg, University of Guelph, Cape Nature and SANPARKS to remote areas of the country to collect plant and animal specimens for DNA barcoding as part of the iBOL project.

Toyota has signed on to provide vehicles and logistical support for annual barcoding expeditions for the next three years. South Africa has undertaken to barcode 20,000 specimens by April 2011 and a further 40,000 specimens by April 2013.

The benefits of this ambitious work program will be enormous. Applications of the DNA barcode identification system with special significance for South Africa include curbing the illegal trade in endangered species, controlling pests and vectors of disease and identifying invasive and poisonous organisms. However, the main application will be to assess species diversity in biodiversity hotspots where a shortage of specialist skills hampers conservation efforts.

TOYOTA enviro outreach

Route Map 2010

Klipbokkop, Noup, Kogelberg, Elandsberg, Knysna Diepwalle, Addo National Park

The Toyota Enviro Outreach initiative will start at the Klipbokkop Mountain Reserve and will run until October 6. During their travels, the research team will work in three of the world's 34 global biodiversity hotspots – the Succulent Karoo, the Cape Floristic Region and Maputaland-Pondoland-Albany.

The goal is to collect specimens from a broad range of taxa and to produce DNA barcode records for all of them. These barcode sequences will be uploaded on the Barcode of Life Data Systems (BOLD), where they will become part of a growing reference library of DNA barcodes for South African plants and animals that is freely available for use by the broader scientific and amateur naturalist communities.

All voucher specimens will be deposited in major national collections where they will be available for examination and in-depth analysis by researchers. The project will also expand the electronic information base on South African biodiversity

and facilitate the growth of the National Collecting Program.

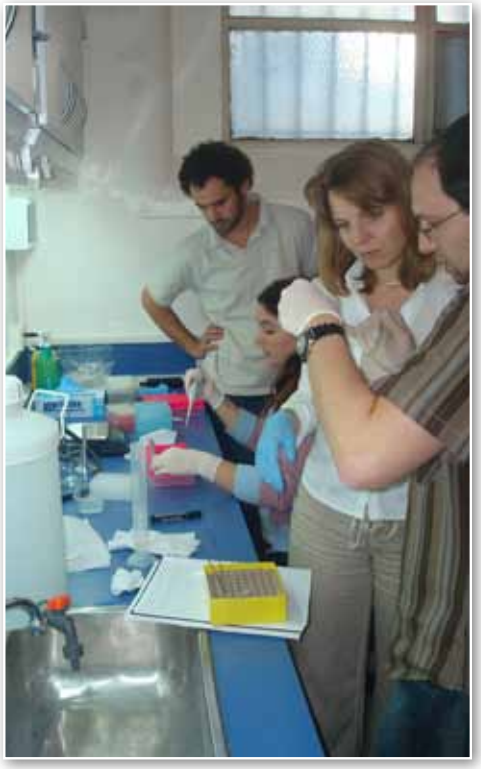
"With these expeditions, Toyota provides the African Centre for DNA Barcoding at the University of Johannesburg together with its partner institutions the unique opportunity to collect research samples from parts of Africa that are normally inaccessible," said Prof. Kinta Burger, the Dean of Science at the University of Johannesburg.

iBOL Scientific Director Paul Hebert said: "The importance of South Africa to the iBOL initiative cannot be overstated. From our perspective, it is the ideal combination – a country with vast biodiversity and a community of skilled scientists dedicated to the application of DNA barcoding in species identification. We are immensely grateful to the Toyota Enviro Outreach initiative for its assistance in ensuring that South Africa achieves its barcoding targets." ✤

University of Johannesberg researchers Michelle van der Bank and Olivier Maurin with one of the Toyoto Enviro vehicles on a test run to magnificent Klipbokkop Mountain Reserve (below).

Two examples of the remarkable flora encoutered at Klipbokkop.

Buenos Aires workshop attracts 60 researchers



The second Leading Labs Training Workshop entitled Extending and Enhancing DNA Barcoding Research in Argentina and Neighbouring Countries attracted a big contingent of researchers from Argentina and six other South American nations.

The five-day workshop, held at Argentina's Bernadino Rivadina Museum of Natural Sciences in Buenos Aires, attracted more than 60 participants – most from Argentina but also five from Peru, two each from Ecuador, Bolivia and Colombia, one each from Brazil and Uruguay.

The workshop was opened by Dr. Faustino Siñeriz, vice president of Argentina's National Council of Scientific and Technical Research (CONICET) and a member of the board of Directors of the International Barcode of Life project.

A team from the Biodiversity Institute of Ontario travelled to Buenos Aires to lead some of the technical sessions. The BIO contingent included Lead DNA Scientist Nataly Ivanova, Director of Collections, Alex Borisenko, Quality Control Analyst Anibal Castillo and Research Associate José Fernández Triana. Argentine instructors were Pablo Tubaro, vice director of the Museum of Natural Sciences, and CONICET researchers Dario Lijtmaer and Cecilia Kopuchian.

The workshop began with sessions introducing front-end processing of specimens, DNA barcoding protocols and Barcode of Life Data Systems (BOLD). These themes were expanded and examined in more detail during subsequent sessions with an emphasis on hands-on instructions and demonstrations by local and visiting experts.

The closing sessions were devoted to several lively discussions about how participants could help to promote DNA barcoding in Argentina and its neighbours. ✤

Tackling health threats, one bug at a time

By Nicole Yada

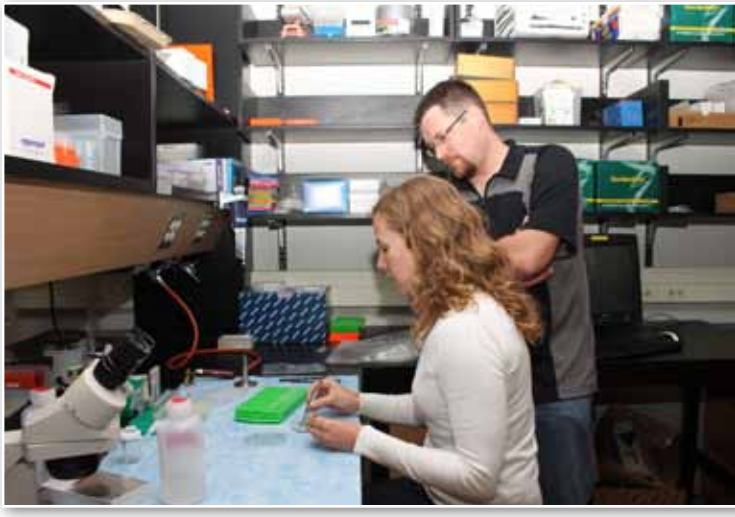
One of the most important weapons in the fight against diseases such as malaria and West Nile virus is the ability to identify and track the mosquitoes that transmit them. Fingering mosquitoes and other vectors of disease has always been a major obstacle but researchers working on the new Health Barcode of Life (HealthBOL) project are planning to change all that.

Launched at a meeting in Nairobi in May, HealthBOL is an International Barcode of Life (iBOL) campaign that will focus on identifying and diagnosing insects and ticks and the diseases they carry as well as a range of parasites affecting humans and other animals.

iBOL's goal is to create five million barcode records from 500,000 different species in five years. Within this timeline, HealthBOL aims to barcode about 10,000 different species directly related to health matters.

HealthBOL made its debut in Africa due to the prevalence of malaria and other insect-borne diseases there. And with approximately 3,000 different species of mosquitoes around the world, HealthBOL researchers have their work cut out for them. "Anywhere there are vector-borne diseases, which is essentially anywhere there are humans, is where we'll focus," says HealthBOL scientific coordinator Ryan Gregory.

At the Kenya conference, Gregory, professor of integrative biology at the University of Guelph, and post-doctoral fellow Dr. Tara Gariepy, named mosquitoes, black flies, tsetse flies, sand flies, ticks, roundworms, flatworms and single-celled parasites as their principal targets.



HealthBOL campaign leader Ryan Gregory and post-doc Tara Gariepy prepare specimens for barcode analysis in their lab at the University of Guelph.

The ability to quickly and positively identify species is vital for controlling the spread of disease. Fewer than five per cent of mosquito species carry diseases, so being able to identify them is extremely important for the targeted deployment of preventative measures such as mosquito nets, insecticides and treatment of standing water.

While obtaining high quality DNA barcodes from thousands of species is a mammoth task, Gregory foresees good prospects for attaining the specimens needed through worldwide collaborations. For example, the HealthBOL team includes researchers from the Natural History Museum in London, England, which already has samples of many different mosquito species in its collection. They will also be working with species captured through surveillance systems operated by scientists in the field collecting specimens for malaria research in Kenya and elsewhere.

At their University of Guelph base, Gregory and Gariepy are working with Prof. Jonathan Barta, of the Pathobiology Department, and various taxonomic experts who are assisting with species identification.

Looking ahead, HealthBOL plans to coordinate with frontline vector monitoring programs, such as those of the United States military, which already tracks mosquitoes because of their impact on local populations and on their own personnel. ✤

Mosquitos specimens (whole and partial) await tissue sampling before being sent for barcoding.

Nicole Yada is a writer for the Students Promoting Awareness of Research Knowledge (SPARK) program at the University of Guelph.

GigaPan: Integrating high-resolution imagery into Barcoding

By M. Alex Smith

"Miles Zhang, Alex Smith, Jill Smith and Renee Labbee in Cape Breton Highlands National Park, Nova Scotia, Canada – BIObus 2009. (photo by Jay Cossey)". [Links at www.ibol.org/gigapan/]

Since 2008, I've been one of a group of scientists beta-testing the GigaPan. This remarkable piece of equipment consists of three technological developments:

- A robotic camera mount for capturing very high-resolution (gigapixel and up) panoramic images using a standard digital camera;
- Custom software for constructing very high-resolution gigapixel panoramas; and
- A new type of website for exploring, sharing and commenting on gigapixel panoramas and the detail users will discover within them.

Carnegie Mellon University researchers Illah Nourbakhsh and Randy Sargent

Note to readers: The remarkable images produced by the GigaPan have to be seen to be believed. To appreciate the versatility and potential of this remarkable tool, check out the web version of this feature where you will find links to some of the panoramas Alex Smith has produced. Go to www.ibol.org/gigapan/
The two GigaPan panoramas on these pages show the tablelands of Gros Morne National Park in Newfoundland (top) and the Gros Morne National Park Discovery Centre (below)

developed the robot and the software, while working with NASA on the Mars Rover project. [Link at www.ibol.org/gigapan/]

Each panorama is filled with a fantastic amount of information! Follow one of the links in the examples mentioned below. Zoom in, move around and explore. A feature of the viewing software, called 'snap-shoting', allows viewers to highlight a section of the photo and then annotate or comment on it; very valuable for collaborations or outreach.

The initial snapshots are visible in the bottom left hand side of the panorama. If you select a snapshot, the comments the author has made appear to the right hand side, while the viewer is zoomed in to that section of the GigaPan. GigaPans can also be integrated seamlessly into Google Earth. The view here is projected on a sphere so that you can explore in a more complete immersion of the image placed on the globe.

Here are three recent examples of how I have easily integrated the GigaPan into my collections, barcoding and ecological workflows:

Aboard the BIObus

In the spring and summer of 2008, 2009 and 2010 students and volunteers were trained in the use of the GigaPan as they accompanied the Biodiversity Institute of Ontario's mobile collection vehicle, the BIObus, on collection expeditions across North America.

In 2009, this group travelled through six National Parks in eastern Canada collecting invertebrates to add to a growing library of reference specimens and sequences in a library of DNA barcodes. At each collecting locality, GigaPans were taken to capture the environment, weather, habitat etc. of the collection site and of the act of collection itself. [Links at www.ibol.org/gigapan/]

Some people took some convincing to place themselves in the GigaPan but they ended up enjoying the process [Link at www.ibol.org/gigapan/]. This was important because the point of the exercise is not just WHAT was collected and WHERE, but WHO, WHY and WHEN – and so our appearance in the shot is part of that narrative.

Below: GigaPan recording habitat from collection site on Volcan Orosi, Costa Rica, January 22, 2010. [Links at www.ibol.org/gigapan/]

Sampling ant community change in Costa Rica

When I am sampling ant communities on volcanos in northwestern Costa Rica, I often feel overwhelmed by the floristic diversity that surrounds me.

Continued on next page

GigaPan: Integrating high-resolution imagery into Barcoding

Continued from previous page

From low-elevation tropical dry forest, through wet mid-elevation rainforest to high-elevation cloud forest, I record my field notes with a concern in the back of my mind that my lack of botanical literacy may mean that I will miss an important piece of metadata that will help contextualize my collections and ecological tests.

To help mitigate this concern, I have begun carrying the GigaPan tripod and unit up to each sampling site. After I set up my traps and while I am actively collecting at that elevation, the GigaPan is snapping photographs. The terabytes of spatially referenced gigapixel imagery is a far superior descriptor of the habitat than my vocabulary. It is also much easier to share – whether as a scientific inquiry (Dear Dr. x – can you tell me what this plant is…) or as outreach. Explore one of the collection sites from this winter on Volcan Orosi here as a Google Earth file. [Link at www.ibol.org/gigapan/]

Seasonal changes in the Dairy Bush

The weekly GigaPan panoramas that I shot in the Dairy Bush, a patch of forest near the University of Guelph, between August 2009 and 2010 [Link at www.ibol.org/gigapan/] were an attempt to make this urban woodlot more accessible to the student and city populations.

Urban forests are exposed to intense anthropogenic pressures of degradation, fragmentation, biological invasion and destruction – and there is evidence of such changes in the GigaPan series. The series also captured the phenology of the native flora and fauna of the forest.

The year-long Dairy Bush GigaPan has captured many examples of seasonal changes in both native and invasive understory plants and animals and examples of environmental damage. It is used in several ecology classes at the University of Guelph to complement field trips to the Dairy Bush.

Conclusions

DNA barcoding is a force for democratizing information and bolstering bioliteracy. I see many comparable features to the GigaPan. Both are publicly accessible, both will be annotated through time by a community of experts and non-experts alike, and both exist as a synthetic connection from the digital to the natural world.

One key to our capacity to understanding the changes caused by the increasing pressures of the urbanization and degradation of natural environments will be ongoing monitoring through time. If such monitoring is democratized and publically available as DNA barcodes and GigaPans then a marginalized environment may become more valued by the human population. ✤

Alex Smith is an assistant professor of molecular ecology at the University of Guelph, Department of Integrative Biology and the Biodiversity Institute of Ontario (BIO) where his research involves the discrimination of cryptic species and fragmented spaces using ants, parasitoids and amphibians. He is the Global co-Lead for Ants within iBOL Working Group 1.9 – Terrestrial Bio-Surveillance and is iBOL's IDRC Project Coordinator for Costa Rica.

The author sets up the GigaPan at the Dairy Bush woodlot in Guelph" (photo Andrew Vowles) [Links at www.ibol.org/gigapan/]

Spotlight on barcoding at plant pest meeting

Participants in the Technical Panel for Diagnostic Protocols, Washington, DC, July 2010"
Front row: Liping Yin, Animal and Plant Inspection and Quarantine Technology Center, Shanghai, China; Geraldine Anthoine, Le Rheu, France; Julie Aliaga, USDA/APHIS, Riverdale, Maryland, USA; Fabienne Grousset, IPPC Secretariat; Mallik Malipatil, Department of Primary Industries Research Victoria, Australia; Delano James, Canadian Food Inspection Agency, Sidney, BC, Canada
Back row: Gerard Clover, Ministry of Agriculture and Forestry Biosecurity, Auckland, New Zealand; Johannes de Gruyter, Plant Protection Service, Wageningen, Netherlands; Jens-Georg Unger, Federal Biological Research Centre for Agriculture and Forestry, Braunschweig, Germany; Brent Larson, IPPC Secretariat; David Schindel, CBOL

The use of DNA barcoding to identify agricultural pests was a hotly discussed topic during the recent meeting of the Technical Panel on Diagnostic Protocols (TPDP) of the International Plant Protection Convention held in the Smithsonian Institutions's National Museum of National History in Washington D.C. from July 26-30.

The meeting was co-hosted by the Consortium for the Barcode of Life (in its capacity as lead of iBOL Working Group 5.2 - Outreach and Networking) and the US Agriculture Department's Animal and Plant Health Inspection Service.

The TPDP devoted a half day on their agenda to presentations on barcoding, including iBOL, CBOL and QBOL (the project to barcode quarantined European pest species) followed by a tour of the museum's molecular lab in nearby Suitland, Maryland.

The TPDP reviewed two documents related directly to barcoding:

- A proposal from Australia that barcoding be considered as a standard approach to diagnostic protocols (DPs) for regulated agricultural pests; and
- A review of molecular methods, including barcoding, that could be used to identify immature fruit fly species.

In the ensuing discussion, there was general agreement that barcoding was much better organized and developed than panel members had realized. They expressed a keen interest in seeing formal proposals for diagnostic protocols based on DNA barcodes.

In an informal discussion about how barcoding can be incorporated into the convention's DPs, several critical questions were identified:

- Getting a DP approved is a long and complicated process. Since the first TPDP meeting in 2004, only a single DP has been approved. Could standardized barcoding protocols expedite the process?
- Most proposed DPs use morphology to diagnose adult specimens but some draft DPs are now proposing molecular techniques as a complement to morphology, specifically for pre-adult stages. DPs for bacteria and viruses are based mostly on molecular techniques. Could future DPs rely entirely on sequence data?
- How will developing countries implement DPs that rely on molecular tools? Could regional barcoding labs be established to analyse samples from agricultural inspectors? ✤

The United Nations' International Plant Protection Convention (IPPC) is a 1952 agreement among 173 countries to create international standards limiting the introduction and spread of pests (including weeds and diseases) on plants and plant products. IPPC's Secretariat is located in the UN's Food and Agriculture Organization's headquarters in Rome.

German researchers compiling mountain forest inventory

This forest research station in the Rio San Francisco Valley in southern Ecuador will be headquarters for a three-year pilot study, funded by the German Science Foundation, that is developing DNA barcode-based workflows to inventory insect and plant communities in a tropical mountain forest.

The sampling location for the project is Podocarpus National Park, where a pristine, species-rich forest extends from 1,000 to 3,50 metres above sea level. Sampling will focus on microalgae, lichens, bryophytes, ferns and insects.

First surveys of the region's moth fauna reveal extreme species diversity. Species accumulation curves developed by Dr. G. Brehm suggest that the area harbours more than 1,200 species of moths.

Institutions participating in the project are the University of Göttingen, the University of Bonn, the Botanical Collections of the State of Bavaria, the State Museum for Natural History in Stuttgart and the Zoological Research Museum in Bonn.

More information: J. Wolfgang Waegele, Museum Koenig, Bonn. w.waegele.zfmk@uni-bonn.de.

Word Scramble

Unscramble the phylum names and put the letters in the boxes.
Then, use the letters in the gray-shaded boxes to unscramble the answer to the riddle, below!

NNEADIAL

COTCAMAOSY

MAOLPTINOYGAH

DCIARIAN

EMEAYSHTNHILTLP

Why do DNA barcoders walk funny? (2 words)

Solution in next issue

The Barcode Bulletin needs YOU!

Whether you're a DNA barcode project leader, a researcher or just an interested onlooker, this is your newsletter and it needs your input.

Tell us what you're doing, what others are doing or what you think about the latest developments in barcode research. Seen something interesting? Let us know. Send comments, pictures, cartoons, reports from other media … we don't promise to print it but we do promise to look it over.

You can contact us at bulletin@ibol.org

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International Barcode of Life Secretariat,
Biodiversity Institute of Ontario, University of Guelph,
20 Stone Road East, Guelph, ON, Canada N1G 2W1
Tel: 1-519-780-5483 Fax: 1-519-824-5703
www.ibol.org

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