

# Mehrdad Hajibabaei, Ph.D.

## **Contact information**

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## **Education**

Ph.D., Biology (Molecular Evolution and Bioinformatics), 2003, Ottawa

B.Sc., Biology (Microbiology), 1994, Tehran

## **Present positions**

Assistant Professor (tenure-track), Department of Integrative Biology, University of Guelph, Canada (2009-)

Director, Technology Development, Biodiversity Institute of Ontario

## **Previous positions**

Research Scientist, Biodiversity Institute of Ontario, University of Guelph (2006-January 2009)

Associate Director, Canadian Centre for DNA Barcoding (2006-2009)

Postdoctoral Fellow, Department of Integrative Biology, University of Guelph, Guelph, Canada, (2003-2006)

Research Assistant, Department of Biology, University of Ottawa (1998-2003)

Teaching Assistant, Department of Biology, University of Ottawa (1998-2003)

## **Awards & Distinctions**

Ranked first (tied) in Genome Canada's Large Scale Applied Research competition in Environment and Forestry category (2011)

Visualization and analysis software for DNA barcode data, 2<sup>nd</sup> International Barcode of Life Conference, Taipei (2007)

Ontario Graduate Scholarship in Science and Technology (2001-2003)

University of Ottawa Tuition Scholarship (2002-2003)

Burroughs Wellcome Fund Scholarship (2002)

### **Research Funding**

<b>Title</b>	<b>Funding Source</b>	<b>Amount (\$)</b>	<b>Role</b>	<b>Support Period</b>
Biomonitoring 2.0: A high-throughput genomics approach for comprehensive biological assessment of environmental change	Genome Canada	3,170,000	Project Leader	2011-2014
Metagenomic approach for the study of total soil biodiversity	Agence de l'environnement et de la maîtrise de l'énergie (ADEME), France	60,000	Co-applicant	2011-2013
Next-generation Biodiversity Analysis	NSERC	100,000	Principle Investigator	2010-2014
International Barcode of Life	Ontario Ministry of Research and Innovation	8,082,900	Co-applicant	2011-2016
Integrative & Innovative Biodiversity Analysis from Tundra to the Tropics	Canada Foundation for Innovation	937,299	Principle Investigator	2012-2014
DNA probe identification and testing for use on 3D-Biochip product	Research contract from Safeguard Biosciences Inc.	173,600	Principle Investigator	2007-2008
Environmental barcoding of benthic macroinvertebrates	Environment Canada	131,000	Principle Investigator	2009-2010
Environmental barcoding for water quality assessment	Environment Canada	12,000	Principle Investigator	2010
International Barcode of Life Consortium	Genome Canada	25,000,000	Co-applicant and WG 4.1 Chair	2009-2014
DNA identification of animal tissue in cattle feed	Ontario Genomics Institute	100,000	Principle Investigator	2008-2011
Environmental DNA barcoding through massively parallelized sequencing	Genome Canada	1,800,000	Co-applicant and Research Coordinator	2008-2010

### **Peer reviewed publications**

Shokralla S, Zhou X, Janzen DH, Hallwachs W, Landry JF, Hajibabaei M (2011) Pyrosequencing for mini-barcoding of fresh and old museum specimens. *PLoS One*: in press.

Hajibabaei M, MaKenna C (2011) DNA Mini-barcodes. In: Kress WJ, Erickson DL, editors. *Methods in Molecular Biology, DNA BARCODES: METHODS AND PROTOCOLS*. Berlin: Humana Press, Springer Science+Publishing Media, LLC. pp. in press.

Hajibabaei M, Shokralla S, Zhou X, Singer GAC, Baird DJ (2011) Environmental barcoding: a next-generation sequencing approach for biomonitoring applications using river benthos. *PLoS ONE* 6: e17497.

Kesanakurti PR, Fazekas AJ, Burgess KS, Percy DM, Newmaster SG, Graham SW, Barrett SCH, Hajibabaei M and Husband BC (2011) Spatial patterns of plant diversity below-ground as revealed by DNA barcoding. *Molecular Ecology*, no. doi: 10.1111/j.1365-294X.2010.04989.x

Baird DJ, Pascoe TJ, Zhou X, Hajibabaei M (2011) Building freshwater macroinvertebrate DNA-barcode libraries from reference collection material: formalin preservation vs specimen age. *Journal of the North American Benthological Society* 30: 125-130.

Baird DJ, Baker CJO, Brua R, Hajibabaei M, McNicol K, Pascoe T, de Zwart D (2011) Towards a knowledge infrastructure for traits-based ecological risk assessment. *Integrated Environmental Assessment and Management* 7:209-215.

Shokralla S, Singer GAC, Hajibabaei M (2010) Direct PCR amplification and sequencing of specimens' DNA from preservative ethanol. *BioTechniques* 48:233-234. Listed among high ranking papers and a commentary was published about this work.

Albu M, Nikbakht H, Hajibabaei M, Hickey DA (2010) The DNA Barcode Linker. *Molecular Ecology Resources*, doi: 10.1111/j.1755-0998.2010.02901.x

Wilson JJ, Landry JF, Janzen DH, Hallwachs W, Nazari V, Hajibabaei M, Hebert PDN (2010) Identity of the ailanthus webworm moth (Lepidoptera: Yponomeutidae), a complex of two species: evidence from DNA barcoding, morphology and ecology. *ZooKeys* 46: 41-60.

Burns JM, Janzen DH, Hallwachs W, Hajibabaei M, et al. (2010) Genitalia, DNA barcodes, larval facies, and foodplants place the mimetic species *Neoxeniades molion* in Rhinthon (Hesperiidae: Hesperinae). *Journal of the Lepidopterists' Society*, 2010, 64: 69-78.

Hollingsworth PM, and 51 others (2009). A DNA barcode for land plants. *Proceedings of the National Academy of Sciences U.S.A.*, 106:12794-12797.

Janzen DH, and 45 others (2009) Integration of DNA barcoding into an ongoing inventory of complex tropical biodiversity. *Molecular Ecology Resources*, 9s1:1-26.

Fazekas AJ, Kesanakurti PR, Burgess KS, Percy DM, Graham SW, Barrett SC, Newmaster SG, Hajibabaei M, Husband BC (2009) Are plant species inherently harder to discriminate than animal species using DNA barcoding markers? *Molecular Ecology Resources*, 9s1:130-139.

Hajibabaei M, Singer GAC (2009) Googling DNA Sequences on the World Wide Web. *BMC Bioinformatics Suppl* 14:4 pp.

Singer GAC, Hajibabaei M (2009) iBarcode.org: web-based molecular biodiversity analysis. *BMC Bioinformatics* 2009, 10 Suppl 6:S14.

Burns JM, Janzen DH, Hallwachs W, Hajibabaei M, and Hebert PDN (2009) Genitalia, DNA barcodes, and life histories synonymize *Telles* with *Thracides*--a genus in which *Telles arcalaus* looks out of place (Hesperiidae: Hesperinae). *Journal of the Lepidopterists' Society*, 63(3): 141-153.

Zimmermann J, Hajibabaei M, Blackburn DC, Hanken J, Cantin E, Posfai J, Evans TC, Jr. (2008) DNA damage in preserved specimens and tissue samples: a molecular assessment. *Frontiers in Zoology*, 5:18.

Meusnier I, Singer GAC, Landry JF, Hickey DA, Hebert PDN, Hajibabaei M (2008) A universal DNA mini-barcode for biodiversity analysis. *BMC Genomics* 2008, 9:214. (Ranked as highly accessed article)

Fazekas AJ, Burgess KS, Kesanakurti PR, Graham SW, Newmaster SG, Husband BC, Percy DM, Hajibabaei M, Barrett SC (2008). Multiple multilocus DNA barcodes from the plastid genome discriminate plant species equally well. *PLoS One*, 3:e2802.

Burns JM, Janzen DH, Hajibabaei M, Hallwachs W, Hebert PDN (2008) DNA barcodes and cryptic species of skipper butterflies in the genus *Perichares* in Area de Conservación Guanacaste, Costa Rica. *Proceedings of the National Academy of Sciences U.S.A.*, 105:6350-6355.

Hajibabaei M, Singer GAC, Hebert PDN, Hickey DA (2007) DNA barcoding: how it complements taxonomy, molecular phylogenetics and population genetics. *Trends in Genetics*, 23:167-172. (Published as cover story and ranked 5<sup>th</sup> in the Top 25 Hottest Articles in April-June 2007)

Hajibabaei M, Singer GAC, Clare EL, Hebert PDN (2007) Design and applicability of DNA arrays and DNA barcodes in biodiversity monitoring. *BMC Biology*, 5:24. (Ranked as highly accessed article)

Burns JM, Janzen DH, Hajibabaei M, Hallwachs W, Hebert PDN (2007) DNA barcodes of closely related (but morphologically and ecologically distinct) species of skipper butterflies (Hesperiidae) differ by only one to three nucleotides. *Journal of the Lepidopterists' Society*, 61:138-153.

Hajibabaei M, Xia J, Drouin G (2006) Seed plant phylogeny: gnetophytes are derived conifers and a sister group to Pinaceae. *Molecular Phylogenetics and Evolution*, 40:208-217.

Hajibabaei M, Smith MA, Janzen DH, Rodriguez JJ, Whitfield JB, Hebert PDN (2006) A minimalist barcode can identify a specimen whose DNA is degraded. *Molecular Ecology Notes*, 6:959-964. (Ranked among top 20 accessed papers on journal's website)

Hajibabaei M, Singer GAC, Hickey DA (2006) Benchmarking DNA barcodes: An assessment using available primate sequences. *Genome*, 49:851-854.

Hajibabaei M, Janzen DH, Burns JM, Hallwachs W, Hebert PD (2006) DNA barcodes distinguish species of tropical Lepidoptera. *Proceedings of the National Academy of Sciences U.S.A.*, 103:968-971. (Presented as cover image and ranked 4<sup>th</sup> among 50<sup>th</sup> Most-Read Articles in January 2006)

Janzen DH, Hajibabaei M, Burns JM, Hallwachs W, Remigio E, Hebert PD (2005) Wedding biodiversity inventory of a large and complex Lepidoptera fauna with DNA barcoding. *Philosophical Transactions of the Royal Society B: Biological Sciences*, 360:1835-1845.

Hajibabaei M, deWaard JR, Ivanova NV, Ratnasingham S, Dooh RT, Kirk SL, Mackie PM, Hebert PDN (2005) Critical factors for assembling a high volume of DNA barcodes. *Philosophical Transactions of the Royal Society B: Biological Sciences*, 360:1959-1967.

### **Patent**

**Hajibabaei, M.**, P.D.N. Hebert, and D.A. Hickey, 2006. Method and device for DNA barcode sequence searching. (patent filed on June 2007, Reference provisional patent # H310952US, patent application was not pursued passed 2008)

### **Software**

**GoogleGene**, Searching for DNA barcode sequences by using Google search engine.

**www.iBarcode.org**, Web-based analysis and visualization tools for DNA barcoding. (Winner of the visualization and analysis software award in the 2<sup>nd</sup> International Barcode of Life Conference, September 2007, Taipei)

### **Training Highly Qualified Personnel**

#### **Postdocs (total 4)**

Shadi Shokralla (postdoctoral fellow), Environmental barcoding using massively parallelized pyrosequencing, 2008-

Pedro Pedro (postdoctoral fellow), Large-scale tropical biodiversity and phylogeography analysis using next-generation sequencing approaches, 2009-2010

Isabelle Meusnier (postdoctoral fellow), Developing DNA barcoding in fungi, plants, and protists, 2007-09

Suresh Nick (postdoctoral fellow), Micro-array identification of fish species, 2007-2008

#### **Graduate Students (total 4)**

Jennifer Spall (MSc), Next generation biomonitoring. 2011-

Claudia Bertrand (MSc), Evaluating cryptic diversity in barcoded Lepidoptera of Costa Rica. 2009-

Saina Taidi (MSc), Biodiversity Assessment of Insects from Environmental Samples Using Next-generation Parallelized Sequencing of DNA Barcodes. 2008-

Rebecca Bloch (PhD), DNA barcoding of fresh water invertebrate communities. Based at Uni. Frankfurt, Germany. 2009-

#### **Undergraduate thesis (total 4)**

Fiona Tsoi (B.Sc. honours student), Investigating the largest subunit of RNA polymerase I as an alternative gene marker for species identification, 2010-2011

J.E. McGregor (B.Sc. project student), Toward a universal primer cocktail for the DNA barcoding of land plants, 2009-2010

Jared Hortie (B.Sc. honours student), Sample preparation for environmental barcoding, 2007-2008

Claudia Bertrand (B.Sc. project student), Plant DNA barcoding, 2008

#### **Teaching experience**

Guest Lecturer, Probing Biodiversity Using Molecular Data, Graduate level course, Department of Integrative Biology, University of Guelph (Fall 2006)

Teaching Assistant and Laboratory Instructor. Molecular Biology, Bioinformatics, Evolutionary Biology, and Microbiology. Biology Department, University of Ottawa (1998-2003)

#### **Selected oral presentations**

**June 14, 2011.** *Biomonitoring 2.0.* **Invited** lecture at Department of Biology, University of Calgary, Calgary, CANADA.

**June 13, 2011.** *Biomonitoring 2.0.* **Invited** presentation at Metagenomics workshop, ISMOS3 Conference. Calgary, CANADA.

**May 18, 2011.** *Applying next-generation DNA sequencing for Biomonitoring 2.0 assessment in a threatened national park (Wood Buffalo, Canada).* Contributed presentation at SETAC Europe Annual Meeting, Milan, ITALY.

**May 17, 2011.** *Next-generation Biodiversity Analysis.* **Invited** lecture at Natural History Museum, Paris, FRANCE.

**May 13, 2011.** *Biomonitoring 2.0.* **Keynote** presentation at Workshop on Application of Next Generation DNA Sequencing in Environmental Risk Assessment and Monitoring: Future Challenges. IBM Forum, Milan, ITALY.

**May 1, 2011.** *Next-generation Biodiversity Analysis.* **Invited** presentation at Joint meeting of the Canadian Institute for Advanced Research program in Integrated Microbial Biodiversity and the Canadian Barcode of Life Network. University of British Columbia, Vancouver, CANADA.

**April 8, 2011.** *Biomonitoring 2.0: A high-throughput genomics approach for comprehensive biological assessment of environmental change.* **Invited** presentation at Environmental Metagenomics: the Ontario Landscape workshop, Toronto, CANADA

**June 2, 2010.** *Next-generation Biodiversity Analysis.* **Keynote** lecture at 'Second European Barcode of Life Conference'. Braga. PORTUGAL.

**May 12, 2010.** *Next-generation Biodiversity Analysis.* **Invited** presentation at The Eighth Biennial International Conference on Monitoring and Measurement of the Environment. Toronto. CANADA.

**March 12, 2010.** *Next-generation Biodiversity Analysis.* **Invited** departmental lecture at Ecology/Evolution Seminar Series. Biology Department. Trent University. Peterborough, CANADA.

**February 22, 2010.** *Next-generation Biodiversity Analysis.* **Invited** departmental Lecture at Biology Department Seminar Series. University of Ottawa. Ottawa. CANADA.

**February 17, 2010.** *Next-generation Biodiversity Analysis.* **Invited** presentation (through video-conference) in the 'DNA Barcoding Colloquium'. South California Coastal Water Research Project, Costa Mesa, USA.

**February 12, 2010.** *Next-generation Biodiversity Analysis.* **Invited** presentation at OGI-TCACG symposium *SOLiD approaches to ILLUMINATING the FLXible nature of Nucleic Acids.* Toronto. CANADA.

**December 3, 2009.** *Next-generation Biodiversity Analysis.* **Invited** seminar at NWRI-Burlington Seminar Series. Canadian Centre for Inland Waters. Burlington. CANADA.

**November 26, 2009.** *Commercializing Barcode of Life.* **Invited** presentation at The Second Annual GPI Seven X Seven Breakfast. Guelph. CANADA.

**November 12, 2009.** *DNA barcoding 2.0: environmental monitoring using next-generation sequencing techniques.* **Invited plenary** presentation in the 'Third International Barcode of Life Conference'. Mexico City, MEXICO.

**November 5, 2009.** *Large-scale biodiversity analysis through next-generation sequencing.* **Invited** presentation at symposium Rendez-Vous Sequencage 2009: Welcome to Next-generation Sequencing. McGill University, Montreal. CANADA.

**October 16, 2009.** *DNA barcoding: Identifying Species using DNA.* **Invited public lecture.** Guelph Rotary Club. Guelph. CANADA.

**October 3, 2009.** *Large-scale biodiversity analysis through next-generation sequencing.* Contributed presentation at Next Generation Sequencing Conference, Barcelona, SPAIN.

**September 7, 2009.** *A DNA-based view of the environment through next-generation sequencing technologies.* **Invited** presentation at Trait-based Ecological Risk Assessment (TERA): Realizing the potential of ecoinformatics approaches in ecotoxicology. Burlington, CANADA.

**July 23, 2009.** *Next-generation Species Identification and Biodiversity Analysis.* **Invited** lecture at Canadian Food Inspection Agency. Ottawa. CANADA.

**April 2, 2009.** *Environmental barcoding: a next generation sequencing approach to biodiversity monitoring.* Contributed presentation at Workshop in Evolutionary Genetics - the impact of next generation sequencing technologies, Wittenberg, GERMANY.

**March 5, 2009.** *Next Generation Biodiversity Analysis.* **Invited** lecture at Institute of Ecology and Evolution, UNAM, Mexico city, MEXICO.

**March 3, 2009.** *Assembling DNA Barcodes.* **Invited** presentation at MexBol Workshop, Institute of Biology, UNAM, Mexico city, MEXICO.

**February 18, 2009.** *Assembling DNA Barcodes.* **Invited** presentation at Barcoding-Towards a DNA PDA. Ontario Genomics institute. Toronto, CANADA.

**January 28, 2009.** *Environmental and Biodiversity Genomics.* **Invited** presentation at Next Generation Sequencing Applications using the Roche 454/GS FLX Platform Workshop at TCAG, MaRS, Toronto, CANADA.

**October 21, 2008.** *DNA barcoding: from organisms to environments.* Contributed presentation at Joint Annual Meeting of the Entomological Societies of Canada and Ontario, Ottawa, CANADA.

**September 22, 2008.** *The Barcode of Life Initiative.* **Invited** lecture at University of Bari, Bari, ITALY.

**September 18, 2008.** *Biodiversity Informatics and Barcode of Life.* **Keynote** presentation at European Molecular Biology Network Annual Conference, Martina Franca, ITALY.

**April 28, 2008.** *Environmental Barcoding.* **Invited** presentation at 2<sup>nd</sup> Canadian Barcode of Life Annual Meeting, Royal Ontario Museum, Toronto, CANADA.

**November 2, 2007.** *Molecular Biodiversity and DNA Barcodes.* **Invited** lecture at Department of Biology, University of Toronto at Mississauga, Mississauga, CANADA.

**October 29, 2007.** *Minimalist barcode sequences.* **Invited** presentation at Workshop on Using Barcode Data in Studies of Molecular and Evolutionary Dynamics, Banbury Center, Cold Spring Harbor, USA.

**October 26, 2007.** *The Barcode of Life Initiative.* **Invited** lecture at Biology Department, Concordia University, Montreal, CANADA.

**October 4, 2007.** *Assembling DNA barcodes.* **Invited** talk at European Barcode of Life Conference, Leiden, the NETHERLANDS.

**September 17, 2007.** *Minimalist barcodes.* **Invited plenary** presentation at 2<sup>nd</sup> International Barcode of Life Conference, Taipei.

**August 5, 2007.** *The Barcode of Life Initiative.* **Invited** presentation at ISOP/PSA annual meeting. Rhode Island, USA.

**July 6, 2006.** *Google Gene: searching DNA barcode sequences using Google search engine.* **Invited** presentation at Data Analysis Workshop, Consortium for the Barcode of Life. Paris, FRANCE.

**June 8, 2006.** *The Barcode of life initiative.* **Invited** lecture at New England BioLabs, Ipswich, USA.

**February 7, 2005.** *Protocols for the high-volume assembly of DNA barcodes.* **Invited** presentation at 1<sup>st</sup> International Barcode of Life Conference, London, UK.

**June 10, 2005.** *Discriminating among tropical Lepidoptera with DNA barcodes.* Contributed presentation at Evolution Conference, Fairbanks, USA.

### **Selected Professional Activities**

**Associate Editor, *BMC Evolutionary Biology*** (2010-2013)

**Associate Editor, *BMC Ecology*** (2009-2012)

**Chair**, Environmental Barcoding Working Group, International Barcode of Life Project (2009-)

**Director**, Technology Development, Biodiversity Institute of Ontario (2009-)

**Associate Director**, Canadian Centre for DNA Barcoding (2007-2009)

**Research Program Coordinator**, Canadian Barcode of Life Network (2006-2009)

**Steering Committee membership**, Data Analysis Working Group (CBOL)

**Scientific Panel membership**, for Plant DNA Barcode Selection (CBOL)

**Reviewer** for several scientific journals including *Systematic Biology*, *Trends in Genetics*, *Trends in Parasitology*, *Molecular Ecology*, *PLoS ONE*, *Proceedings B*, *BMC Evolutionary Biology*, *BMC Bioinformatics*, *Bioinformatics*, *Nucleic Acids Research*, *Canadian Journal of Botany*, *Zootaxa*, *Frontiers of Zoology*, *BioEssays*, *PNAS*

**Consultant**, Safeguard Biosystems Inc. (2008-2009)

**Expert Reviewer**, NSERC Discovery Grants, NSERC Strategic Grants, European Commission (Framework 7, 2008), Large-scale research proposals for German Science Foundation (2010, 2011), Swiss Science Foundation (2011), the Netherlands Technology Foundation STW (2011)

**Co-founder and co-organizer**, Ottawa Bioinformatics Discussion Group (2001-2003)