Orientation & Navigation
Birds, Humans & Other Animals

9th Conference in this series

13-15 April 2016

Royal Holloway College
University of London

PROGRAMME AND CONFERENCE GUIDE

Hosted by the Royal Institute of Navigation's Animal Navigation Group (ANG)
Founders Building

Route to car parks - Green route

Green route to car parks
The Ninth International Conference on Animal Navigation, hosted by the Animal Navigation Special Interest Group of the Royal Institute of Navigation (RIN) in the UK, will be held at Royal Holloway College, Egham, Surrey, TW20 0EX, in the Runnymede borough of Surrey, UK, on 13-15 April 2016. No animals or pets are allowed on the site.
The conference fee includes two nights in modern en-suite accommodation, all meals, including the Conference Dinner, and an 'ice-breaker' reception.

Royal Holloway College is situated about 20 miles from London and 8 miles from Heathrow. It is served by a direct bus service (Number 441) from Heathrow Airport Bus Station, thence via Terminal 5 Heathrow to the front entrance of Royal Holloway College. Conferees not familiar with the area should ask the driver to stop at Royal Holloway College. Frequency of service is ~ every 30 minutes and the journey takes ~ 55 minutes. Egham is also served by a direct rail service from Waterloo station, London and a slower direct rail service from Victoria station, London. A taxi from Egham station to Royal Holloway College is ~£6. The cheapest taxis from Heathrow Airport are obtained by calling Gemini Cars (Tel: +44 (0)1784 471111) ~£23 from Terminal 5 and ~£26 from all other terminals and from Egham Cars (Tel: +44 (0)1784 434340) ~£23 from Terminal 5 and ~£28 from all other terminals. Conferees arriving by taxi should ask to be taken to The Hub.

On arrival at Royal Holloway College, conferees should check-in at The Hub (see map), where they will be given a key to their accommodation plus Internet Username and Password.

The auditorium is located in Moore Building (see map), about 50m from the main entrance.

The conference will bring together research scientists from the whole range of disciplines that relate to how animals navigate.

We are grateful to the following for their contribution to the success of the conference:

Company of Biologists Ltd, Frontiers in Zoology, Defence Science & Technology Laboratory (DSTL), the United States Air Force Office of Scientific Research’s European Office of Aerospace Research and Development (EOARD) and the United States Office of Naval Research Global (ONRG)

Buffet Lunches on all days will be served in the Moore Building. Dinner on the 13th will be provided in The Picture Gallery (see map). Breakfast is available on the 14th and 15th from 0730 in The Founders Dining Hall. The Conference Dinner at 1900 on the 14th will be held in the Founders Building (see map). The Crosslands Bar in the Founders Building will be available each evening, providing excellent opportunities for networking.
Free Wi-Fi is available throughout the Royal Holloway College site. Conferees should however bring an Ethernet cable with them and a three-pin UK adaptor.

**Accommodation**

En-suite single accommodation is located in the new halls, very close to The Hub (see map).

**Parking**

Free parking is available throughout the site. See map for locations, the main car park is car park 4.

**Wednesday 13 April**

1000  Registration and coffee

1200  BUFFET LUNCH -

1245  Welcome and housekeeping notices  M Liedvogel, Chairman ANG  P Chapman-Andrews, Director RIN

**Magnetoreception**

Chairman: Miriam Liedvogel, Chairman ANG

1300  **Transcriptomic Analysis of Hair Cells with Iron-Rich Organelles from the Rock Pigeon Columba livia**  Simon Nimpf, Research Institute of Molecular Pathology, Vienna, Austria

1315  **Magnetically Induced Neuronal Activation in the Pigeon Columba livia**  David Keays, Research Institute of Molecular Pathology, Vienna, Austria

1330  **No evidence for the involvement of the inner ear lagena in magnetoreception in the migratory blackcap (Sylvia atricapilla)**  Nele Lefeldt, Department of Neuroscience, Baylor College of Medicine, Houston, USA

1345  **Central processing of magnetic information: Insights from C57BL/6J mice**  Veronika Blahova, Department of Zoology, Charles University in Prague

1400  **Are the ferrous inclusions in the mole-rat cornea magnetoreceptors?**  Pascal Malkemper, Department of General Zoology, Faculty of Biology, University of Duisburg-Essen, Germany

1415  **Planarians as a model for magnetoreception**  Hervé Cadiou, Institut des Neurosciences Cellulaires et Intégratives, Strasbourg, France

1430  **Molecular Characterisation of Pigeon Cryptochromes**  Tobias Hochstoger, David Keays, Research Institute of Molecular Pathology, Vienna, Austria

1445  **A magnetic protein bicompass in animal**  Can Xie, Laboratory of Molecular Biophysics, School of Life Sciences, Peking University, China
1545 Cryptochrome 2 mediates directional magnetoreception in cockroaches
Martin Vacha, Masaryk University, Czech Republic

1600 Cryptochrome 1 in Retinal Cone Photoreceptors Suggests a Novel Functional Role in Mammals
Christine Nießner, Ludwig-Maximilians-University, Germany

1615 Light-dependent magnetic compass orientation in zebra finches
Atticus Pinzon-Rodriguez, Lund University, Sweden

1630 Long-lived spin coherence improves the compass bearing available from a cryptochrome-based magnetoreceptor
Peter Hore, Oxford University, UK

1645 Towards revealing the structure of avian cryptochrome
Emil Sjulstok Rasmussen, University of Southern Denmark, Denmark

1700 A Psychophysical and Neuro-Engineering Approach to Human Magnetoreception
Joseph Kirschvink, California Institute of Technology, USA

1715 Close

Thursday 14 April

Magnetic cues and compass orientation

Chairman: David Keays

0900 Weak broadband oscillating fields are more disruptive than strong single-frequency electromagnetic fields to magnetic compass orientation in a night migratory songbird (Erithacus rubecula)
Susanne Schwarz, University of Oldenburg, Germany

0915 A virtual magnetic displacement shows that Eurasian reed warblers use a magnetic map
Nikita Chernetsov, St. Petersburg State University, Russia

0930 The effects of anthropogenic electromagnetic noise on magnetic compass orientation in a migratory bird
Henrik Mouritsen, University of Oldenburg, Germany

0945 Effect of radio-frequency magnetic fields on orientation of garden warblers Sylvia borin
K Kavokin, St. Petersburg State University, Russia

1000 Bird Navigation in Polar Regions
Susanne Akesson, Lund University, Sweden

1015 Magnetic alignment in horses
Sabine Begall, University of Duisburg-Essen, Germany

1030-1130 COFFEE AND TEA BREAK

1130 Neural processing of magnetic intensity and inclination cues by lesioned homing pigeons (Columba livia) in a magnetic conditioning paradigm
Merissa Acerbi, Bowling Green State University, USA
<table>
<thead>
<tr>
<th>Time</th>
<th>Title</th>
<th>Speaker</th>
</tr>
</thead>
<tbody>
<tr>
<td>1145</td>
<td>Polarized light modulates light-dependent magnetic compass orientation in birds</td>
<td>Rachel Muheim, Lund University, Sweden</td>
</tr>
<tr>
<td>1200</td>
<td>Complex Role of Magnetic Cues in Mouse Water Maze Assay: Rapid Learning, Sequence Effects, Rotated Axes of Response, and Cue Transfer</td>
<td>John Philips, Virginia Tech, USA</td>
</tr>
<tr>
<td>1215</td>
<td>Characterizing the mouse magnetic sense</td>
<td>Michael Painter, Virginia Tech, USA</td>
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<tr>
<td>1230</td>
<td><strong>BUFFET LUNCH</strong></td>
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<tr>
<td></td>
<td><strong>Magnetic cues and compass orientation</strong></td>
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<tr>
<td>1330</td>
<td>Rain forest navigators: homing behavior in poison frogs</td>
<td>Andrius Pasukonis, University of Vienna, Austria</td>
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<tr>
<td>1345</td>
<td>One trial landmark learning in wild hummingbirds</td>
<td>David Pritchard, University of St Andrews, UK</td>
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<tr>
<td>1400</td>
<td>Towards a fully predictive model of visual navigation in pigeons</td>
<td>Richard Mann, University of Leeds, UK</td>
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<tr>
<td>1415</td>
<td>The anterior thalamic nucleus and the navigational process</td>
<td>Paulo Alexandre Jorge, ISPA, Portugal</td>
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<tr>
<td>1430</td>
<td>The solar cycle has a global effect on pigeon races</td>
<td>Mike Walker, University of Auckland, New Zealand</td>
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<tr>
<td>1445</td>
<td>Evidence for Geomagnetic Imprinting in Sea Turtles</td>
<td>Roger Brothers, University of North Carolina, USA</td>
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<tr>
<td>1500</td>
<td><strong>COFFEE AND TEA BREAK</strong></td>
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<td>1600</td>
<td>The role of olfaction in desert ant navigation</td>
<td>Cornelia Buehlmann, University of Sussex, UK</td>
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<tr>
<td>1615</td>
<td>Nocturnal navigation by amblypygids (Class Arachnida, Order Amblypygi)</td>
<td>Daniel Wiegmann, Bowling Green State University, USA</td>
</tr>
<tr>
<td>1630</td>
<td>Evaluating the role of current drift in sea turtle long-distance oceanic migrations</td>
<td>Paolo Luschi, University of Pisa, Italy</td>
</tr>
<tr>
<td>1645</td>
<td>Nocturnal migratory songbirds adjust their travelling direction aloft: evidence from a radiotelemetry and radar study</td>
<td>Sissel Sjoberg, Lund University, Sweden</td>
</tr>
<tr>
<td>1700</td>
<td>Long-distance migratory orientation and navigation in free-flying migrants</td>
<td>Kasper Thorup, University of Copenhagen, Denmark</td>
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<tr>
<td>1715</td>
<td>In seek of navigation answers for the ocean wanderers: a comparative study on the trans-equatorrial migrations of ten shearwater species</td>
<td>G Dell'Ariccia, University of Barcelona, Spain</td>
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<td>1730</td>
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<td>1730</td>
<td><strong>RECEPTION</strong> Sponsored by the Royal Institute of Navigation</td>
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<td>1900</td>
<td><strong>CONFERENCE DINNER</strong></td>
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Friday 15 April

Genetics | Visual control

Chairman: Emily Baird, Hon Secretary ANG

0900  
**Is polymorphism in personality-associated genes driving changes in migratory behaviour?**
J Ferrer-Obiol, University of Barcelona, Spain

0915  
**Examining the genetic basis of migratory orientation in a songbird**
Kira Delmore, Max Planck Institute for Evolutionary Biology, Germany

0930  
**Elucidating the genetic basis of magnetite crystal production in eukaryotes**
Renee Bellinger, University of Hawaii, Hawaii

0945  
**Visual control of flight speed in Budgerigars**
Ingo Schiffner, Queensland Brain Institute, Australia

1000  
**Cross-Model object recognition in a fish**
Theresa Burt de Perera, Oxford University, UK

1015  
**Motion improves contrast sensitivity in bumblebee**
Aravin Chakravarthi, Lund University, Sweden

1030 - 1130  
**COFFEE AND TEA BREAK**

1130  
**Place cells, grid cells and navigation in complex space**
RM Grieves, University College London, UK

1145  
**Magnetic Maps and Multi-modal Navigation in Sea Turtles and Salmon**
Kenneth Lohmann, University of North Carolina, USA

1200  
**The compass system of homing and migratory bats**
Richard Holland, Bangor University, Wales

1215  
**A model for navigational errors in complex environmental fields**
Claire Postlethwaite, University of Auckland, New Zealand

1230  
**The role of wind regimes and constraints to navigation in shaping non-stop flight strategies**
James McLaren, University of Delaware, USA

1245  
**CLOSING ADDRESS**
E Baird, Hon Secretary ANG

1300  
**END OF CONFERENCE**

BUFFET LUNCH
<table>
<thead>
<tr>
<th>Poster Number</th>
<th>Title</th>
<th>Authors</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1</td>
<td>Directional swimming in coral reef fish larvae</td>
<td>Igal Berenshtein et al., Department of Life Sciences, Eilat Campus, Ben-Gurion University, Be’er Sheva 84105, Israel</td>
</tr>
<tr>
<td>P2</td>
<td>Can internal waves be used as a compass?</td>
<td>Igal Berenshtein et al., Department of Life Sciences, Eilat Campus, Ben-Gurion University, Be’er Sheva 84105, Israel</td>
</tr>
<tr>
<td>P3</td>
<td>Localisation of the Putative Magnetoreceptor Cryptochrome 1b in the Retinae of Migratory Birds and Homing Pigeons</td>
<td>Petra Bolte et al., University of Oldenburg, Germany</td>
</tr>
<tr>
<td>P4</td>
<td>Gap negotiation behaviour in bees: A comparative study</td>
<td>Guiliano Di Canio et al. Dept Biology, Lund University, Sweden</td>
</tr>
<tr>
<td>P5</td>
<td>A magnetic pulse induces directed orientation in the Caribbean spiny lobster: Evidence for magnetite-based magnetoreception</td>
<td>David A. Ernst et al., University of North Carolina at Chapel Hill, US</td>
</tr>
<tr>
<td>P6</td>
<td>Multimodal coding of gravity, angular acceleration, temperature and hydrostatic pressure in crab statocyst sensory neurones</td>
<td>Peter J. Fraser, School of Biological Sciences, University of Aberdeen</td>
</tr>
<tr>
<td>P7</td>
<td>Field Testing Short-Term Geomagnetic Navigation in an Antarctic Seal</td>
<td>Lee A. Fuiman et al., University of Texas Marine Science Institute, Port Aransas, Texas, USA</td>
</tr>
<tr>
<td>P8</td>
<td>Seasonal changes in atmospheric noise levels and the annual variation in pigeon homing performance</td>
<td>Jonathan T. Hagstrum et al., U.S. Geological Survey, Menlo Park, California 94025; University of Denver, Denver, Colorado 80208; Naval Research Laboratory, Washington, DC 20375</td>
</tr>
<tr>
<td>P9</td>
<td>Magnetoreception in dogs revisited</td>
<td>Vlastimil Hart et al., Czech University of Life Sciences and University Duisburg-Essen</td>
</tr>
<tr>
<td>P10</td>
<td>The Neural Basis of Long-Distance Navigation in Birds</td>
<td>Dominik Heyers et al., Institute of Biology and Environmental Sciences, D-26111 Oldenburg</td>
</tr>
<tr>
<td>P11</td>
<td>The Design and Testing of an Artificial Magnetoreceptor</td>
<td>Robert Hickman, Research Institute of Molecular Pathology, Vienna, Austria</td>
</tr>
<tr>
<td>P12</td>
<td>A Quantum Needle for the Avian Magnetic Compass</td>
<td>Hamish G. Hiscock, Susannah Worster, Dept Chemistry, Oxford University, OX1 3QZ, UK</td>
</tr>
<tr>
<td>P13</td>
<td>Application of new technologies to determine the migration strategy of an elusive woodland bird</td>
<td>Andrew Hoodless et al., Game &amp; Wildlife Conservation Trust, UK</td>
</tr>
<tr>
<td>P14</td>
<td>The characterization of pigeon tissues employing Total Reflection X-Ray Fluorescence (TXRF) and Superconducting quantum interference device (SQUID) magnetometry.</td>
<td>Daniel Kagerbauer, et al. Research Institute of Molecular Pathology, Vienna Biocenter, 1030 Vienna, Austria</td>
</tr>
<tr>
<td>P15</td>
<td>Sensory mechanisms of long-distance navigation in migratory songbirds: new insights from displacement and magnetic pulse experiments</td>
<td>Dmitry Kishkinev, Queen’s University Belfast</td>
</tr>
<tr>
<td>P16</td>
<td>Biophysical Puzzles Concerning Magnetoreception in the Common Nematode, Caenorhabditis elegans.</td>
<td>Joseph L. Kirschvink, California Institute of Technology</td>
</tr>
<tr>
<td>P17</td>
<td>Does Caenorhabditis elegans respond to earth-strength magnetic fields?</td>
<td>Lukas Landler, Institute of Molecular Pathology, Vienna Biocenter (VBC), 1030 Vienna, Austria</td>
</tr>
<tr>
<td>P18</td>
<td>Bumblebee flight performance in environments of different proximity</td>
<td>Nellie Linander et al., Lund University, Sweden</td>
</tr>
</tbody>
</table>
Possible lateralization of the mole-rat’s magnetic sense
Sandra Malewski, RIN Associated Membership

Exploring magnetic-dependent navigation in the genetic model organism zebrafish
A. Myklutun*, A. Lauri* et al., Helmholtz Zentrum & TU München, (*equal contribution)

Inertial Animal Navigation
Antonio Nafarrate, www.animalnav.org

Magnetically induced freezing in cockroach. Effect of interstimulus interval.
Radek Netusil et al., Masaryk University, Brno

How does Animal Navigation work?
Richard Nissen, www.animalnav.org

Iron-rich Structures in the Upper Beak of Pigeons: Magnetoreceptors or Macrophages?
C Nießner, M Winklhofer, Dept. Earth & Environmental Science, University of Munich

The effect of magnetic fields on the expression of Intermediate early genes in pigeon
Nordmann, et al. Research Institute of Molecular Pathology, Vienna, Austria

Long-distance songbird migrant, garden warbler Sylvia borin, does not calibrate its magnetic compass during autumn migration
Alexander Pakhomov, Biological Station Rybachy

Migratory blackcaps (Sylvia atricapilla) can use their magnetic compass at 5 degrees inclination, but are completely random at 0 degrees inclination
Susanne Schwarze, Res. Centre for Neurosensory Sciences, Oldenburg University, Germany

Investigating magnetic and olfactory orientation sense in free-flying songbirds: an upcoming study
Katherine Snell & Kasper Thorup, University of Copenhagen, Denmark

Constructing Cryptochrome: A complete model for plant Cryptochrome from Arabidopsis thaliana
Ilia A. Solov'yov, Claus Nielsen, University of Southern Denmark

Theoretical insights into cryptochrome magnetoreception
Ilia A. Solov'yov, Dept of Physics, Chemistry and Pharmacy, University of Southern Denmark

Literal Grid Map Models of Animal Navigation: Assumptions and Predictions
Rebecca Turner et al., The University of Auckland

Cue conflict experiments between magnetic and visual cues on Dunlin Calidris alpina and Curlew sandpiper Calidris ferruginea
Lorenzo Vanni, Paolo Luschi (presenting author), Department of Biology, University of Pisa, Via Volta 6, Italy

The migration program in a nocturnal and solitary long-distance migrant
Marta L. Vega et al., University of Copenhagen

Radio frequency effects on spontaneous magnetic alignment in deer mice (Peromyscus)
Jack Whitehead, John Phillips, Virginia Tech Dept. Biological Sciences, USA

Are experimentally displaced adult common cuckoos navigating using a map based on geomagnetic coordinates?
Mikkel Willemoes, Kasper Thorup, Center for Macroecology, Evolution and Climate; Natural History Museum of Denmark; University of Copenhagen