

# "Development of the Enteric Nervous System: Cells, Signals and Genes"

March 26-29 2006

New York Academy of Medicine, New York

## Program

### Sunday March 26

3-5pm Registration

4-5 pm Welcoming drinks

**5:00 pm Conference opening – Michael Gershon**

**5:05 pm *Plenary Lecture:* Professor Nicole Le Douarin, College de France, France**

*The neural crest, a pluripotent structure and its role in the evolution of vertebrates*

**Chair: Michael Gershon**

**This lecture is sponsored by the Company of Biologists, publisher of *Development***

**Monday March 27****8:30 am: Session #1- Migratory pathways and cellular behaviour of enteric neural crest-derived cells****Chair: Judith Eisen**

This session is sponsored by the American Association of Anatomists

- 8:30 Alan Burns**, Institute of Child Health London, UK  
*Colonisation of the gut by vagal and sacral neural crest cells – migration pathways and developmental potentials*
- 8:50 Don Newgreen**, Royal Children's Hospital, Melbourne, Australia  
*Mathematical and experimental modeling of colonization of the intestine by enteric neural precursor cells*
- 9:10 Paul Kulesa**, Stowers Institute for Medical Research, Kansas City, USA  
*A dynamic in vivo analysis of chick cranial neural crest cell migratory behaviors*
- 9:30 Miles Epstein**, University of Wisconsin, Madison, USA  
*The pattern of wavefront advance of enteric neural crest-derived cells varies with the gut region being colonized*
- 9:50 Carol Erickson**, University of California, Davis, USA  
*Molecular control of melanoblast specification and morphogenesis: Is it the exception or the rule?*
- 10:10 Amanda Barlow**, Institute of Child Health London, UK (selected oral)  
*Does reduction in neural crest cell number delay progression of the migratory wavefront along the gut during enteric nervous system formation?*

**10:30-11:00 Tea/coffee****11:00 am: Session #2 - Ret (Part 1)****Chair: Vassilis Pachnis**

- 11:00 Carlos Ibáñez**, Karolinska Institute, Stockholm, Sweden  
*Signaling by GDNF and its receptors*
- 11:20 Mart Saarma**, University of Helsinki, Finland  
*Characterization of a novel GDNF receptor*
- 11:40 Frank Costantini**, Columbia University, New York, USA  
*The role of GDNF/Ret signaling in kidney development*
- 12:00 Hideki Enomoto**, Riken Center for Developmental Biology, Kobe, Japan  
*Pleiotropic effects of GDNF in regulation of enteric nervous system development*

**12:20-2:20 lunch/posters** (posters are listed on pages 8-10)**2:20 pm: Session #2 (continued) - Ret (Part 2)****Chair: Carlos Ibáñez**

- 2:20 Masahide Takahashi**, Nagoya University, Japan  
*Characterization of Ret knock-in mice carrying Y1062F or S697A mutation*
- 2:40 Andrew McCallion**, Johns Hopkins University School of Medicine, Baltimore, USA  
*Ret regulation: Efforts to understand control of a critical developmental and disease gene*
- 3:00 Servane Tauszig-Delamasure**, CNRS FRE2870, Centre Léon Bérard, Lyon, France (selected oral)  
*Effect of apoptosis induced by the dependence receptor Ret on the development of the neural crest-derived enteric nervous system*
- 3:20 Elizabeth Grice**, Johns Hopkins University School of Medicine, Baltimore, USA (selected oral)  
*A survey of conserved non-coding sequences at the RET locus reveals the biological significance of an enhancer implicated in HSCR*

**3:40-4:10 Tea/coffee**

**4:10 pm: Session #3- Endothelin-3/endothelin receptor B and interactions**

**Chair: Don Newgreen**

- 4:10 Elisabeth Dupin**, Laboratoire d'Embryologie Cellulaire et Moleculaire, CNRS, Nogent-sur-Marne cedex, France  
*Expression of stem cell properties by avian neural crest-derived cells; role of endothelin-3 peptide*
- 4:30 Vassilis Pachnis**, National Institute of Medical Research, London, UK  
*Title to come*
- 4:50 Nadege Bondurand**, Hôpital Henri Mondor, Creteil, France (selected oral)  
*Interactions between SOX10, EDN3 and EDNRB during enteric nervous system and melanocyte development.*

**5:10 pm Plenary lecture: Aravinda Chakravarti**, Johns Hopkins University School of Medicine, Baltimore

*The genetic landscape in Hirschsprung disease*

**Chair: Stan Lyonnet**

**Tuesday March 28****8:30 am: Session #4 - Sox10 and its interactions****Chair: Mai Har Sham**

- 8:30** **Lukas Sommer**, Swiss Federal Institute of Technology, Zürich, Switzerland  
*Functional characterization of Sox10 and potential target genes in neural crest stem cell development*
- 8:50** **Michael Wegner**, Universität Erlangen-Nürnberg, Erlangen, Germany  
*The role of Sox10 proteins for the development of the enteric nervous system*
- 9:10** **Robert Kelsh**, University of Bath, UK  
*Fate specification defects – a common theme in Sox10 mutants*
- 9:30** **Michelle Southard-Smith**, Vanderbilt University School of Medicine, Nashville, USA  
*Genetic interactions that modulate the penetrance and severity of aganglionosis in the Sox10<sup>Dom</sup> model of Hirschsprung disease*
- 9:50** **Anthony Antonellis**, National Human Genome Research Institute, National Institutes of Health, Bethesda, USA (selected oral)  
*Deletion of long-range sequences at Sox10 compromises developmental expression in a mouse model of Waardenburg-Shah (WS4) Syndrome*

**10:10-10:40** Tea/coffee

**10:40 am: Session #5 - Other molecules involved in enteric neuron development****Chair: Heather Young**

- 10:40** **Vincent Lui**, University of Hong Kong  
*Conditional knockout of PTC1 gene in vagal neural crest cells causes defective ENS development in mice*
- 11:00** **Raj Kapur**, University of Washington, Seattle, USA  
*The importance of PKA for development and function of the enteric nervous system*
- 11:20** **Alcmène Chalazonitis**, Columbia University, New York, USA  
*Bone morphogenetic proteins (BMPs)-2 and -4 differentially regulate the phenotypic expression of enteric neurons and their aggregation in ganglia*
- 11:40** **Richard Anderson**, University of Melbourne, Australia (selected oral)  
*The cell adhesion molecule L1 is required for the migration of enteric neural crest cells in the developing gut*
- 12:00** **Ming Fu**, Washington University School of Medicine, St Louis, USA (selected oral)  
*BMP induced PSA-NCAM affects neurite fasciculation and enteric nervous system (ENS) patterning*
- 12:20** **Elyanne Ratcliffe**, Columbia University, New York, USA (selected oral)  
*Chemorepulsion in the guidance of vagal sensory axons that innervate the fetal gut.*

**12:40-2:40** lunch/posters (posters are listed on pages 8-10)

**2:40 pm: Session #6 - Genetic basis of Hirschsprung disease****Chair: Aravinda Chakravarti**

This session is sponsored by the March of Dimes

- 2:40** **Stan Lyonnet**, Hôpital Necker-Enfants Malades, Paris, France  
*Genetics of syndromic Hirschsprung disease and clinical issues in non-syndromic cases*
- 3:00** **Isabella Ceccherini**, Istituto Giannina Gaslini, Genova, Italy  
*Genotype dependent RET proto-oncogene transcript levels determine different degrees of susceptibility to Hirschsprung disease*
- 3:20** **Alice Brooks**, Department of Clinical Genetics, ErasmusMC, Rotterdam, the Netherlands  
*Clinical and molecular studies in Goldberg-Shprintzen syndrome*
- 3:40** **Cam Tu Nguyen**, Emory University, Atlanta, USA (selected oral)  
*Characterization of KIAA1279 orthologue in zebrafish. A model for Goldberg-Shprintzen syndrome*

**4:00** **Jeanne Amiel**, Hôpital Necker-Enfants Malades, Paris, France (selected oral)  
*The RET gene is a modifier of the PHOX2B gene for the Hirschsprung disease phenotype*

**4:20-4:50** Tea/coffee

**4:50 Plenary lecture: Michael Gershon** - Columbia University, New York, USA  
*Beyond Hirschsprung's Disease: Molecules Required For Refining the ENS*  
**Chair: Raj Kapur**

**Wednesday March 29****8:30 am: Session #7- Screens to identify genes involved in enteric neuron development****Chair: Lukas Sommer**

This session is sponsored by the Society for Developmental Biology

- 8:30 Judith Eisen**, University of Oregon, Eugene, USA  
*Characterizing the function of enteric neurons in zebrafish mutants*
- 8:50 Iain Shepherd**, Emory University, Atlanta, USA  
*A genetic screen to identify zebrafish enteric nervous system mutants*
- 9:10 Bill Pavan**, NIH, Bethesda, USA  
*A sensitized mouse mutagenesis screen for novel loci regulating mammalian neural crest development*
- 9:30 Robert Heuckeroth**, Washington University School of Medicine, St Louis, USA  
*Defining novel molecular mechanisms controlling enteric nervous system development*
- 9:50 Tiffany Heanue**, National Institute of Medical Research, London, UK (selected oral)  
*Microarray-based identification of novel markers of the developing enteric nervous system*
- 10:10 Cornelia Hagl**, University of Heidelberg, Mannheim, Germany (selected oral)  
*Proteome analysis of enteric nervous system*

**10:30-11:00 Tea/coffee**

**11:00 am: Session #8 - Stem cells in the ENS: Basic research and therapeutic potential****Chair: Robert Heuckeroth**

This session is co-sponsored by Children's Neurobiological Solutions and the International Foundation for Functional Gastrointestinal Disorders (IFFGD)

- 11:00 Sean Morrison**, University of Michigan, Ann Arbor, USA  
*Title to come*
- 11:20 Mai Har Sham**, University of Hong Kong  
*Properties and potential applications of enteric neural crest stem cells from mouse embryonic gut*
- 11:40 Jay Pasricha**, University of Texas, Galveston, USA  
*Neural stem cell transplantation in the stomach rescues gastric function in neuronal nitric oxide synthase-deficient mice*
- 12:00 Nikhil Thapar**, Institute of Child Health London, UK (selected oral)  
*ENS progenitors can be isolated from Hirschsprung's-like gut but show altered differentiation.*
- 12:20 Gudrun Gossrau**, University of Dresden Medical Center, Germany (selected oral)  
*Enrichment of peripheral neuronal subtypes during neural ES cell differentiation*

**12:40-1:30 Lunch (no poster session)**

**1:30 pm: Session #8 (continued) - Stem cells in the ENS (Part 2)****Chair: Alan Burns**

This session is co-sponsored by Children's Neurobiological Solutions and the International Foundation for Functional Gastrointestinal Disorders (IFFGD)

- 1:30 Jack Mosher**, University of Michigan, Ann Arbor, USA (selected oral)  
*Prospectively isolated, postmigratory gut neural crest stem cells retain the potential to generate diverse types of neurons in vivo and can survive in the aganglionic gut after autologous transplantation*
- 1:50 Ulrich Rauch**, University of Applied Sciences, Kaiserslautern, Germany (selected oral)  
*Neuronal precursor cells from the developing human enteric nervous system*
- 2:10 Richard Lindley**, University of Liverpool, Liverpool, UK (selected oral)  
*Isolation, characterisation and transplantation of postnatal human enteric nervous system stem cells*

**2:30 pm: Session #9 - Development of gastrointestinal motility**

**Chair: Peter Milla**

This session is co-sponsored by the American Motility Society and March of Dimes

- 2:30**    **Joel Bornstein**, University of Melbourne, Australia  
*Development of spontaneous motility patterns in the mouse colon*
- 2:50**    **Kent Sanders**, University of Nevada School of Medicine, Reno, USA  
*Title to come*
- 3:10**    **Dieter Saur**, Technical University of Munich, Germany  
*Nitric oxide signaling in the gut: Implications for intestinal motor function in health and disease*
- 3:30**    **Monika Sundqvist**, University of Göteborg, Sweden (selected oral)  
*Ontogeny of gastrointestinal motility control in larval African clawed frog, *Xenopus laevis*.*
- 4:00**    **END OF CONFERENCE**

**POSTERS:**

1. Naoya Asai, Toshifumi Fukuda, Vassilis Pachnis, Frank Costantini, Masahide Takahashi  
*Analysis of PKA-dependent modification of the Ret signaling in vivo*
2. Mária Bagyánszki, András Horváth, Viktor Román, Árpád Béla Resch, Éva Fekete, Mónika Krecsmarik  
*A new computational model to study the spatiotemporal pattern of myenteric neurons in the developing human fetal intestine*
3. Annette J. Bergner, Heather M. Young and Richard B. Anderson  
*Examination of the migratory ability of enteric neural crest-derived cells in different regions of the developing gut*
4. Xiaochun Bian and Martin Carrasquillo  
*The pattern of excitation/inhibition of ileal longitudinal muscle is different in neonatal and adult guinea pigs*
5. Grzegorz Burzynski, Anita Wiersema, Bert Dontje, Frans Gerbens, Gerald de Haan, Robert Hofstra  
*The expression profile of the ENS precursors, modulated by Ret receptor signaling*
6. Claire Caldwell, Alan J. Burns, Nikhil Thapar  
*Chick chorio-allantoic membrane as a model system to support the growth of gut following transplantation of neurosphere-like bodies*
7. V. Ashley Cantrell, Karen K. Deal, and E. Michelle Southard-Smith  
*Distant regulatory elements are required for expression of Sox10 in the enteric nervous system*
8. Alfonso Carreón-Rodríguez, Leticia Verdugo Díaz, Jaime Belkind-Gerson  
*Neurogenesis in cell culture from aganglionic enteric tissue*
9. Fabien D'Autréaux, Peter Scheiffele, Timothy Gershon, Daniela Levanon, Alcmène Chalazonitis, and Michael D. Gershon  
*Function of neuroligins and neurexins in enteric synaptogenesis*
10. Jean-Marie Delalande, Meaghann Guyote, Derek Stensby, William Talbot, David Raible and Iain Shepherd  
*Cellular and genetic characterization of the zebrafish enteric nervous system mutant enema*
11. Noah Druckenbrod, Miles Epstein  
*Neural crest cell-specific knockout of endothelin-B alters cell migration and morphology in the developing gut*
12. Breau M.A., Pietri T., Eder O., Blanche M., Brakebusch C., Fässler R., Thiery JP. and Dufour S.  
*Lack of  $\beta 1$  integrins in enteric neural crest cells leads to a Hirschsprung-like phenotype*
13. C. Van Ginneken, U. Rauch, A. Weyns, K.-H. Schäfer  
*Dissociated cultures of myenteric neurons of pig jejunum*
14. D.Giuliani, C.Thrasivoulou, V.Soubeyre, H. Ridha, C.Giaroni, S.Lecchini, M.J.Saffrey, T.Cowen  
*Mechanisms underlying the neuroprotective effects of dietary restriction in the ageing enteric nervous system: an antioxidant role for neurotrophic factors*
15. Allan M. Goldstein, Olive Mwizerwa, Katherine C. Brewer, Nandor Nagy  
*Endothelin-3 regulates neural crest cell proliferation, differentiation, and migration in the avian hindgut enteric nervous system*
16. Priya Gomes, Werend Boesmans, Jozef Janssens, Jan Tack, Pieter Vanden Berghe  
*Role of enteric glia in growth and maintenance of enteric neurons in a primary cell culture model derived from embryonic mice*

17. Meaghann Guyote and Iain T. Shepherd  
*The role of SIP1 in zebrafish development*
18. Anna Holmberg, Catharina Olsson and Susanne Holmgren  
*Development of nitrergic control of gut motility in the zebrafish*
19. Markus Klotz, Ulrich Rauch, Karl-Herbert Schaefer  
*Monitoring the protein expression of human enteric precursor cells in culture*
20. Julie Kuhlman, Judith Eisen  
*A gut wrenching tale – A zebrafish mutant with fewer enteric neurons*
21. Danny Ko-chun Lau, Mercè Garcia-Barceló, Thomas Yuk-yu Leon, Man-ting So, Paul Kwong-hang Tam  
*Evaluation of thyroid transcription factor 1 (TTF-1) as a Hirschsprung's disease (HSCR) locus by mutation analysis*
22. Cátia Laranjeira, Vassilis Pachnis and Dipa Natarajan  
*The role of Ret signaling pathway in enteric neuron and glia cell commitment and differentiation*
23. Hongbin Liu and Marthe J. Howard  
*Expression of Hand2 is sufficient to support neurogenesis of gut-derived neural crest cells in vitro*
24. Martínez L, Montedonico S, Fernández-Dumont V, Matesanz R, Burgos E, Tovar JA  
*Abnormal esophageal innervation of the esophagus in experimental congenital diaphragmatic hernia: A probably neural crest-related etiology*
25. Ivana Matera, Dawn E. Watkins-Chow, MaryPat S. Jones, Laura L. Baxter, Gene Elliott, Cecelia Rivas, Arturo Incao, William J. Pavan  
*Analysis of the neural crest mutant, Chastity, identified in a Sox10 sensitized mutagenesis screen*
26. Metzger M, Bareiss P, Conrad S, Skutella T, Just L  
*Repulsive guidance molecule inhibits migration of enteric neuronal progenitor cells*
27. Maria-Chiara Osterheld, Blaise J. Meyrat, Kathleen Meagher Villemure  
*A novel technique for the assessment of the enteric nervous system in Hirschsprung's disease*
28. Sandra Montedonico, Thambipillai Sri Paran, Udo Rolle and Prem Puri  
*Notable developmental alterations in submucosal nitrergic neurones of the distal porcine colon throughout life*
29. Moore SW, Johnson G  
*Acetylcholinesterase, laminin and the developing enteric nervous system*
30. Nandor Nagy, Katherine C. Brewer, Olive Mwizerwa, Allan M. Goldstein  
*Intestinal coelomic grafting: a method for studying enteric nervous system development*
31. Anne-Marie O' Donnell, Sandra Montedonico, John Bannigan and Prem Puri  
*Differences in nitrergic innervation of the developing chick cloaca and colorectum*
32. Catharina Olsson, Anna Holmberg and Susanne Holmgren  
*Development of vagal and enteric innervation of the zebrafish (Danio rerio) gut*
33. Thambipillai Sri Paran, Udo Rolle, Sandra Montedonico, Prem Puri  
*Developmental changes in the myenteric and submucous plexuses of the porcine bowel*
34. Rachael R. Roberts, Jessica F. Murphy, Heather M. Young and Joel C. Bornstein  
*Correlated anatomical and functional development of the ENS in wild-type and Gdnf<sup>+/-</sup> mouse colon*

35. Udo Rolle, Thambipillai Sri Paran, Prem Puri  
*Development of enteric mucosal innervation in the fetal and postnatal period*
36. Valentina Sasselli, Maria-Adelaide Micci, Pankaj Jay Pasricha  
*In vitro response of embryonic stem cells to the gut environment*
37. Karl-Herbert Schäfer, Andrea Hänsgen, Cornelia Hagl, Markus Klotz, Ulrich Rauch  
*Influence of GDNF family growth factors and protein extracts from ganglionic and aganglionic smooth muscle upon postnatal myenteric neurones in vitro*
38. Mallappa Anitha, Bindu Chandrasekharan, Simon Mwangi, Eric Grouzmann, Shanthi V. Sitaraman, Shanthi Srinivasan  
*Neuropeptide Y is a neuroproliferative factor for enteric neurons*
39. Ashley L. Stewart, Heather M. Young and Richard B. Anderson  
*Effects of inhibition of Rho GTP-ases on neural crest cell migration and axon growth in the developing gut*
40. Brent J. Thompson, M. Kay Washington and Ronald B. Emeson  
*The roles of  $\alpha$  &  $\beta$ -CGRP in experimentally induced colitis*
41. Toshihiro Uesaka, Sanjay Jain, Jeffrey Milbrandt and Hideki Enomoto  
*Multiple roles of GDNF during enteric nervous system development*
42. Van de Putte T., Racz I., Francis A., Seuntjens E., De Smet L., Debruyne J., Zimmer A., Gailus-Durner V., Huylebroeck D  
*Severe neurocristopathies in mice with a neural crest-specific removal of *Zfhx1b**
43. Bhupinder P.S. Vohra, Daniel Wind, Jennifer L. Armon, Ming Fu, Robert O. Heuckeroth  
*Differential gene expression and functional analysis implicate new molecules in enteric neural crest cell migration and neuritogenesis*
44. L. Wang, A.K. Chan and W.Y. Chan  
*Migration of vagal neural crest-derived cells is not influenced by the migratory environment in the hindgut of the Dominant megacolon mutant embryo*