

## Curriculum Vitae - Vincenzo De Paola, PhD

### WEB LINKS

<http://www.imperial.ac.uk/people/vincenzo.depaola> - [www.DePaolaLab.com](http://www.DePaolaLab.com) - [https://twitter.com/DePaola\\_Lab](https://twitter.com/DePaola_Lab)

### RESEARCH PROFILE

The goal of my scientific research is to understand the regulation of neural network connectivity and function in the adult neocortex, a brain region affected in numerous developmental and degenerative diseases as well as acute injuries, which are incurable to date. My ultimate aim is to use this knowledge to promote brain repair. Recently, my team developed a new approach to study the dynamics of human cortical networks using transplanted patient derived cells and intravital longitudinal imaging (Real et al., *Science* 2018). We are now using this new experimental system, at the interface between neuroscience, human stem cell and tissue biology and high-resolution optical imaging, to uncover human-specific principles of cortical circuit development and function and for disease modelling.

I received my Ph.D. in molecular and cellular neurobiology from the University of Basel, Switzerland, for work in the laboratory of Dr. Pico Caroni at the Friedrich Miescher Institut, part of the Novartis foundation. I was then awarded an EMBO post-doctoral fellowship to train with Dr. Karel Svoboda at Cold Spring Harbor Laboratory, USA. Since 2008 I am honorary Group Leader at the MRC London Institute of Medical Sciences and a permanent member of the Faculty of Medicine of Imperial College London.

### CURRENT POSITION

- 2014-present Senior Lecturer (equivalent to Associate Professor) of Translational Neuroscience, Imperial College London  
2008-present Honorary Group Leader, MRC London Institute of Medical Sciences (MRC LMS)

### PREVIOUS ACADEMIC POSITIONS

- 2008-2013 Lecturer (equivalent to Assistant Professor), Imperial College London  
2003-2007 EMBO Postdoctoral fellow - Howard Hughes Medical Institute (with Karel Svoboda at Cold Spring Harbor Laboratory, USA)  
2003-2004 Postdoctoral fellow – Friedrich Miescher Institute for Biomedical Research, Basel (jointly with Pico Caroni and Karel Svoboda)

### EDUCATION

- 2003 DPhil Friedrich Miescher Institute for Biomedical Research, Basel, Switzerland (with Pico Caroni); PhD from Basel University, Molecular and Cellular Neurobiology  
1997 MSc Bari University, Italy. Genetics (with Mariano Rocchi), (1st class honours)  
1996 BSc Bari University, Italy. Biology and Molecular Biology, (1st class honours)

### EDITORIAL BOARDS

- 2018-present F1000 (Faculty member - Neurobiology of Disease and Regeneration section)  
2016-present Science matters  
2014-present Frontiers in Cellular Neuroscience  
2013-present Frontiers in Molecular Neuroscience  
2013-present Frontiers in Cellular Biochemistry  
2012-present Neural Plasticity

### SELECTED HONOURS AND INTERNATIONAL EXTERNAL COMMITTEES

- 2015 Elected Fellow of the Royal Society of Biology  
2013 EPSRC Centre for Doctoral Training in Neurotechnology for Life and Health, Member  
2010 DIADEM Challenge, Howard Hughes Medical Institute Scientific Competition, Jury member  
2009-present Reviewer of grants for ERC, HFSP, 'Fondation pour la Recherche Médicale' and 'L'Agence nationale de la recherche' (EU), Alzheimer's and Related Diseases Research Award Fund (USA) and NC3Rs, BBSRC, MRC (UK).  
2008-present Reviewer for *Nature*, *Nature Neuroscience*, *Neuron*, *Nature Communications*, *Cerebral Cortex*, *Trends in Neurosciences*, *Neuroinformatics*, *JoVE*, *FEBS journal*, *Genesis*, *Frontiers journals*, *Biological Psychiatry*.

### SUMMARY OF RECENT FUNDING HISTORY (LAST 5 YEARS)

2019-23 EU, H2020-ITN, Synaptic dysfunction in neuropsychiatric disorders, £432,000, PI  
 2017-20 MRC, Project Grant, Stimulating axon regeneration in adult cortical circuits, £653,000, PI  
 2017-20 ARUK PhD studentship (with Prof. MG Spillantini) (£112,000, Maria Tortora, Italy)  
 2014-19 EPSRC funded PhD studentship (£140,000, Cher Bachar, Israel)  
 2014-18 FCT-GABBA and Rosetrees Trust PhD studentship (£68,750, Raquel Real, MD, Portugal)  
 2016-17 ARUK, A new *in vivo* model to study human axon pathology in AD, £30,000, PI  
 2012-17 MRC, Imaging cellular structure and function beyond the diffraction limit, £2,457,731, Co-I  
 2008-16 MRC Core Support, Neuroplasticity and Disease group, (MRC LMS) £2,229,000, PI  
 2014-15 EPSRC, Neurotechnology for Life and Health, £31,000, PI  
 2012-13 Wellcome Trust, Network of Excellence in Optogenetics, £150,000, Co-PI.  
 2012-15 MRC Interdisciplinary Cross Campus PhD Studentship (£70,000, Lucien West, UK)  
 2012-13 ERASMUS Studentship, European Union (£5,000, Sara Camporesi, Italy)

### RESEARCH GROUP AND TRAINING

Current group size: 5 (1 postdoctoral fellow, 3 PhD students, 1 MSc student).

Training track record: Currently supervising 3 PhD students, two recently graduated (Federico Grillo, now a post-doc with Juan Burrone at King's College London and Peter Bloomfield, now a post-doc with Bill Richardson at UCL). Three postdocs (Lieven Huang, Johanna Jackson and Alison Canty) have been trained in the lab, two now hold group leader positions in Australia and at Eli Lilly (Alison Canty and Jo Jackson). Mentored 10 and examined 2 PhD students. Fifteen undergraduate students (6 international, 4 EU funded, 5 medical) visited the lab for periods of 2-6 months in the last 4 years. Of these, 8 accepted PhD positions and 2 started medical studies.

### SELECTED INTERNATIONAL PRESENTATIONS

In the past 5 years I've been invited to give 39 talks, including talks at the major conferences on synaptic structural plasticity. Of these, I list below a selection of lectures at international conferences since 2010. Session chairs are indicated in bold.

2018-11 CSH Asia meeting, Advances in Optical Imaging: Focus on the Brain, Suzhou, China  
 2017-11 Minisymposium on In Vivo Imaging of CNS Injury and Disease, SFN 2017, DC, USA  
 2016-10 CSH Asia meeting, Probing Neural Networks with Light, Suzhou, China  
 2016-10 Normal and pathological brain ageing: from systems biology to the clinic, Paris, France  
 2016-01 Keystone Symposium, Axons: form cell biology to pathology, Santa Fe, USA  
 2015-09 International PhD Course on The Aging Brain, Turin, Italy  
 2015-09 12th International Congress of Polish Neuroscience Society, Gdansk, Poland  
 2015-03 COSYNE workshop, Functional Stability in a Dynamic Connectome, Snowbird, USA  
 2014-04 Imaging Synapse Structure and Function in the Brain, HHMI, Janelia Farm, USA  
**2014-02 Winter Conference on Neural Plasticity, Symposium Chair, Vieques, USA**  
**2013-08 Neural circuit development and plasticity, Workshop Chair, Utrecht, Holland**  
 2012-10 Nanosymposium on Axon Regeneration, SFN 2012, New Orleans, USA  
 2011-07 Computational Neuroscience Meeting, Stockholm, Sweden  
 2011-05 Light for Health Meeting, ICFO, Barcelona, Spain  
 2010-11 Minisymposium on axon branching, SFN 2010, San Diego, USA  
 2010-10 3d Axon Degeneration Meeting, Eibsee, Germany  
 2010-08 DIADEM Challenge, HHMI Janelia Farm, USA  
**2010-03 Structural Plasticity In The Mammalian Brain, Session Chair, HHMI Janelia Farm, USA**

### AWARDS TO THE GROUP

2018 Proteintech FENS travel grant, (Raquel Real, MD)  
 2017 Best Poster prize, 6<sup>th</sup> Cambridge Neuroscience Symposium, Cambridge, UK (Raquel Real, MD)  
 2015 Biotech Koniku shortlisted for the MassChallenge, Boston, USA (Osh Agabi, co-Founder)  
 2015 Best Business Plan and Elevator Pitch Competition, MIT GSW competition (Osh Agabi)  
 2014 Best Poster Award, BAP 2014 Summer Meeting, Cambridge, UK (Peter Bloomfield)  
 2014 Training bursary, BAP 2014 Summer Meeting, Cambridge, UK (Peter Bloomfield)  
 2013 Cooper-Int Award, EU international scheme (Michele Ettore)  
 2013 ECNP Young Researcher Workshop travel award, Nice, France (Peter Bloomfield)  
 2013 BSF Student travel bursary (Peter Bloomfield)  
 2006 Armenise-Harvard Career Development Award, Start-up grant, finalist (V. De Paola)

2006 Neurotrain Award, Marie Curie Conferences and Training Courses (V. De Paola)

2005 RIKEN-BSI Summer Course on Mental Disorders, RIKEN-BSI Travel Award (V. De Paola)

### PUBLIC ENGAGEMENT

My group participated in 15 activities in the last 5 years, including <http://www.nativescientist.com/> (R. Real and S. Papadopolou), microscopy workshop for school children (P. Bloomfield and S. Papadopolou, 2015), two talks at the University of the 3d age (F. Grillo on synapses and ageing in 2012 and P. Bloomfield on inflammation in schizophrenia in 2013), British Science Festival (P. Bloomfield 2013 and 2015), Strictly Science (L. West, 2013), Ethical Review panel meeting in 2010, Imperial Science Festival (Cher Bachar, 2015) and 'Skeptics in the pub' talk on changes in the brain in schizophrenia (P. Bloomfield, 2015).

### INTERNATIONAL COLLABORATIONS (ONGOING)

**Graham Knott**, Interdisciplinary Centre for Electron Microscopy, EPFL, Lausanne, Switzerland

**Ryohei Yasuda**, Max Planck Florida Institute (MPFL), Jupiter, USA

**Atsushi Miyawaki**, RIKEN Brain Science Institute (RIKEN-BSI), Tokyo, Japan

**Ali Ertürk**, Institute for Stroke and Dementia Research (ISD), München, Germany

**Sen Song**, Department of Biomedical Engineering, Tsinghua University, Beijing, China

### RESEARCH HIGHLIGHTS

- Human axon pruning, synaptogenesis and network activity can be modelled *in vivo*, combining patient-specific genetic background with live imaging in a multi-structured cortical tissue system, with Livesey (*Science* 2018).
- Early involvement of inflammation in schizophrenia, with Howes (*Am. J. Psych.* 2015).
- Spontaneous axon regeneration in the injured adult cortex; the glia scar is probably not the main player in the inhibition of axon regrowth (*Nat Commun.* 2013; *PNAS* 2013; *J Neurosci.* 2013).
- Synapses are more dynamic in the aged brain than in young adults, highlighting a new principle for long-term memory impairment (*PNAS* 2013).
- Axons and presynaptic terminals undergo cell type-specific structural changes in the adult cortex *in Vivo*, with Svoboda (*Neuron* 2006, *Nat Protoc.* 2009).
- Developed Thy1-GFP mice, a genetic labelling tool now widely used, with Caroni (*Neuron* 2002; *Nat Neurosci.* 2003).
- Presynaptic terminals, previously considered stable elements in the adult, can be structurally plastic. We elucidated a pathway directing their stability in the hippocampus, with Caroni (*Nat Neurosci.* 2003).

In most of these studies we were the first to longitudinally image neurons, axons and their synapses in the mammalian brain *in vivo*. Overall, our work highlights the central role of cell-type in regulating structural and functional plasticity in the adult cortex. We are now studying the mechanisms of this cell-intrinsic regulation in patient-derived cortical tissue systems, to discover their relevance for human brain development, regeneration and degeneration.

### SUMMARY OF PUBLICATION RECORD

**45 journal papers** (<http://orcid.org/0000-0001-9987-8291>) including 6 reviews/book chapters and 9 conference proceedings. Eight papers with > 100 citations ea. H-index = 20, >2600 total citations (Google Scholar). Mean Impact Factor = 13 (first/last author primary research papers excluding reviews). **Since the establishment of my own lab in 2008, I have published 35 papers** (20 primary research, 6 reviews and 9 conference proceedings), **10 of the 20 primary research papers are as lead author.**

### SELECTED PUBLICATIONS

#### **My own group**

1. Raquel Real\*, Antonio Trabalza\*, Manuel Peter\*, Shabana Khan, Mark A. Smith, Joana Dopp, Samuel J. Barnes, Ayiba Momoh, Alessio Strano, Emanuela Volpi, Graham Knott, Frederick J. Livesey<sup>^</sup> and **Vincenzo De Paola<sup>^</sup>** (2018). *In vivo* modeling of human neuron dynamics and Down syndrome. *Science, in press*. *First in vivo imaging study of the earliest stages of human cortical neuron development and applicability to model a complex genetic disorder. We combined live imaging in a multi structured tissue environment and patient-specific genetic background.* \*Equal Contribution, <sup>^</sup>Corresponding authors.

2. M. Peter\*, R. Real\*, A. Trabalza\*, S. Khan, S. Barnes, M. Smith, G. Knott, **V. De Paola**<sup>^</sup>, F. Livesey<sup>^</sup>. Aberrant neuronal network activity development and connectivity in human Down syndrome cortical neurons (*in submission*). \*Equal Contribution, <sup>^</sup>Corresponding authors.
3. Canty, A.J.\*, Jackson, J.S.\*, Huang, L., Trabalza, A., Little, G., **De Paola, V.** Single-axon-resolution intravital imaging reveals a rapid onset form of Wallerian degeneration in the adult neocortex *BioRxiv*.
4. K Akassoglou,<sup>1\*</sup> M Merlino,<sup>1</sup> V A. Rafalski,<sup>1</sup> R Real,<sup>2</sup> L Liang<sup>3\*</sup>, Y Jin,<sup>4</sup> S E. Dougherty,<sup>4,5</sup> **V De Paola**,<sup>2\*</sup> D J. Linden,<sup>4\*</sup> T Misgeld,<sup>6\*</sup> and B Zheng<sup>7\*</sup> (2017). In Vivo Imaging of CNS Injury and Disease. *J. Neuroscience* Nov 8;37(45):10808-10816. \*Equal Contribution. (4 citations)
5. Bloomfield P, Sudhakar S, Veronese V, Rizzo G, Bertoldo A, Owen D, Bloomfield M, Bonoldi I, Kalk N, Turkheimer F, McGuire P, **De Paola V**<sup>§</sup>, Howes O<sup>§</sup> (2016). Microglial activity in people at ultra-high risk of psychosis and in schizophrenia; an [11C]PBR28 PET brain imaging study. *American Journal of Psychiatry*. Oct 16. §Co-Senior authors. (175 citations).
6. Grillo, F, Song, S<sup>^</sup>, Teles-Grilo Ruivo, LM, Huang, L, Ge, G, Knott, G, Ferretti, V, Thompson, D, Little, G, **De Paola, V.**<sup>^</sup> (2013). Increased axonal bouton dynamics in the ageing mouse cortex. *Proc. National Academy of Sciences Plus*. (77 citations). *First in vivo imaging study in the aged brain at synaptic resolution. We discovered that synapses are more dynamic in the aged brain than in young adults, highlighting a new principle for long-term memory impairment.* <sup>^</sup>Corresponding authors.
7. Canty, A.J., Huang, L., Jackson, J.S., Little, G., Knott, G., Maco, B., **De Paola, V.** (2013). In-vivo single neuron axotomy triggers axon regeneration to restore synaptic density in specific cortical circuits. *Nature Commun.* 4, 2038. (50 citations). *Evidence for spontaneous cell type-specific axon regeneration associated with the re-establishment of normal synaptic density after laser-mediated axotomy in vivo.*
8. Canty, A.J., Teles-Grilo Ruivo, L., Nesarajah, C., Jackson, J.S., Little, G., Song, S., **De Paola, V.** (2013). Synaptic elimination and protection after minimal injury depend on cell type and their pre-lesion structural dynamics in the adult cerebral cortex. *J. Neuroscience* 33:10374-10383. (20 citations). *Axons undergo a rapid and lasting process of synaptic elimination, which depends on cell type and their pre-lesion structural dynamics, while synapse formation rates are globally unaffected after laser-axotomy.*
9. L. Allegra-Mascaro, P. Cesare, L. Sacconi, G. Grasselli, G. Mandolesi, B. Maco, G. Knott, L. Huang, **V. De Paola**, P. Strata and F.S. Pavone (2013). In vivo single branch axotomy induces GAP-43 dependent sprouting and synaptic remodeling in cerebellar cortex. *Proc. National Academy of Sciences*. (76 citations). *First quantitative analysis of axonal regeneration and synaptic reorganization in the cerebellum of living mice by combining longitudinal in vivo 2-photon imaging with laser microsurgery, viral mediated shRNA manipulation and correlated 2P-FIBSEM.*
10. Holtmaat\* A, Bonhoeffer T, Chow D, Chuckowree J, **De Paola\* V**, Hofer S, Hübener\* M, Keck T, Knott\* G, Lee W, Mostany R, Mrsic-Flogel T, Nedivi E, Portera-Cailliau\* C, Svoboda K, Trachtenberg\* J, Wilbrecht L. (2009). Long-term high resolution imaging in the mouse neocortex through a chronic cranial window. *Nature Prot.* 4:1128-1144. (Except first author, leading/corresponding authors\* are listed in alphabetical order). (535 citations).

#### Before 2008

11. **De Paola, V.**, Holtmaat, A., Knott, G., Song, S., Wilbrecht, L., Caroni, P., and Svoboda, K. (2006). Cell type-specific structural plasticity of axonal branches and boutons in the adult neocortex. *Neuron* 49, 861-875. (365 citations).
12. Portera-Cailliau, C., Weimer, R. M., **De Paola, V.**, Caroni, P., & Svoboda, K. (2005). Diverse modes of axon elaboration in the developing neocortex. *PLoS Biology* 3, e272. (191 citations).
13. **De Paola, V.**, Arber, S., and Caroni, P. (2003). AMPA receptors regulate dynamic equilibrium of presynaptic terminals in mature hippocampal networks. *Nature Neurosci.* 6, 491 (237 citations).
14. Livet, J., Sigrist, M., Stroebel, S., **De Paola, V.**, Price, S. R., Henderson, C. E., Jessell, T. M., and Arber, S. (2002). ETS gene Pea3 controls the central position and terminal arborization of specific motor neuron pools. *Neuron* 35, 877-892. (226 citations).