

# Nathan Curry

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## Research experience

**PDRA** **Using Oblique Plane Microscopy to quantify the relationships between morphological plasticity in 3D, ERK signalling and metastasis**  
Feb 2018–present

**Supervisor** Dr. Christopher Dunsby, *Imperial College London*  
Optimised and applied an oblique plane microscope to perform high content time-lapse 3D, 3 colour imaging of live cells in 3D culture on multiwell plates. Applied the system to drug discovery projects and studies of metastasis in cancer.

- **Optimised** hardware and data handling to enable the system to image 800 cells per 5 minutes from 8 different biological conditions over 24 hours.
- **Developed** custom code for efficient cell segmentation and tracking of 3D cell images (>2 TB) and the extraction and analysis of 3D morphological parameters, including tracking over up to 24 hours.

**PhD thesis** **Development of correlative STED and atomic force microscopy, and application in neuroscience**  
2013–2017

**Supervisor** Prof. Clemens Kaminski, *University of Cambridge*  
A custom STED super-resolution microscope was developed and applied to 3D imaging of cell cultures and cleared tissues. This was integrated with an atomic force microscope to investigate cytoskeletal organisation and mechanical properties of live cells, in particular during polarised migration. This was the first study of correlative live-cell AFM and led to two publications.

- Prof. Nathalie Rouach, *College de France*
- **Designed, constructed and characterised** a STED microscope which involved aligning to photonic crystal fibres and single mode optical fibres, developing LabVIEW and MATLAB control software, and characterising the resolution of the system.
  - **Optical alignment** and spatiotemporal shaping of 2 beams for STED imaging.
  - **Applied** this system to biological projects including imaging of the polarised migration of live primary cell cultures and 3D imaging of astroglia in cleared tissue.
  - **Integrated** advanced fluorescence and atomic force microscopes for live cell mechanical property recording.
  - **Optimised** sample preparation including fluorescent labelling of primary cell cultures for super-resolution imaging.
  - **Analysed images** including 3D image stacks and multidimensional data.

**MRes project** **Automated wavelength selection from a supercontinuum source for fluorescence lifetime imaging**  
summer 2013

**Supervisor** Prof. Clemens Kaminski, *University of Cambridge*  
Developed a low cost platform for spectral selection from a supercontinuum source combining stepper motors and Linear Variable filters for arbitrary wavelength selection.

- **Ray tracing** using MATLAB, OSLO and Zemax to design optical systems.
- **Designed** the system using SolidWorks.

**MRes project** Oct 2012–Jun 2013 **Investigating the feasibility of photoacoustic AFM for label-free nanoscale imaging**

**Supervisors** Dr Ben Cox, *UCL* Investigated the viability of using an AFM probe in contact with a sample to measure photoacoustic waves induced by a modulated IR source using theoretical models and experimental measurements on custom phantoms.

Dr Bart Hoogenboom, *UCL*

- **Hardware and software integration** of AFM, a laser source, lock-in amplifiers and a Mach-Zender interferometer.

**MSci project** Aug 2010–Jun 2011 **Spatiotemporal characterisation of light in scattering media**  
Developed a technique for the characterisation of the optical scattering properties of a turbid medium and developed an instrument to aid in spatiotemporal focusing of light through these media, leading to a publication in *Optics Letters*.

**Supervisor** Dr. Sylvain Gigan, *ESPCI, Paris*

- **Automation** of data acquisition and analysis using MATLAB and LabVIEW.
- **Modelling** of optical diffusion in Fortran and MATLAB.

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## Teaching experience

**Academic tutor** **Imperial College London, Department of Physics**

Oct 2018–Present Responsible for preparing 5 groups of four students for exams applying fundamental physics concepts to new situation

- **Adapted** the pace and type of material covered in tutorials to suit the needs of individual groups (100% of students rating tutorials good or very good).
- **Delivered** detailed feedback on written work to students (89% of students rating this good or very good).

**Teaching associate** **Cambridge Centre for Doctoral Training in Sensor Technologies and Applications**

Dec 2016–Feb 2018 Responsible for delivering the MRes aspect of the course as well as providing continuous skills training to PhD students.

- **Conceived and delivered** the Sensor Café evening workshop series. Motivated initially sceptical students to give up their evenings to attend an event which regularly achieves 90% attendance.
- **Identified and resolved** issues with the new student induction program by adding 2 days of flash talks from 27 academics and industrial supervisors. This led to the creation of new research projects for students and received positive feedback.
- **Chaired** the team of supervisors overseeing the 12-week, 12-student team challenge research project, which presented at the Sensors Day research conference and raised £5000 of additional research funding.
- **Organised** the Sensors Student Showcase event 2017 (~100 local and international students and industry delegates) and supported the organisation of the Sensors Day 2017 flagship conference.

**Project supervisor** **Laser Analytics Group, Cambridge**

2013–present **Proposed and supervised** undergraduate and graduate student research projects and first year PhD students leading to poster presentations at international conferences.

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## Industry experience

### Intern, Systems Illumina Ltd., Cambridge

- Integration**  
Jul 2011–Sep 2011
- **Investigated** a new optical technique to reduce the error rate of a commercial DNA sequencer.
  - **Communicated** results to colleagues locally and in the USA via teleconference.

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## Education and qualifications

- Oct 2012–Sep 2013 Distinction  
**UCL/Cambridge** MRes in photonics systems development
- Oct 2012–Sep 2013 Distinction  
**Imperial College London** MSci Physics with a year in Europe
- Oct 2008–Jun 2012 2:1 (69%)

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## Administrative responsibilities

- Lab organisation** Took a lead role in preparing for and delivering a lab move in 2016 including arranging specialist movers and outlining actions and timelines.
- Purchasing** Directly responsible for the purchase of 7 new optical tables (worth £70 000).
- Conference organisation** A key player in organising the Sensors Day international conference and directly responsible for coordination the Sensors Student showcase event.
- Science communication** Maintained research group website, including preparing news items.

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## Prizes

- Poster prizes**
- Second prize, *Bruker SPM Users Meeting & Conference (2016)*
  - Second year prize, *Department of Chemical Engineering and Biotechnology Graduate Conference (2015)*

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## Membership of professional bodies and other activities

- OSA
- Co-founder and vice-president of the OSA Cambridge student chapter.
  - Increased membership to 15 members.
  - Raised £1000 for outreach and student engagement activities.
  - Selected to attend the OSA student conference 2016.

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## Conferences

- Invited talks**
- Correlative STED and AFM on live cells to investigate cell migration, *Bruker SPM Users Meeting & Conference (2017)*

- Oral presentations**
- Correlative live cell STED and atomic force microscopy identifies changes of cytoskeletal organisation and cell physical properties during polarised migration, *Microscience and Microscopy Congress (2017)*
  - Live-cell STED/AFM correlates cytoskeletal structure and cell physical properties, *Frontiers in Optics (2016)*
  - Investigation of dendritic spines by STED Nanoscopy, *European Conferences on Biomedical Optics (2015)*
- Selected poster presentations**
- Live cell STED-AFM correlates cellular structure with membrane physical properties, *Focus on Microscopy (2017)*
  - Automation of the spectral selection of super-continuum laser sources for advanced microscopy, *Microscience and Microscopy Congress (2014)*
  - Stimulated emission depletion microscopy to study amyloid fibril formation, *Nanoscopy and Labelling (2014)*

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## Publications

- Published**
- Lautenschläger J, Stephens A, Fusco G, Ströhl F, **Curry N**, Zacharopoulou M, Michel C, Laine R, Nespovitaya N, Pinotsi D, Zago W, Fraser P, Tandon A, ; George-Hyslop P, Rees E, Phillips J, De Simone A, Kaminski CF, Kaminski Schierle GS, "C-terminal calcium binding of ÎŒ-synuclein modulates synaptic vesicle interaction" *Nat. Comms.* **9** (712).
  - **Curry N**, Ghézali G, Kaminski Schierle G, Rouach N, Kaminski CF, "Correlative STED and atomic force microscopy on live astrocytes reveals plasticity of cytoskeletal structure and membrane physical properties during polarized migration", *Front. Cell. Neurosci.* (2017), **11** (104).
  - **Curry N**, Bondareff P, Leclercq M, van Hulst NF, Sapienza R, Gigan S, Grèsillon, "Direct determination of diffusion properties of random media from speckle contrast" *Optics Letters* (2011) **36** (17) 3332–3334.
- Submitted**
- **Curry N**, Mahou P, Eggeling C, Kaminski CF, "A comparison of the photon efficiency of different STED implementations: a theoretical review."
  - Ghézali G, Vasile F, **Curry N**, Fantham M, Ezan P, Cohen-Salmon M, Kaminski CF, Rouach N, "Neuronal activity drives astroglial connexin 30 in perisynaptic processes and shapes its functions" *eLife*
  - Ghézali G, **Curry N**, Vasile F, Kaminski CF, Rouach N, "Connexin 30 controls actin cytoskeleton remodeling and membrane physical properties in migrating astrocytes."

**Selected  
conference  
proceedings and  
preprints**

- **Curry N**, Ghézali G, Kaminski Schierle G, Rouach N, Kaminski CF, "Live Cell STED-AFM Analysis Correlates Cytoskeletal Structure Remodelling and Membrane Physical Properties during Polarized Migration in Astrocytes," *Biophysical Journal*, 114 (3), 386a.
- Laine RF, Sinnige T, Yu Ma K, Haack AJ, Poudel C, Gaida P, **Curry N**, Perni M, Nollen EAA, Dobson CM, Vendruscolo M, Kaminski Schierle GS, Kaminski CF, "Fast fluorescence lifetime imaging reveals the aggregation processes of  $\alpha$ -synuclein and polyglutamine in aging *Caenorhabditis elegans*," bioRxiv, 414714.
- **Curry N**, Ghézali G, Kaminski Schierle G, Rouach N, Kaminski CF, "Live-cell STED/AFM correlates cytoskeletal structure and cell physical properties," *Frontiers in Optics OSA Technical Digest*, Optical Society of America, (2016), paper FF2A.1
- Mahou P, **Curry N**, Pinotsi D, Kaminski-Schierle GS, Kaminski CF, "Stimulated emission depletion microscopy to study amyloid fibril formation", *SPIE NanoScience+ Engineering*, VIII, 93310U
- **Curry N**, Bondareff P, Leclercq M, van Hulst NF, Sapienza R, Gigan S, Grèsillon, "Measuring the optical traversal time of a thick complex medium," *Conference on Lasers and Electro-Optics 2012 OSA Technical Digest*, Optical Society of America, (2012), paper QF3H.5