

# Peter Reader

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## Technical skills

(L)SPR on in-house light-scattering biosensor instrument  
Antibody screening  
Microarray printing  
ELISA  
SDS-PAGE (Western blot and Coomassie staining)  
Data fitting

## EDUCATION

- 2015-2019 *University of Exeter Medical School*  
PhD Medical Studies, *viva* passed on 9<sup>th</sup> July 2019.
- 2012-2015 *University of Exeter*  
BSc Biological and Medicinal Chemistry with honours  
College Commendation for Academic Excellence
- 2005-2012 *West Buckland School, Devon*  
Four A Levels (A-B): Chemistry, Biology, French, Product Design. Physics (AS level).  
Eleven GCSEs (A\*-B)

## EXPERIENCE

- 2015-2019 *PhD Research, University of Exeter Medical School*  
Thesis title: *in vitro* Characterisation of the Complement Cascade for Predicting Patient Outcome Post-operatively

The project was based in the laboratories of Attomarker Ltd, an *in vitro* diagnostics start-up, and involved a period of industrial experience at a technology partner in Europe. The project involved 3 research areas:

- 1) Developing quantitative microarray immunoassays for protein biomarkers in blood, denoting immune state and risk of hospital acquired infection. The assays were based on a novel optical (SPR) biosensor platform which records light scattering of antibody-functionalised gold nanoparticles to observe kinetics of analyte binding to assay surfaces in real time. Bespoke signal processing routines were written in MATLAB / LabView to automate data analysis and instrument calibration / quality control, allowing sensitivity of the biosensor assay surfaces to be optimised with iterative method development. In addition to the biomarker assays, a novel technique for assessing antibody monomeric purity was developed to improve the reliability of immunoassay experiments.
- 2) Kinetic characterisation of a complex protein system. Complement is a system of plasma proteins in the innate immune system and the dynamics of Complement activation to a standard stimulus *in vitro* was proposed as new test of host vulnerability to infection. Complement activation was characterised in pooled human serum using a Systems Biology approach: constructing and fitting a mechanistic model of ordinary differential equations to kinetic time-course data from ELISA and a novel SPR biosensor. Model parameter estimation was performed in MATLAB using global optimisation routines to explore a multi-dimensional search space with many local minima. The optimised model enables hypothesis-driven selection of candidate biomarkers sensitive to a compromised Complement system, such as depleted protein concentrations as observed following sepsis.

- 3) Clinical investigation of Complement activation phenotypes in a cohort of healthy adults.  
Human serum data was studied to establish the variation of phenotypes in the adult population and compared to predictions of the kinetic model with a number of statistical tests. A correlation analysis was performed to identify relationships between starting protein concentrations and the kinetics of Complement activation in patient samples.

The project provided many prerequisites for further research into Complement activation phenotypes as biomarkers of post-operative infection risk: new biosensor assays, new biomarkers and a new mathematical model to predict effect size of Complement depletion.

Publications: 2 under review, 2 published:

**Reader, P.P. and A.M. Shaw, Kinetic Analysis of the Multivalent Ligand Binding Interaction between Protein A/G and IgG: A Standard System Setting. The Journal of Physical Chemistry B, 2017. 121(38): p. 8919-8925.**

**Reader, P.P., et al., A rapid and quantitative technique for assessing IgG monomeric purity, calibrated with the NISTmAb reference material. Analytical and Bioanalytical Chemistry, 2019.**

- 2015-present *Reaction-Science.com*  
Creator and webmaster of an online science communication magazine which caters for readers with no specialist knowledge. Monthly articles are concise accounts of popular science with references revealing the facts behind sensationalist stories in the media as well as intriguing fundamental concepts. Website: [reaction-science.com](http://reaction-science.com)
- 2015-2016 *Wiley Publishing*  
Programming Wolfram Mathematica CDF files for the text book "Astrochemistry" by Dr Andrew Shaw. CDF files are dynamic graphs, figures and animations with which the user may interact to visualise data and processes. Focus on data visualisation to concisely display many experimental results in a single dynamic figure.
- 2015 *Experimentation Magazine*  
Science communication writer for Life Sciences and Physical Sciences: articles on the science of everyday processes, fundamental concepts and new discoveries. Targeted at a non-specialist readership.
- 2015 *Undergraduate Research Project, University of Exeter*  
Distinguishing between Gram positive and negative bacterial blood infections based on differential Complement system activation to aid antibiotic selection. Extensive use of aseptic technique and ELISA, requiring precise time management and efficient lab work. I developed a MATLAB image analysis programme to improve the efficiency of data collection (CFU counts). Available at: [ppr-development.com/matlab.html](http://ppr-development.com/matlab.html)
- 2014 *Undergraduate Research Competition, International Genetically Engineered Machine (iGEM)*  
Genetic modification of *E. coli* to produce proteins capable of degrading the explosive pollutants nitroglycerin and TNT. Responsible for the kinetic characterisation of our enzymes and data analysis. I developed HPLC solvent gradient step methods to separate and quantify nitroglycerin and TNT from complex elution profiles. I presented the project to an audience and judging panel in Boston, USA. Team website: [2014.igem.org/Team:Exeter](http://2014.igem.org/Team:Exeter)
- 2013 *University of Exeter*  
Life Sciences ambassador to visitors/prospective students

## LANGUAGE SKILLS

Fluent in French (2 years of school in France).

## I.T SKILLS

Highly competent user of Microsoft software: Word, PowerPoint, Excel, Publisher, Outlook.

Regular user of Adobe editing and animation software: After Effects, Premiere, Photoshop.

## PROGRAMMING EXPERIENCE

A portfolio of projects can be found at my website: [ppr-development.com](http://ppr-development.com)

Languages: MATLAB, Mathematica, HTML / CSS, Java.

Designed and coded numerous MATLAB image analysis and signal analysis programs to streamline data collection for my PhD.

Designed and coded 4 Android mobile apps with >3000 combined downloads on the Google Play store:



Chem Calc: equation solver and calculator for chemistry students



ERASE: public outreach tool for the Exeter iGEM bioremediation project



Chase Me Running: motivational media player for runners



Tap Attack: mobile arcade game

Creator and webmaster of [reaction-science.com](http://reaction-science.com)

## OTHER SKILLS

Combined Cadet Force (Army) N.C.O and First Aider

PADI certified scuba diver

Level 2 Royal Yacht Association certified sailor

Holds a Full (clean) UK Driving License

## INTERESTS AND ACHIEVEMENTS

Represented the University of Exeter team in the 'Battle of Ideas' debates at The Barbican in London and at the International Genetically Engineered Machine Competition (iGEM) in Boston, USA.

Met Sir Patrick Moore and featured in the popular *Sky At Night* magazine for a novel telescope design.

Builds and flies large performance RC helicopters and a member of cycling, field hockey and squash clubs.