

Jonathan Wray, Ph.D.

Professional experience

Open source project contributions

- Released code to integrate the Spring Rich Client Platform (RCP) with advanced Swing components from JIDE. The major focus of the project was the implementation of the Spring RCP concepts of multiple view and/or editor per page using the JIDE docking framework. The code is in use in a number of production applications and is freely available at <https://jide-springrcp.dev.java.net/>.
- Contributed a plug-in to the Hudson continuous integration engine that provides integration with the Polarion web client for Subversion.
- Developed, and released to the public domain, a browser for the cancer bioinformatics infrastructure objects web services provided by the National Cancer Institute. The browser is written in Java Swing, and is available from <http://www.jonnywray.com/java>.

Jan 2004 – Present. Five Prime Therapeutics

San Francisco, CA

Sr. Architect, Bioinformatics

Jan. 2002 – Dec. 2003. BD Biosciences Clontech

Palo Alto, CA

Group Leader, Bioinformatics Software Development Team

- Responsible for the software development team within BD Biosciences Clontech.
- Team is responsible for the development of software tools used both internally to aid in product development, and externally as product support.
- Designed and implemented a number of database driven systems to aid in product development and support. The development process included the design of the database schemas and the design and implementation of Java based systems for data access. Examples include:
- Web based search and ordering system for Clontech's Freedom ORF Clone product. The application greatly improves, over traditional string searching, the customers ability to find clones of interest from within Clontech's collection.
- Design and implementation of the database system underlying an automated, robotic facility used in microarray production. Project involved considerable collaboration with the robotic engineers as well as the development of a Swing application for data manipulation.
- Web application and database to provide support for Clontech's disease profiling arrays. The application provides array layout information as well as clinical information from the patients that provided the samples used on the arrays.
- Web application to allow users to design RNAi sequences for target sequences of their choice, and also to design the long oligos needed to insert the RNAi sequence into Clontech delivery vectors.
- Database and web application development for support of Clontech's microarrays, both gene arrays and antibody arrays. System provides array layouts, detailed probe and target information and search capabilities.
- A centralized repository for Clontech's vector collection for use internally by the research and development, marketing and technical communications departments. System has greatly improved the sharing of information between and within the disparate departments.
- Designed and implemented the expansion of Clontech's bioinformatics web site from a system hosting one web application, and supporting one product, to a site hosting 10 web applications supporting 6 product lines. The majority of the applications are data driven using J2EE technology with an Oracle backend database.
- Supervised the design and development of a system used to manage the design, development, ordering and product support aspects of Clontech's real time PCR product line.
- Continued the development and maintenance of existing software, including probe design software,

database client access code and Clontech's collection of reusable Java class libraries.

- Install and maintain local copies of various biological databases including RefSeq, LocusLink, SwissProt and GO.

Oct. 2000 – Dec. 2001. BD Biosciences Clontech

Palo Alto, CA

Research Scientist, Bioinformatics

- Successfully organized and implemented the migration of bioinformatics database system from Sybase to Oracle.
- Developed database system and client-server based front-end software to aid in gene probe design. System significantly improved probe design timeframes.
- Designed and developed bioinformatics web site providing customer support for gene array products using a three-tier architecture with J2EE technology and an Oracle backend database. The performance, reliability, and functionality of the site were greatly improved compared with the previous implementation.
- Designed and developed a generic, configurable parser to enable the parsing of external, flat-file based databases. Currently used for the parsing and loading of multiple external databases into Clontech's internal relational database.
- Design and development of Java based class libraries, or packages, specific to the needs of Clontech bioinformatics. Currently used within a number of projects.
- System administration of Tru64 based UNIX system used in probe design process.
- Organization of departmental computer infrastructure.

1993 – Oct. 2000. The Neurosciences Institute

San Diego, CA

Senior Fellow in Theoretical Neurobiology

- Utilized statistical measures based on information theory, originally developed to characterize brain dynamics, to develop a practical system for novelty detection. System was shown to provide significant performance improvements over traditional neural network based techniques, in two applications: mechanical fault detection and text-independent speaker recognition.
- Successfully designed and implemented human imaging studies aimed at characterizing brain dynamics underlying visual perception. Experiments involved the gathering of large-scale, biological data sets and their subsequent analysis using a combination of statistical data analysis techniques, statistical hypothesis testing methodology and concepts from dynamic system theory.
- Involved in a theoretical study of the role of natural images and eye movements on the development of the visual cortex. Using statistical techniques to analyze the firing patterns of spatially distributed neurons, the brain's response to static natural images was shown to be incompatible with the development of normal visual cortical responses. Analysis of the change in statistical patterns produced during microscopic eye movements led to a novel proposal of their potential role during visual development.
- Played a major role in the development of the machine psychology laboratory at the Neurosciences Institute. The laboratory, which couples robotic devices with computer simulated nervous systems, is a unique approach in the study of the neural basis of behavior.
- Designed, specified and implemented a robotic ocular motor system for use as a tool in the study of the role of eye and head movements in vision and visual development. Development of the system involved the integration and programming, under C, C++ and assembler, of five different computer systems, each controlling a different aspect of data collection, robotic control and neural simulation.
- Participation in a collaborative research project, using the aforementioned robotic ocular motor systems, that proposed and successfully demonstrated the feasibility of a particular method to align maps of space in different sensory modalities as these maps continuously change during brain development. Project involved the development of a neural simulation, written under C, modeling specific parts of auditory and visual brain. The simulation was interfaced with the robotic system using various digital signal processing techniques. In addition, standard techniques of data analysis were used to assess the performance of the system.

- Successfully developed large-scale, accurate models of parts of the brain with the aim of validating mechanistic theories of contextual interaction within color vision. Project involved the expansion of two neural simulators, under both C and Objective-C, to provide major functionality not previously implemented.
- Produced peer-reviewed papers in prestigious journals with both theoretical and experimental audiences.
- Organized a four-day international symposium on brain dynamics and visual processing at the Neurosciences Institute.
- Presented work at major international conferences of the neuroscience, vision and neural network communities.
- Given invited presentations to audiences as diverse as the Physiological Society of London and an advanced technology committee of the US intelligence community.
- Awarded a DARPA contract to produce a detailed proposal for a multiyear research program into the practical applications of modern brain theory.

1991 – 1992. Dept. Physiological Sciences

Newcastle University, UK

Lecturer in Mathematics

- Designed and taught a course in mathematics to the staff of the Dept. of Physiological Sciences. Concentrated on numerical implementation of mathematical concepts.

1989 – 1992. Depts. of Eng. Math., Physiology and Electrical Eng.

Newcastle University, UK

Tutorial Assistant and Laboratory Demonstrator

- Taught and marked tutorials in mathematics to engineering students.
- Ran and marked laboratory classes in membrane biophysics, psychophysical techniques, computer modeling in neuroscience, microprocessor design and programming, robotics and electronics.

Summer 1991. Dept. Chemical Engineering

University of Maryland, MD

Faculty Research Assistant

- Involved with the successful development and implementation of the department's CONSCIENCE project, a suite of tools for control and system identification using an integration of neural networks and traditional techniques.
- Developed both the neural network and GUI aspects of the project.

1989-1990. Interactive learning project

Newcastle, UK

Contract C programmer

- Designed and wrote a program to control, and the GUI to, a videodisk teaching system in use by the public at the 1990 National Garden Festival.

Education

1989 – 1992. Dept. Physiological Sciences

Newcastle University, UK

Ph.D. Computational Biology

- Thesis title: Theory and Application of Neural Networks.
- Successful development of a new mathematical framework for the analysis of neural networks.
- New mathematical framework led to the development of an algorithm for the calculation of Volterra kernels of unknown, non-linear dynamic systems. Application of the algorithm to an analytic system illustrated a significant improvement in accuracy over traditional techniques.
- Technique has since been successfully applied in a number of applications from characterizing the dynamics of chemical reaction systems to modeling dynamic interactions with the human brain.

1986 – 1989. Dept. Electrical Engineering

Newcastle University, UK

B.Eng. (1st class) Electrical and Electronic Engineering

- Courses included a wide selection of electrical engineering courses with a final emphasis on microprocessor and computer engineering.
- Industrial sponsorship by Marconi Radar Systems. Successful completion of a structured training course involving 3-4 month placements within different areas of the company and a variety of training courses.

Skills

- Over 15 years experience in applying computational techniques to a diverse range of biological research and development problems, from molecular biology to systems level neurobiology.
- Over 18 years computer programming experience in multiple languages including Java, C, C++, Objective-C, Matlab, UNIX shell scripts and various assembly languages.
- Over 7 years of in depth, object-oriented programming experience in Java. Knowledge of object orientated analysis and design, the UML and the design pattern literature.
- Extensive experience in server-side development using J2EE technology, including the various component technologies (Servlets, JSP, JDBC, JMS, Java Mail), supporting frameworks (Struts, Hibernate, Spring, Tapestry), application servers and other related technology such as JavaSpaces and Enterprise Service Bus (Mule)
- In depth experience in GUI development ranging from older technology, such as Motif and X11, to Java based experience with Swing. Developed, and released as open source, a code base allowing the JIDE Swing libraries to integrate with the Spring rich client platform
- Extensive knowledge and experience in database design and object relational mapping technology. SQL coding and administration experience in Oracle.
- Knowledge of XML technology including XML Schema design, XSLT, and the various Java XML libraries. Experience in data driven graphics using SVG.
- Extensive experience with the implementation and use of a variety of numerical techniques under both C and MatLab.
- User knowledge of multiple operating systems, including UNIX (Solaris, Tru64 and Linux), MS Windows, and MacOS.
- Extensive technical writing skills evidenced by multiple peer reviewed journal publications, peer reviewed conference articles, and conference abstracts.
- Served as referee for peer-reviewed journals including Learning and Memory, Neural Networks and IEEE Transactions on Neural Networks.

Publications

Journal Articles

- Rucci, M., Edelman, G.M., & Wray, J. (2000). Modeling LGN responses during free-viewing: A possible role of microscopic eye movements in the refinement of cortical orientation selectivity. *Journal of Neuroscience*. **20**, 4708-4720.
- Rucci, M., Edelman, G.M., & Wray, J. (2000). Robust localization of auditory and visual targets in a robotic barn owl. *Journal of Robotics and Autonomous Systems*. **30**, 181-193.
- Rucci, M., Edelman, G.M., & Wray, J. (1999). Adaptation of orienting behavior: From the barn owl to a robotic system. *IEEE Transactions on Robotics and Automation*. **15**, 96-110.
- Rucci, M. & Wray, J. (1999). Binaural cross-correlation and auditory localization in the barn owl: A theoretical study. *Neural Networks*. **12**, 31-42.
- Wray, J. & Edelman, G.M. (1996). A model of color vision based on cortical reentry. *Cerebral Cortex*. **6**, 701-716.
- Verschure, P.F.M.J., Wray, J., Sporns, O., Tononi, G. & Edelman, G.M. (1995). Multilevel analysis of classical conditioning in a behaving real world artifact: An illustration of synthetic neural modeling. *Robotics and Autonomous Systems*. **16**, 247-265.
- Wray, J. & Green, G.G.R. (1995). Neural networks, approximation theory, and finite precision computation. *Neural Networks*. **8**, 31-37.
- Wray, J. & Green, G.G.R. (1994). Calculation of the Volterra kernels of non-linear dynamic systems using an artificial neural network. *Biological Cybernetics*. **71**, 187-195.

Meeting Articles

- Rucci, M., Wray, J. & Edelman, G.M. (1998). Spatial localization and the refinement of orienting behavior: What can be learnt from the barn owl? *Proceedings of the 1998 IEEE International Symposium on Intelligent Control*. 253-256.
- Rucci, M. Wray, J. & Edelman, G.M. (1997). Adaptation of orienting behavior: From the barn owl to a robotic system. *IEEE Transactions on Robotics and Automation*. **10-11**, 91-93.
- Wray, J. & Green, G.G.R. (1992). Hardware implementation of trained networks. *Proceedings of the International Joint Conference on Neural Networks*. **2**, 560-564.
- Wray, J. & Green, G.G.R. (1991). Analysis of networks that have learnt control problems. *Control 1991: International Conference on Control*. **1**:261-265.
- Wray, J. & Green, G.G.R. (1991). The practical use of artificial neural networks: an investigation using Taylor series expansions of the network equations. *International Joint Conference on Neural Networks*. **2**, 995.
- Wray, J. & Green, G.G.R. (1991). The production of equivalent transfer functions from trained networks. *International Joint Conference on Neural Networks*. **2**, 973.
- Gorgui-Naguib, R.N., Dlay, S.S., Wray, J. & Green, G.G.R. (1991). An investigation into the use of non-linear neural network architectures. *Control 1991: International Conference on Control*. **1**, 51-154.

Meeting Abstracts

- Wray, J. & Srinivasan, R. (1999). Neural correlates of contextual interactions within color perception revealed by MEG dynamics. *Invest. Ophthalmol. Vis. Sci*. **40**, S818.
- Wray, J. & Srinivasan, R. (1999). Synchronization of neural activity during brightness induction revealed by MEG frequency tagging. *Soc. Neurosci. Abstr.* **25**:2187.
- Rucci, M., Edelman, G.M., & Wray, J. (1998). Modeling the influence of eye movements on the development of orientation selectivity. *Soc. Neurosci. Abstr.* **24**:812.
- Rucci, M. & Wray, J. (1997). A theoretical study of auditory azimuth localization in the barn owl. *Soc. Neurosci. Abstr.* **23**:734.
- Rucci, M. Wray, J. Tononi, G. & Edelman, G.M. (1997). A robotic system emulating the adaptive orienting behavior of the barn owl. *IEEE International Conference on Robotics and Automation*. **30**.
- Wray, J. & Edelman, G.M. (1997). Modeling the interaction of multiple cortical areas involved in the perception of color. *ARVO Annual Meeting*. **38**:S900.

- Wray, J. & Edelman, G.M. (1995). Computer simulations of the role of reentrant interaction in mediating contextual aspects of color vision. *Soc. Neurosci. Abstr.* **21**:905.
- Verschure, P.F.M.J., Wray, J. & Edelman, G.M. (1994). Classical conditioning and value-dependent learning in NOMAD, a real world artifact. *Soc. Neurosci. Abstr.* **20**:1208.