



School of Psychology  
University of St Andrews



G-Node  
German  
Neuroinformatics Node  
www.g-node.org

# Advanced Scientific Programming in Python

a Summer School by  
the G-Node and the School of Psychology, University of St Andrews

Scientists spend more and more time writing, maintaining, and debugging software. While techniques for doing this efficiently have evolved, only few scientists actually use them. As a result, instead of doing their research, they spend far too much time writing deficient code and reinventing the wheel. In this course we will present a selection of advanced programming techniques, incorporating theoretical lectures and practical exercises tailored to the needs of a programming scientist. New skills will be tested in a real programming project: we will team up to develop an entertaining scientific computer game.

We use the Python programming language for the entire course. Python works as a simple programming language for beginners, but more importantly, it also works great in scientific simulations and data analysis. We show how clean language design, ease of extensibility, and the great wealth of open source libraries for scientific computing and data visualization are driving Python to become a standard tool for the programming scientist.

This school is targeted at PhD students and Post-docs from all areas of science. Competence in Python or in another language such as Java, C/C++, MATLAB, or Mathematica is absolutely required. Basic knowledge of Python is assumed. Participants without any prior experience with Python should work through the proposed introductory materials before the course.

## Date and Location

September 11–16, 2011. St Andrews, UK.

## Preliminary Program

### Day 0 (Sun Sept 11) — Best Programming Practices

- Agile development & Extreme Programming
- Advanced Python: decorators, generators, context managers
- Version control with git

### Day 1 (Mon Sept 12) — Software Carpentry

- Object-oriented programming & design patterns
- Test-driven development, unit testing & quality assurance
- Debugging, profiling and benchmarking techniques
- Programming in teams

### Day 2 (Tue Sept 13) — Scientific Tools for Python

- Advanced NumPy
- The Quest for Speed (intro): Interfacing to C with Cython
- Best practices in data visualization

### Day 3 (Wed Sept 14) — The Quest for Speed

- Writing parallel applications in Python
- Programming project

### Day 4 (Thu Sept 15) — Efficient Memory Management

- When parallelization does not help:  
the starving CPUs problem
- Data serialization: from pickle to databases
- Programming project

### Day 5 (Fri Sept 16) — Practical Software Development

- Programming project
- The Pac-Man Tournament

Every evening we will have the **tutors' consultation hour**: Tutors will answer your questions and give suggestions for your own projects.

## Applications

You can apply on-line at <http://python.g-node.org>

Applications must be submitted before **May 29, 2011**. Notifications of acceptance will be sent by **June 19, 2011**.

No fee is charged but participants should take care of travel, living, and accommodation expenses. Candidates will be selected on the basis of their profile. Places are limited: acceptance rate in past editions was around 30%.

**Prerequisites:** You are supposed to know the basics of Python to participate in the lectures. Please consult the website for a list of introductory material.

## Faculty

**Francesc Alted**, author of PyTables, Castelló de la Plana, Spain

**Pietro Berkes**, Volen Center for Complex Systems, Brandeis University, USA

**Valentin Haenel**, Berlin Institute of Technology and Bernstein Center for Computational Neuroscience Berlin, Germany

**Zbigniew Jędrzejewski-Szmek**, Faculty of Physics, University of Warsaw, Poland

**Eilif Müller**, The Blue Brain Project, Ecole Polytechnique Fédérale de Lausanne, Switzerland

**Emanuele Olivetti**, Neuroinformatics Laboratory, Fondazione Bruno Kessler and University of Trento, Italy

**Rike-Benjamin Schuppner**, Bernstein Center for Computational Neuroscience Berlin, Germany

**Bartosz Teleńczuk**, Institute for Theoretical Biology, Humboldt-Universität zu Berlin, Germany

**Bastian Venthur**, Berlin Institute of Technology and Bernstein Focus: Neurotechnology, Germany

**Pauli Virtanen**, Institute for Theoretical Physics and Astrophysics, University of Würzburg, Germany

**Tiziano Zito**, Berlin Institute of Technology and Bernstein Center for Computational Neuroscience Berlin, Germany

Organized by Katharina Maria Zeiner and Manuel Spitschan of the School of Psychology, University of St Andrews, and by Zbigniew Jędrzejewski-Szmek and Tiziano Zito for the German Neuroinformatics Node of the INCF.

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