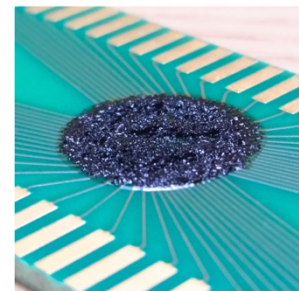
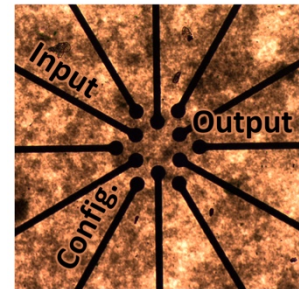
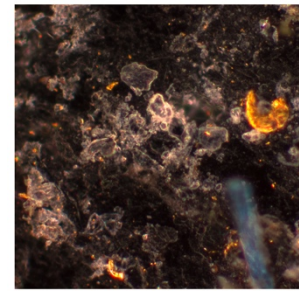


2 PhD Studentships on Splnspired

We are seeking two PhD students (3 year, UK fees + stipend; start date 1 Oct 2018) to join our team of researchers working on the **Splnspired** research project funded by EPSRC and the University of York, UK. Splnspired is developing a **methodology for exploiting unconventional computing in unconventional materials** such as carbon nanotubes, NMR, and liquid crystals. It is an interdisciplinary collaboration between researchers from York's Departments of Computer Science, Electronic Engineering, and Chemistry, and the York Cross-disciplinary Centre for Systems Analysis (YCCSA).

As we approach the miniaturisation limits of conventional electronics, alternatives to silicon transistors -- the building blocks of the multitude of today's electronic devices -- are being hotly pursued. Unconventional computing exploits unconventional material substrates within which to perform computation. Practical unconventional computing devices can comprise multiple unconventional substrates, each performing the part of the overall computation that it does best. For example, a bacterial system may be combined with an optical system to solve the 'wiring problem' of composing components, or a reaction-diffusion chemical system may be combined with a microfluidic droplet system to provide a range of contexts for the reactions. In even the simplest cases, an unconventional substrate is often combined with a conventional digital computer, for example carbon nanotubes in an evolutionary algorithm loop controlled by a traditional PC.

We have developed a computational framework called *Heterotic computing* (named from the term in genetics meaning 'hybrid vigour'), which can be used to extend a theory of unconventional computing to such multiple substrates.



PhD 1: Heterotic Computing: Theory

(Department of Computer Science; YCCSA)

This PhD research will be cosupervised by

Prof Susan Stepney (Dept Computer Science; YCCSA) susan.stepney@york.ac.uk

Dr Angelika Sebald (Dept Chemistry; YCCSA) angelika.sebald@york.ac.uk

PhD 2: Heterotic Computing: Practice

(Department of Electronic Engineering; YCCSA)

This PhD research will be cosupervised by

Dr Martin Trefzer (Dept Electronic Engineering; YCCSA) martin.trefzer@york.ac.uk

Dr Simon O'Keefe (Dept Computer Science; YCCSA) simon.okeefe@york.ac.uk

PhD Project Details

PhD 1: Heterotic Computing: Theory

(Department of Computer Science; YCCSA)

The goal of this PhD research is to **formalise the theory of heterotic computing**, in order to provide a means for quantifying the computation done in each substrate layer, in the various transduction processes needed to convert data representations, and in the setup and readout processes. (Many proposed hypercomputational devices neglect consideration of many of these aspects, misconcluding that the devices are more computationally powerful than they actually are, thus demonstrating the importance of accounting for all computational resources.) Additionally, the formalisation will provide a rigorous approach for designing such systems, and evaluating the computational capacity of novel substrates.

This research would suit a student with a strong theoretical computer science, physics, or mathematics background, with an interest in the theory of unconventional computing, and in interdisciplinary research.

This PhD research will be cosupervised by

Prof Susan Stepney (Dept Computer Science; YCCSA) susan.stepney@york.ac.uk

Dr Angelika Sebald (Dept Chemistry; YCCSA) angelika.sebald@york.ac.uk

PhD 2: Heterotic Computing: Practice

(Department of Electronic Engineering; YCCSA)

The goal of this PhD research is to **develop the practice of heterotic computing**, in order to provide a practical means for designing, constructing, evaluating, and exploiting future heterotic computers. Instead of creating computing devices from predefined discrete components, the physical properties of electrically active random disordered materials in combination with suitable electronic configuration will be utilised to perform computation with them.

This project is focussed on one of the most challenging research questions in heterotic computing, which is the choice and evaluation of materials that exhibit the desired properties and behaviours to make them good computers. This will include the preparation and application of nano materials as computational substrates, initially looking at a combination of carbon nanotubes, graphene and liquid crystal. Guided by the initial results other unconventional materials will be included.

The project would suit a student with any science and/or engineering background with a keen interest in interdisciplinary work between environment, biology and computing/engineering. Basic knowledge of electronics and programming would be beneficial.

This PhD research will be co-supervised by

Dr Martin Trefzer (Dept Electronic Engineering; YCCSA) martin.trefzer@york.ac.uk

Dr Simon O'Keefe (Dept Computer Science; YCCSA) simon.okeefe@york.ac.uk