## INSTITUTE OF Physics In Scotland

## Design Secrets of Energy Efficient Brains

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Talk starts at 7.30 pm in the Royal Society of Edinburgh, 22 - 26 George Street, with refreshments from 7.00 pm

**Talk abstract:** Brains are remarkably energy efficient, our 15 watt brain outperforms megawatt supercomputers, and new theories and experiments are showing how this achieved. Brains mix is computationally efficient analogue with robust digital, in massively parallel architectures, in which only a small proportion of neurons signal at any one time. Brains miniaturise components to limits set by molecular noise and optimize wiring. The neurons that process information avoid wasting power. Like a nightmarish Physics PhD student, they work as slowly and inaccurately as possible, using Chemistry as often as possible. Molecular chemistry, implemented by proteins, computes efficiently - close to thermodynamic limits - and is easier to connect into circuits than molecular electronics. Importantly the brain's winning "technology", cell biology, supports smart wetware. Neurons use internal microprocessors to allocate molecules to tasks, according to ongoing needs. Hopefully, these principles of energy efficient design will help us to unlock brains' bigger secrets.