

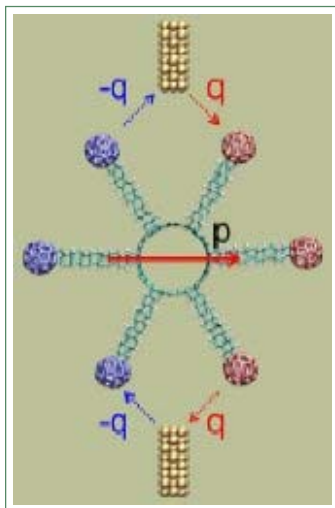
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Cognition

Reflection and Analysis, Nasrin Afshar Azadeh

MONDAY, NOVEMBER 17, 2008

Tunnelling electrons nano-motor



Nature contains a wide range of nanomotors – for example, some bacteria and other tiny organisms propel themselves using whip-like structures that are driven by biomolecular motors. Not surprisingly, researchers are looking at such “biomotors” for inspiration.

Powered by tunneling electrons

The quantum-mechanical tunnelling of protons is believed to be at the heart of some biomotors, and now Petr Král and colleagues that the University of Illinois at Chicago have shown that electron tunnelling could be used to drive manmade nanomotors.

The team used molecular-dynamics computer simulations

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to model nanomotors that comprise a carbon nanotube shaft with molecular "stalks" terminated by conducting "blades" (see figure). The rotor resembles a water wheel, except that one electron at a time tunnels between stationary electrodes and moving blades.

With each electron passing through the blades, the device rotates by either 120° or 60° – depending on how the blades are configured. Rotation occurs because the net effect of charging and discharging the blades nearest to the electrodes creates an electrode dipole moment across the rotor. This dipole is subject to the electric field created by the two oppositely-charged electrodes and the resulting torque drives the rotor.

<http://nanotechweb.org/cws/article/tech/36611;jsessionid=AA00ABFFF75D0344F557B783FEEEF543>

posted by Nasrin Afshar Azadeh @ [9:13 AM](#) [0 comments](#)



SUNDAY, NOVEMBER 16, 2008

Calcium: Cell biology

CELL BIOLOGY

It's a bit like talking to your neighbor at a dinner party with a megaphone, but Tovey et al. report that the stimulation of calcium release through inositol 1,4,5-trisphosphate receptors (IP3R) results from enormous amounts (1000 times greater than the amount needed to activate protein kinase A) of the second messenger cAMP produced by adenylyl cyclase (AC) molecules that are closely apposed to the IP3R channel. The authors were led to this unorthodox interpretation by their exploration of the mechanisms by which parathyroid hormone (PTH), which itself does not cause the release of calcium, enhanced the effects of other hormones on the release via IP3Rs of calcium from internal stores. Only PTH

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analogues that activated AC potentiated calcium release. High concentrations of cAMP analogues were sufficient to reproduce the effects of PTH and were not additive with the effects of the hormone. The authors propose that AC and IP3Rs are in such close proximity that activation of the cyclase produces a massive all-or-none response of the channel that is resistant to modulation by agents that alter cytoplasmic concentrations of cAMP; immunoprecipitation experiments confirmed the prediction that IP3Rs and AC were associated physically. Such signaling complexes would have on-off or switchlike properties and could allow graded responses by recruitment of more activated complexes rather than graded response at an individual complex. To add to the complexity, the IP3R-associated isoform of AC is inhibited by calcium. Thus, localized concentrations of cAMP and calcium might oscillate as a result of feedback inhibition. -- LBR

Ray B, Journal Cell Biol. 183, 297 (2008)

The ANK3 protein has a role in the assembly of voltage-gated Na⁺ channels; CACNA1C encodes the alpha1c subunit of the L-type Ca²⁺ channel. Interestingly, Na⁺ channels are targets of the anticonvulsant drugs used to treat bipolar disorder.

.....What is the significance for neurobiology of these recent advances in neuropsychiatric genetics? Even variants that contribute a small increment of risk, as is likely to be the case for ANK3 and CACNA1C28, can point to pathways that might be involved in pathophysiology and can thus suggest biological hypotheses and possible drug targets. Where highly penetrant mutations can be identified, they can provide particularly powerful tools for neurobiology, as illustrated by the neurexin and neuroligin story or the investigations into fragile X syndrome and Rett syndrome that have produced animal

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models of treatment. There is, of course, still a long distance to travel in the identification of risk-conferring alleles, of which there will be many, and in the replication of association studies and demonstration of both statistical and biological significance. There is much challenging neurobiology to come, but it is biology that will ultimately have enormous significance for human health.

Hyman S, 2008, Nature, 455

VITAMINE D DILEMMA

Radiological health expert Daniel Hayes who works at the New York City Department of Health and Mental Hygiene recent published on the subject of low dose radiation and the possibility that a form of vitamin D could be the key to protecting us from background radiation and perhaps save lives following a nuclear incident or terrorist attack involving a so-called dirty bomb.

Hayes explains that calcitriol, the active form of vitamin D, could be the oral agent, that medics have been searching for to provide a quick, simple, and inexpensive way to protect us when the warning sirens sound.

Having spoken to various researchers with markedly different views on vitamin D, its benefits and its its potentially detrimental effects on health, I wasn't too sure about how adding yet another dietary supplement to our daily intake would be beneficial. I asked Hayes to expand.

"One should get vitamin D3 either from solar irradiation of the skin or from dietary supplementation," he told me, "I personally take 2000 IU daily which is obtained without a physician's prescription...2000 IU is definitely safe, I can dig up the documentation."

<http://www.sciencebase.com/science-blog/vitamin-d-dilemma.html>

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