So how can game players solve difficult research problems in quantum theory when they have no knowledge of either the puzzling phenomena of quantum physics or the sophisticated mathematical formalism used to describe it? One can do things in games that cannot be done in reality, so gamers are used to experimenting with possibilities that go beyond the classical laws of physics. Perhaps this ability to think outside the box allows them to make the creative leap necessary to tackle quantum problems.

Understanding the principles and key conditions for the successful gamification of quantum problems is an interdisciplinary endeavour requiring the interaction and collaboration of quantum physicists, game researchers, neuroscientists and many others. Whether Sørensen and colleagues' method will be applicable to a wide range of problems in quantum physics is currently an open question. But because we are on the verge of a new era of quantum technologies, this approach is definitely worth pursuing, and is a theme of initiatives such as *Quantum Game Jam*[11]. ■

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NEUROINFLAMMATION

Surprises from the sanitary engineers

In mammals, microglial cells of the central nervous system are responsible for the normal clearance of dead brain cells. TAM–receptor proteins have now been found to mediate this function. SEE LETTER P.240

RICHARD M. RANSOHOFF

Cell-surface receptors are specialized molecules that respond to precise signals, so that environmental input elicits commensurate responses. On page 240 of this issue, Fourgeaud *et al.*[1] describe how they manipulated the mouse genome to delete receptor proteins of the TAM family from microglia — a type of brain cell distantly related to the resident inflammatory cells found in tissues such as the skin, spleen and liver. The results provide startling insight into the process by which the adult brain generates new neurons, and open up avenues for studying microglia.

TAM receptors (named from the first letters of the member proteins Tyro3, Axl and Mer) are evolutionarily recent, appearing first in the invertebrate sea squirts. Newly emerged gene families often have highly refined roles, and their function is commonly dispensable for embryonic development. People (or genetically engineered mice) with defective TAM genes develop normally but show varied effects later in life[2]. For example, humans or rodents deficient in the *Mer* gene develop a form of retinitis pigmentosa. This degenerative eye disease occurs because rod photoreceptor cells (RPCs) accumulate toxic by-products of chemical reactions through which light is converted to nerve impulses. This waste material is removed through engulfment of the RPCs' outer segment by retinal pigment epithelial cells; without Mer, this process fails and RPCs die.

Another example is that mice lacking all three TAM receptors show male infertility, because vast numbers of superfluous germ cells die and accumulate in the testes, leading to degeneration of the remaining, otherwise-viable germ cells. Mice that lack individual receptors or ligands of the TAM system also show blood-clotting defects, and those deficient in all three receptors develop widespread autoimmune responses that are reminiscent of the human disease systemic lupus erythematosus[3]. Thus, TAM-receptor signalling is used in a wide variety of disparate functions primarily associated with the removal of dying cells and waste material.

Mice that lack all three TAM receptors are normal at birth, indicating that these proteins are not required to eliminate dead cells during embryonic development[2]. But the TAM receptors are involved in a variant form of this elimination mechanism to achieve dynamic tissue remodelling throughout life[2]. This cell-corpse

50 Years Ago

Engineers get the rough end of the stick even in countries where they are more esteemed than in ours … You fire off a rocket and a satellite moves successfully around the world. That is a scientific triumph. On the other hand, if it flops on the launching pad, that is an engineering failure … It is no accident that among our scientists there is still a cheerful and relaxed attitude to qualifications. Cockcroft is a great physicist, but he has never taken a physics course in his life … Crick has revolutionized modern biology; but he has had as much formal instruction in biology as he has in Hebrew … Engineering has … suffered through the rigidity of its training … Where the esteem and the rewards appear to be, there able people will go … Contemporary engineering education does not encourage enough the speculative and rebellious intelligence … It is rare for engineering students to question everything under heaven or earth in the way that good scientific students will … If we get our education right … the place of the engineer in society will become right … To most sane persons, esteem is more important than pay. If we had a choice most of us, I hope, would prefer to be President of the Royal Society than the most successful pop singer in the world.

Lord Snow

From *Nature* 16 April 1966

100 Years Ago

The old Romans and Greeks, as evidenced by the statues, were evidently gentlemen addicted to shaving, but … the means of producing soap in those days must have been limited. The only conclusion that one can arrive at is that they must have shaved without soap.

From *Nature* 13 April 1916