and Danijela Vignjevic of the Curie Institute in Paris and their co-workers surmised that the process occurs in stages. First, finger-like protrusions called invadopodia form at the tumour-cell surface and punch a hole through the basement membrane. These then elongate before leading the cells into the tissue beneath.

The team used molecular markers and selective gene silencing to identify three classes of protein filaments that drive this process. Actin filaments, which are known to help other cells migrate, are vital for the first stage. As the invadopodia elongate, other protein filaments — microtubules and vimentin intermediate filaments — help the actin network to further lengthen the protrusions.

BIOGEOCHEMISTRY

Bogs of change

Glob. Biogeochem. Cycles doi:10.1029/2008GB003354 (2010)

Wetlands such as bogs and rice paddies are the largest single source of methane — a potent greenhouse gas — emitted into the atmosphere. Researchers have found that fluctuations in regional and global methane budgets are attributable mainly to weather- and climate-driven changes in the area covered by wetlands worldwide.

Bruno Ringeval at the Laboratory of Climate and Environmental Sciences in Gif-sur-Yvette, France, and his colleagues combined monthly satellite observations of flooded land area with models of global vegetation and methane emissions from wetlands. They found that, in some years between 1993 and 2000, year-to-year variations in wetland extent account for up to 90% of variability in tropical methane emissions. The findings could help to improve models of shifting methane emissions.

PLANETARY SCIENCE

Martian cold traps

Icarus doi:10.1016/j.icarus.2010.03.039 (2010)

On Earth, caves can shelter ice, allowing it to persist all year round, even when temperatures outside rise above freezing. This may well happen on Mars too, according to Kaj Williams of NASA Ames Research Center in Moffett Field, California, and his colleagues.

Extinct volcanoes on Mars are likely to have developed hollow lava tubes that could today function as ice caves. The researchers modelled the growth and loss rates of frost for a subterranean room connected by a small chimney to the planet's surface. They suggest that ice can remain stable for 100,000 years or more. The volcanic 'cave' terrains on Mars, the authors add, could thus be important regions to target in the search for extraterrestrial life.

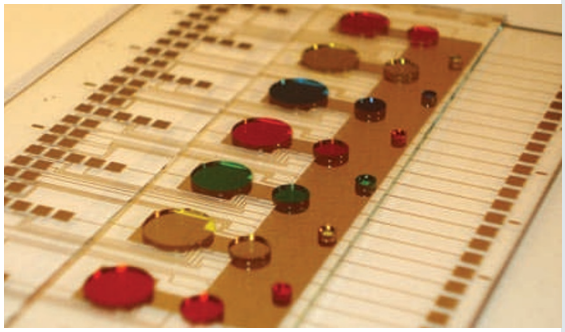
BIOENGINEERING

Cell culture on a chip

Lab Chip doi:10.1039/c002147d (2010)

Single cells can be sorted and analysed using an assortment of microfluidic devices, which use tiny channels and pumps to move liquid around on chips. Now researchers in Canada have devised a 'lab-on-a-chip' that can grow mammalian cells and repeatedly seed new generations in fresh media (pictured).

Two advantages of microfluidic chips are that they use only a fraction of the reagents required at the macroscale and can automate and accelerate tedious manual tasks. Aaron Wheeler and his colleagues at the University of Toronto created a digital version that uses electrodes to manipulate fluids. Their device was able to replace old media with new and at the same time keep cultured cells hydrated. The chip could also harvest a subset of the cells and place them on a fresh surface, all while maintaining cell-growth rates similar to those of conventional culturing.



R. SOC. CHEM.

EVOLUTIONARY BIOLOGY

Good times and bad

Am. Nat. doi:10.1086/652470 (2010)

If natural selection favours the fittest, a population's genetic variance should decline over time. Yet many species adapt to changing environments, so variation must persist.

Caitlin Dmitriew at the University of Toronto in Canada and her colleagues investigated this paradox by putting some larvae of the ladybird beetle (*Harmonia axyridis*) on a restricted diet while giving others plenty of food. They found that the amount of variance in body size attributable to genetics decreased within a generation in well-fed male beetles, but increased in rationed ones. With enough food, the beetles converge towards an optimal adult size, masking the underlying genetic variation in body size. In hungrier beetles, body size varies more.

The accumulation of such 'hidden' genetic variance when times are good could explain how organisms retain the variation they may need when the good times turn bad.

JOURNAL CLUB

Jean-Christophe Marine
VIB–Catholic University Leuven, Belgium

A cancer geneticist looks at the link between small RNA molecules and cancer.

My laboratory studies how cancer cells evade the action of tumour-suppressor (TS) genes. For most TS genes, both copies must be lost to facilitate tumour progression. For some, haploinsufficiency — loss of only one copy — may also contribute to carcinogenesis. However, selection generally favours the inactivation of the remaining functional gene copy to accelerate cancer pathogenesis.

Now, an additional class of haploinsufficient TS genes has been identified. Tyler Jacks at the Massachusetts Institute of Technology in Cambridge and his team found that loss of one copy of the gene *Dicer1* enhanced tumour formation in a mouse model of lung cancer, but selection strongly disfavoured loss of both copies (M. S. Kumar *et al. Genes Dev.* **23,** 2700–2704; 2009). Publicly available data reveal that in one-third of human tumours only one copy of *DICER1* is deleted.

This finding has several profound implications for cancer mechanisms and therapies. *Dicer1* codes for an enzyme involved in the generation of microRNAs, short fragments of RNA that silence specific genes. The study provides mechanistic insight into the long-standing observation that microRNAs are often downregulated in human tumours. Perhaps more importantly, the data strongly indicate that *Dicer1* — and, by extension, a subset of microRNAs — are in fact required for tumours to survive and/or grow. Further studies aimed at deciphering the dependency of tumours on *Dicer1* or microRNAs should therefore lead to exciting therapeutic possibilities.

Meanwhile, this class of TS genes, for which partial loss is advantageous to tumours but complete loss is disadvantageous, must not be overlooked in the ever-growing number of high-resolution analyses of mutations found in cancer.

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