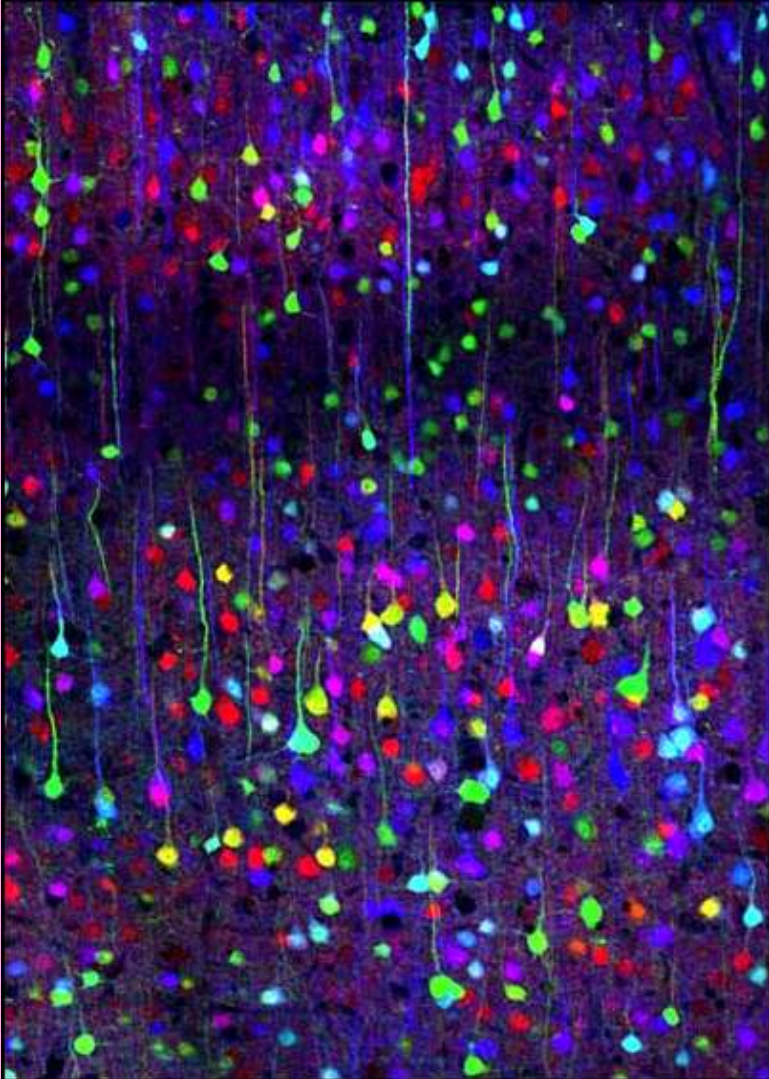


Brainbow



Never before has a brain been so beautiful. Jeff Lichtman and Joshua Sanes, researchers at the Harvard Brain Centre, have created transgenic mice with fluorescent multicoloured neurons.

It is the potential of this research to revolutionise neurobiology that excites scientists.

The Harvard researchers have introduced genetic machinery that mixes green, cyan and yellow fluorescent proteins in individual neurons creating a palette of ninety distinctive shades and colours.

Researchers will now be able to map the neural circuits of the brain. The individually coloured neurons will help define the complex tangle of neurons that make up the brain and nervous system.

By creating a wiring diagram of the brain, researchers hope to help identify the defective wiring found in diseases such as Alzheimer's and Parkinson's where neurons and neuron pathways degenerate.

<http://www.livescience.com/1977-brain-cells-colored-create-brainbow.html>

Why is it important to neurobiologists to have a 'palette' of FP colours?

Chickens and Bird Flu



At least four times in recorded history, a flu outbreak has swept across the world, infecting a significant portion of its population. Such outbreaks are known as **pandemics**. The most recent pandemic was the 2009 flu pandemic, known as swine flu because the virus had been circulating amongst pigs before infecting humans.

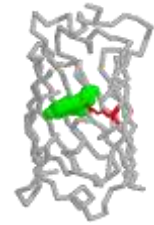
Another big danger is **bird flu** which is usually lethal when it infects humans. Fortunately the virus has not yet spread to the human population. However, the risk has led to governments killing millions of chicken to try to prevent the spread.

<http://www.roslin.ed.ac.uk/public-interest/gm-chickens/>





Chickens and Bird Flu



Now researchers have created a genetically modified chicken which has a nucleic acid designed to block bird flu viruses. To track the nucleic acid the researchers have added a gene for a fluorescent protein. So the transgenic chickens glow green when exposed to UV light.

When the transgenic chickens were exposed to a high level of virus they all died but when they were exposed to a moderate level a few survived. The real breakthrough is more exciting. When infected normal chickens were housed with other birds all the other birds died. But when infected transgenic chickens were housed with other birds the other birds survived!

Chickens and Bird Flu

So although the transgenic chicken is not totally protected it seems as if the way in which infection occurs in it has been altered.

This reduces the risk to humans and the need to do wholesale culling of infected flocks.

Overall, it looks like a promising approach to limiting the spread of bird flu.



Explain what is different when you put either normal infected chickens or transgenic infected chickens with other birds?

Fluoro Fish



http://lem.ch.unito.it/didattica/infochimica/2008_GFP/Fish.html

Fluoro Fish

Taiwan's leading fluorescent fish industry has developed fluorescent fish that only glow from their blood vessels.

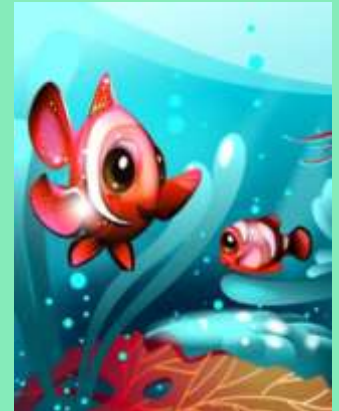
This technology could be used in the future to detect tumours in other species.

The Fluoro Fish are available at pet stores in all the US states, except California. They are marketed as GloFish and are available in Star-fire Red, Sunburst Orange, and Electric Green. They cost between \$5-10.

The fluorescent zebra fish are created by microinjecting a fluorescent gene construct into fertilized zebra fish embryos.

Australia, Canada, New Zealand and Europe prohibit the sale of genetically modified organisms, such as GloFish and they can not be purchased there.

Is it morally right to produce glowing fish for fish tanks?



Glowing cats shed light on AIDS



<http://www.bbc.co.uk/news/science-environment-14882008>

Glowing cats shed light on AIDS



- Cats that have been genetically modified to glow in the dark are being used to gain insights into AIDS.
- The scientists inserted one gene into the cats that helps them resist the feline form of AIDS.
- They also inserted a gene that produces a fluorescent protein called GFP.
- This protein - which is produced naturally in jellyfish - is commonly used in this area of research to monitor the activity of altered genes.
- "We did it to mark cells easily just by looking under the microscope or shining a light on the animal," said Dr Eric Poeschla, from the Mayo Clinic in Rochester, US.
- The antiviral gene comes from a rhesus macaque, and produces a protein called a restriction factor that can resist AIDS-causing viruses affecting other animals.

Glowing cats shed light on AIDS

The team from the US and Japan then transferred this gene, along with the one for GFP, into feline eggs - known as oocytes.

The method worked so well that nearly all offspring from the modified eggs had the restriction factor genes. And these proteins were made throughout the cats' bodies.

The researchers found that there was reduced replication of the feline AIDS virus - known as feline immunodeficiency virus (FIV) - in these cats.



What does the restriction factor do?

Glowing pigs



Glowing pigs

Scottish scientists are creating pigs that are genetically modified to suffer from incurable human diseases – so they can be used by drug companies to test new therapies.

The team of researchers is trying to produce pigs which are diseased with the lethal lung condition cystic fibrosis and an eye disease that leads to blindness in humans.

The research is being carried out at the Roslin Institute in Edinburgh, famous for creating Dolly the cloned sheep. If the team is successful, the diseased animals would be used by drug companies to test potential new gene therapies for the conditions.

<http://www.martinfrost.ws/htmlfiles/scotnews10/100617-pigs.html>



Glowing pigs

The cutting-edge research raises ethical issues about harming animals intentionally for the benefit of humans. It has led to outrage from animal rights organisations.

Dr Bruce Whitelaw, head of developmental biology at the Roslin Institute, admitted he had struggled with the idea of creating diseased animals purely to try to benefit humans.

"We are saying we will make these animals sick purely for our benefit," he admitted. However, he believes his team has a "moral right" to give the technique a try.

Why might Dr Whitelaw feel he has a moral right to try this technique?

Glowing Salamanders

The road to limb regeneration?



Elly M. Tanaka of Max Planck Institute has created a transgenic GFP axolotl, a half-foot long salamander that dwells in the Aztec canals of Mexico City. Although axolotls are endangered, they hold significant promise for human amputees.

The salamander has the ability to re-grow injured or missing parts of its body such as limbs, jaws, skin, organs, and parts of its brain and spinal cord.

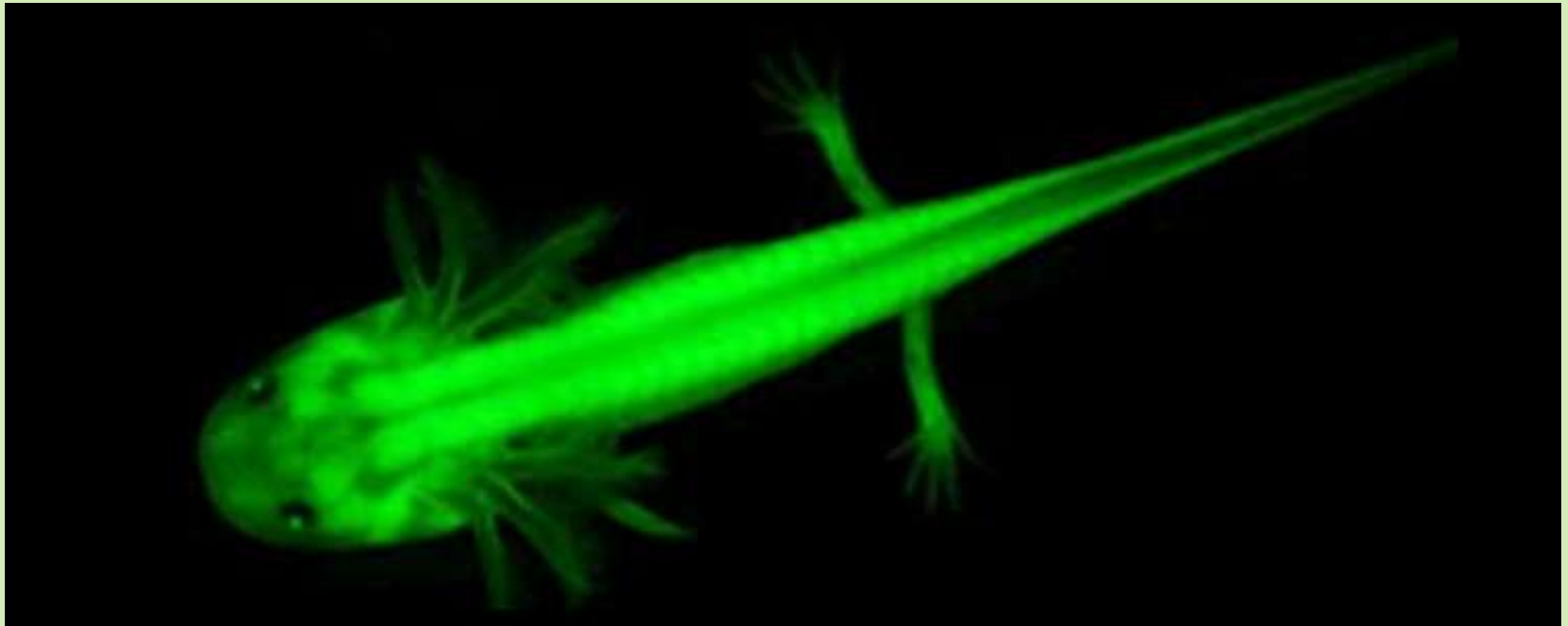
Glowing Salamanders

The road to limb regeneration?



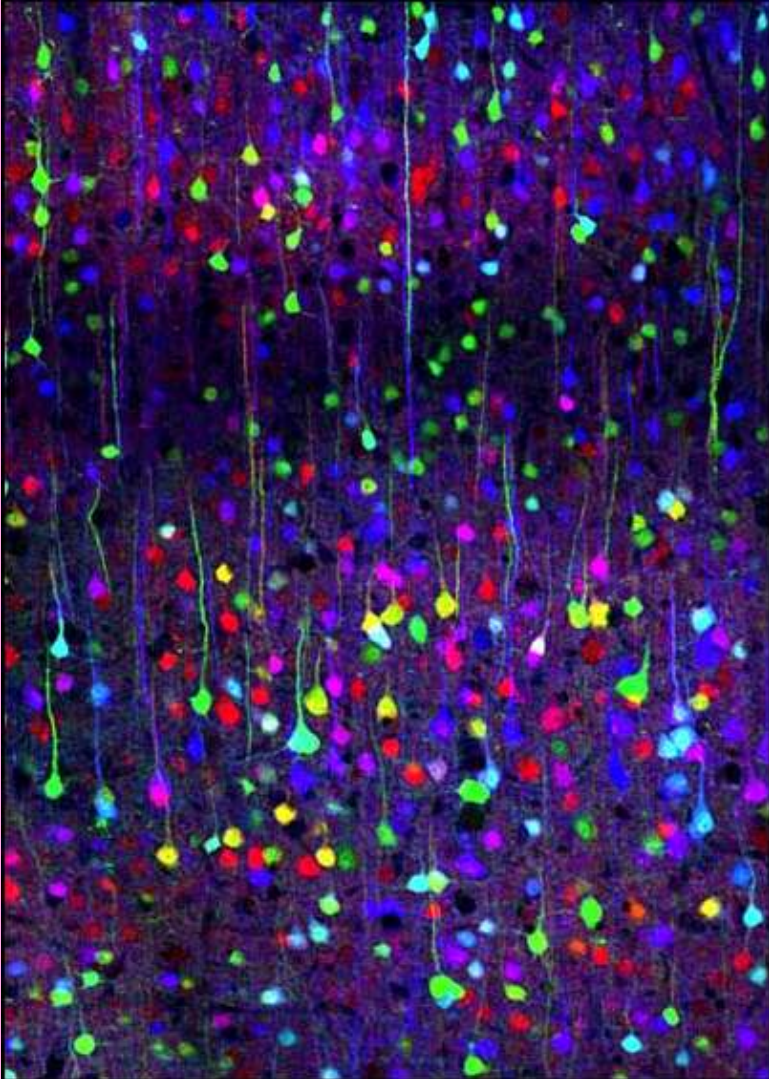
In order to monitor the axolotl's limb regeneration process, the Max Planck scientists have inserted a green fluorescent protein into a mutant axolotl that lacks skin pigment. Since the salamander has clear skin, it is very easy to identify how the group of cells at the wound, can multiply and form a new limb.

Why do the scientists use Salamanders for this research?



<http://www.crt-dresden.de/index.php?id=46>

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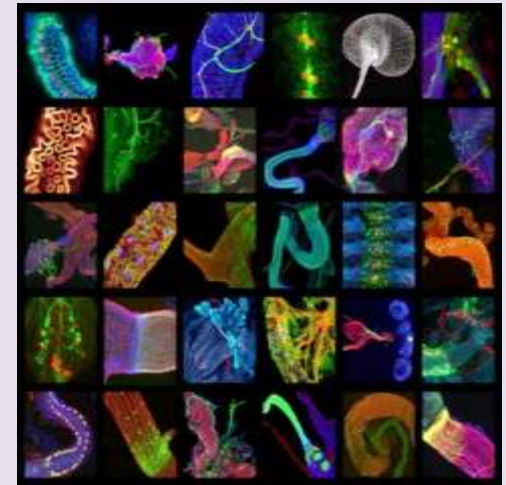
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Pregnant, bloated and constipated in Technicolor

Why does pregnancy lead to water retention and constipation? It's not fair to the mother, but does it serve a biological purpose? In strikingly bold colours researchers at the University of Cambridge have found the answers to these questions. Humans have about 500 million neurons that control our intestinal behaviour, an overwhelmingly large number that complicates the research into bloating and constipation. Fruit flies are much simpler and yet like humans, pregnant fruit flies are plagued by constipation and water retention. Dr. Irene Miguel Aliaga and her colleagues at Cambridge University have studied fruit flies as models for humans. They have created a slew of genetically modified fruit flies with intestinal neurons that light up when they are used, and that can be switched on and off by the researchers. Photographs of fruit fly guts stained with fluorescent neurons, such as the ones shown here, were used to locate the neurons that were responsible for regulating appetite and adjusting intestinal water balance during pregnancy.



The female fruit flies have no way of expressing their discomfort and so Dr. Aliaga and her students have to collect all the fly faeces and determine their water content and protein content. A rather unpleasant job you might think, but no says the good doctor, "the flies faecal deposits are actually rather pretty and don't smell bad".



According to the fluorescent intestinal neurons and fruit fly poop analysis it's the fruit fly dad who is responsible for that bloated feeling experienced by the pregnant mom. During copulation he passes along his sperm as well as some hormones. One of the hormones switches on a set of intestinal neurons that are responsible slowing down the gut emptying rate, resulting in constipation, and so even though pregnant fruit flies are eating more food during pregnancy the contents of their intestines become more concentrated. This allows the pregnant mother to absorb the maximum amount of nutrition. The same hormones also result in water retention and bloating. Similar behaviour is observed in humans. And the colour-coding of the neurons in fruit flies actually helps us understand it.

So if you are pregnant why do you get bloated and constipated?



Ruppy the puppy



Ruppy, a beagle, is the first transgenic dog.

She expresses **Red Fluorescent Protein** in all her cells, however due to the pigments in her fur the RFP is only visible in places not covered by fur e.g. her paws. Her name, Ruppy, is a combination of ruby and puppy. The description of the creation of the first transgenic dog can be found in the April 8, 2009 issue of Genesis.

Ruppy was created to study human genetic diseases. Dogs and humans have 224 hereditary diseases in common. The RFP gene was inserted using a retrovirus, unfortunately the researches had no control over the location of the gene insertion.

Ruppy



Why does Ruppy only glow in her paws?

<http://www.dailymail.co.uk/sciencetech/article-1173171/Seeing-red-The-cloned-puppy-glow-dark.html>