E-fillip

From virtual sketchbooks to alarm clocks, check out these smart ways to get the pupils in your house learning...

Course notes
(iPad)
This app is like having your own secretary. It keeps all your notes and organises them by subject, so you can quickly review lessons.

Mathboard
(iPad)
Mathboard's fun chalk and blackboard may look playful but the app has a range of addition and multiplication tests to challenge the most nimble brains. There's also a section to review the answers.

The Elements: A Visual Exploration
(iPad)
The Periodic Table never looked so cool. Theodore Gray's Elements has gone all interactive. As well as presenting facts and figures, it has lots of tween-friendly pictures.

Flash Cards
(iPhone, iPad, Android, Windows Phone 7)
Flash Cards helps you create memory cards. Use text and images to memorise a variety of topics. Sets of cards can be exchanged via DropBox to build a database.

Visual Anatomy
(iPad, iPhone, Android)
This app is an interactive version of *Gray's Anatomy*, so it's perfect for getting your little ones interested in biology and physiology. It's really engaging so, with luck, they won't even notice they are learning.

Evernote
(iPad, iPhone, Android, Windows Phone 7, Blackberry)
The app is available on smartphones as well as browsers. It enables you to capture notes, photos, lists and records, which you can then search through at the end.

Colors!
(Nintendo 3DS, iPhone)
Nurture your little Tracey or Damien (and tolerate American spelling) with an app that promotes their artistic side without ruining your rug. Then you can replay their efforts, stroke by stroke.

Lola's Alphabet Train
(DSi, 3DS, iPhone)
Good at easing little children back to school. Players follow Lola as she gives presents to friends. You help her by identifying letters to spell out each gift. For the 3-5s or 5-7s.

Wolfram Alpha
(iPhone, iPad)
Like having an encyclopaedia in your pocket. It piques intellectual curiosity and provides a reference guide. It's split into sections and has information on everything from the weather to astrophysics.

Wakeful
(iPhone, Blackberry, Android)
Let Wakeful get your tricky teens out of bed. There is the loud sound of course, but also lots of information on everything from the day's weather to the news headlines.

Changing colours

Some paints used by master artists discolour with age, writes s ananthanarayanan

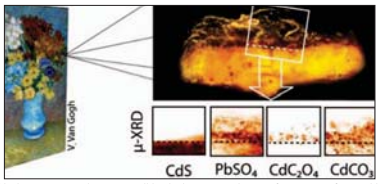
THE journal, *Analytical Chemistry*, is shortly to carry a report by scientists from Antwerp, Delft University of Technology and scientists from France and Holland, of high-energy X-ray study of the surface of the painting, which has revealed the nature of the colour changes as being a degradation process at the interface of the cadmium paint and the layer of varnish that is there to protect the paint. The high-energy X-ray sources were the European Synchrotron Radiation Facility in Grenoble, France, and the Deutsches Elektronen-Synchrotron in Hamburg.

Gradual changes in the bright yellow flowers in this Vincent Van Gogh painting, "Flowers in a blue vase", to an orange-grey, have caused grave concern to the Kröller-Müller Museum. The cadmium sulphide paint that Van Gogh had used is known to oxidize in the air, getting covered by a slightly off-white, transparent layer and losing colour and luminosity. But what was seen was an orange-grey crust, which could not be removed without damaging the original paint.

Paint and pigment

Modern oil paints are believed to have been formally invented in the early 15th century by the Flemish painter, Jan van Eyck, who mixed mineral pigments with an oil, mostly linseed oil, that would gradually dry and harden. A series of painting masters perfected the method of mixing minerals and oils, or even beeswax. Artists used to grind their own pigments and carefully mix in the oils in the correct proportions. Modern paints use a number of plant based oils, adjusted for viscosity and modern manufacture ensures consistency, while delivery in tubes even helped the technique of application on the canvas.

Paint gets its colour from small particles of pigment that are suspended in the oily carrier. Mineral oxides, like lead oxide, now replaced by zinc or titanium, give white paint, while cadmium, copper, arsenic, mercury, iron, cobalt, chromium, not just as oxides but in combination with sulpur or carbon, are used for different pastels. Combination of pigments produces a range of shades, while the artist mixes colours on his palette for the final effect. But the colours are basically because of the different coloured salts – and these salts can be affected by heat, humidity and the gases in the air.



Cadmium paints

Cadmium is a silvery white metal but the colour of salts of cadmium can be red, yellow or green. Cadmium pigments are usually yellow, orange or red and about half the cadmium produced worldwide is used for making paint, although its use is declining as cadmium is poisonous. But in the late 19th century cadmium paints were a newly discovered medium and were widely used by artists. The cadmium sulphide, yellow pigment used by Van Gogh was one such.

Cadmium sulphide is known to get oxidized, to cadmium suphate, which is dull yellow. Paintings were hence coated with a layer of transparent varnish, to protect the pigments. Van Gogh, himself, produced all his 800 paintings and 700 drawings within 10 short years (till he died in 1890 at the age of 37) and did not cover any of his painting works with varnish. But with cadmium paints found to discolour, most other Van Goghs were covered in varnish in the early 20th century and the Kröller-Müller Museum did the same with Van Gogh's 'Flowers in a blue vase', which they had acquired.

This is the context of the discovery in 2009 that even under the coat of varnish, the yellow flowers in cadmium paint had turned darker. "The removal of the orange-grey crust and discoloured varnish was not possible without affecting the very fragile original cadmium yellow paint on these parts," paintings conservator Margie Leeuwestein from the Kröller-Müller Museum says. As ordinary methods did not seem feasible, the museum extracted two microscopic paint samples from the affected parts of the painting and sent them to Koen Janssens from the University of Antwerp for analysis.

X-ray study

The changes in the nature of the coat on the canvas were not at the level of particles or specks of pigment, that any microscopic analysis was possible. The changes are at the atom level and analysis required probing by X Rays of short and controlled wavelength. X Ray beams are scattered by individual atoms and the scattering pattern reveals how the atoms are oriented and what atoms they are – the internal structure of the grey-brown crust at the place where the cadmium paint and the varnish made contact.

The scientists were surprised to find that even if the cadmium sulphide had oxidized, no crystals of cadmium sulphate, or its compounds were present. But "it emerged that the sulphate anions had found a suitable reaction partner in lead ions from the varnish and had formed anglesite," says DESY scientist Gerald Falkenberg. Anglesite (lead sulphate) is an opaque compound that was found nearly everywhere throughout the varnish. The sulphate had arisen from the cadmium sulphide pigment and "the source of the lead probably is a lead-based siccative (thickening agent) that had been added to the varnish," adds Falkenberg.

"The research into this hitherto unknown degradation process of varnished cadmium yellow oil paint allows to better understand the current appearance of the painting," explains Leeuwestein. Joris Dik from TU Delft adds that "it also provides information on how later-applied varnish layers may contribute to the decline of certain pigments of a painting. In the future, this degradation process can hopefully be inhibited or even prevented thanks to novel preservation and conservation techniques." Whether removing the varnish and crusts from paintings with this type of degradation is possible and appropriate is not yet fully understood. Leeuwestein adds that "in every similar case of a possible varnish and crust removal, it should always be considered that this varnish and crust contain original material from the cadmium yellow oil paint. The possible removal of original material from a painting during a conservation treatment is of course undesirable."

"Many of Van Gogh's French period paintings have been inappropriately varnished in the past and removal of these non-original varnish layers is one of the challenges facing conservators on a world-wide basis today. The type of information provided by Janssens and his team is vital to support the difficult decisions that conservators often have to make regarding such complex cleaning treatments," says Ella Hendricks, head of conservation of the Van Gogh Museum in Amsterdam.

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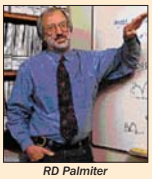
Mouse and supermouse

tapan kumar maitra **writes about the 'supermouse' which can grow three to four times faster than their average friends**

A DNA fragment containing the gene of a rat growth hormone was microinjected into the pronuclei of fertilised mouse eggs. Of the 21 mice that developed from these eggs, seven carried the gene and six of these grew significantly larger than their littermates *(Palmiter et al, 1982)*.



RD Palmiter

With these words, a team of investigators led by Richard Palmiter and Ralph Brinster, reported how a genetic trait can be introduced experimentally into mice without adopting the usual breeding procedure — sexual reproduction — followed by the selection of desired traits.

"Supermouse" (on the left) is significantly larger than its littermate because it was engineered to carry and express at high levels the gene for rat growth hormone.

The researchers injected rat growth hormone genes into fertilised mouse eggs, and from one of these evolved a "supermouse" weighing almost twice as much as its littermates. This accomplishment was understood as a significant breakthrough because it proved the feasibility of applying genetic engineering to animals.

What Palmiter, Brinster, and their colleagues did to create the "supermouse" is an intriguing story that begins with the isolation of the gene for growth hormone from a library of rat DNA, using techniques similar to those described in this chapter. The cloned GH gene from which the regulatory region had been deleted was then fused to the regulatory portion of a mouse gene — that codes for metallothionein.

MT is a small metal-binding protein normally present in most mouse tissues and regulates the level of zinc in the animal. The advantage of fusing the MT gene to the GH gene was that the expression of the MT gene could then be specifically induced (turned on) by zinc.

To make multiple copies of the MT-GH hybrid gene, it was cloned in E.coli using a plasmid as a cloning vector. After isolating the recombinant plasmid DNA from the bacterial cells, the MT-GH region was excised by digesting the DNA with two restriction enzymes, each of which cleaved a restriction site located at one end of the desired DNA fragment. About 600 copies of the excised DNA fragment were then microinjected into fertilised mouse eggs, in a volume of about two picoliters (0.000002 mL). The DNA was injected into the male pronucleus, the haploid sperm nucleus that has not yet fused with the haploid egg nucleus. (The success rate for integration and retention of the MT-GH gene had been found to be higher when the male pronucleus was used than when the DNA was injected into either the female pronucleus or the cytoplasm.) From the 170 fertilised eggs that were injected and implanted back into the reproductive tracts of foster mothers, 21 animals developed. Seven of them turned out to be transgenic mice with MT-GH genes present in their cells. In at least one case, a transgenic mouse transmitted the MT-GH gene faithfully to about half of its offsprings, indicating that the gene had become stable into one of its chromosomes.

Because the GH gene had been linked to an MT gene regulatory region, it was predicted that the hybrid gene could be turned on by adding zinc in the drinking water of the mice. Three kinds of evidence confirmed that exposing mice to zinc caused the rat GH gene to be expressed. First, when mouse liver tissue was assayed for the presence of messenger RNA for GH the results indicated about 800-3000 mRNA molecules per liver cell. Moreover, elevated levels of growth hormone were found in the blood: Four of the transgenic mice had blood GH levels that were 100-800 times higher than those of their non-engineered littermates. But the most dramatic evidence for expression of the rat GH genes was that the transgenic mice grew faster and weighed about twice as much as the normal ones. During the period of maximum sensitivity to growth hormone — three weeks to three months of age — the transgenic animals grew three to four times as fast as their normal counterparts.

This dramatic experiment proved that it is possible to introduce cloned genes into the cells of higher organisms and that such genes can become stably integrated into the genome, where they are expressed and passed on to the offspring.

As the authors pointed out when the report was published, "this approach has implications for studying the biological effects of growth hormone, as a way to accelerate animal growth, as a model for gigantism (a human growth abnormality caused few growth hormone), as a means of correcting genetic diseases, and as a method of farming valuable products." Whether (and how fast) all these possibilities become realities remains, of course, to be seen. But in the years since the supermouse's creation, rapid progress has been made in most areas. Supermouse, it seems, was just the beginning.

The writer is associate professor and head of the Botany department, Ananda Mohan College, Kolkata

Emotions run wild

Injecting life into drab emails and short messages on mobile phones are emoticons of which the most popular ones are :-(and :-), both creations of Professor Scott E Fahlman. By sonali bhowmick

WRITING letters is an art form that few appreciate. Apart from bills, and more bills, few letters get delivered. E-mails are here to stay and so is SMSing. Binding the two communication techniques are emoticons, which allows one to express emotions using dots and brackets.

Emoticons are not new. *The National Telegraphic Review and Operators Guide* in April 1857 documented the use of the number 73 in Morse code to express "love and kisses". *Dodge's Manual* in 1908 documented the re-introduction of "love and kisses" as the number 88. Typographical emoticons were published in the 30 March 1881 issue of *Puck*. But it is the ASCII emoticons that are most frequently used. On most mobile phones if you punch in :-) or :-(the characters get transformed into colourful faces. The gentleman responsible for sideways "smiley face" that is commonly used in e-mail, chat, and newsgroup posts speaks to *The Statesman*.

Meet Scott E Fahlman, research professor of Computer Science at Language Technologies Institute and Computer Science Department of Carnegie Mellon University. He is interested in artificial intelligence and its applications and worked in many areas of AI: Problem solving, knowledge representation, image processing, natural language, document classification, artificial neural networks, and the use of massively parallel machines to solve AI problems.

From 1996 to 2000 he was the head of Justsystem Pittsburgh Research Center (also known as "Just Research"), a 25-person research lab located a few blocks from the CMU campus. From July 2000 through April 2003 he was on leave from Carnegie Mellon, working for IBM's Watson Research Center.

By the early 1980's, the Computer Science community at his university was frequently using online bulletin boards or "bboards", precursor of today's newsgroups. Bboards allowed faculty, staff and students to discuss weighty matters of the day on an equal footing. Many of the posts were serious: talk announcements, requests for information, and things like "I've just found a ring in the fifth-floor men's room. Who does it belong to?" Other posts discussed topics of general interest, ranging from politics to abortion to campus parking to keyboard layout (in increasing order of passion).

Before meeting Professor Fahlman, let's understand how the sideway smiling face came into being. On 'bboards' many posts were humorous but there were a few who would fail to get the joke, and each of them would post a lengthy diatribe in response. "That would stir up more people with more responses, and soon the original thread of the discussion was buried. In at least one case, a humorous remark was interpreted by someone as a serious safety warning.

"This problem caused some of us to suggest (only half seriously) that maybe it would be a good idea to explicitly mark posts that were not to be taken seriously. After all, when using text-based online communication, we lack the body language or tone-of-voice cues that convey this information when we talk in person or on the phone. Various 'joke markers' were suggested, and in the midst of that discussion it occurred to me that the character sequence :-) would be an elegant solution ~ one that could be handled by the ASCII-based computer terminals of the day."

Carnegie Mellon professor Scott E Fahlman

The professor suggested the use of :-(to indicate that a message was meant to be taken seriously, though that symbol quickly evolved into a marker for displeasure, frustration, or anger.

He says 30 years back he didn't expect the smiley to become popular. "It was just a silly thing I tossed off in 10 minutes in the middle of an online discussion. I didn't even save a copy of the original post, and we had to find it years later from backup tapes. I think the smiley is popular because it's both useful and a bit whimsical. And the media love to report about it because there are never enough 'feel good' stories."

Since nothing much goes into making emoticons, care needs to be taken to retain their popularity. "Until now, there has been no need to do anything to make these things more popular ~ most people think they are too popular. Personally, I really don't like the graphical or animated ones at all, and would be happy if they died off ~ the text ones are more fun, I think.

"I don't know how much longer the old text emoticons will be popular. It's surprising to me that the text emoticons are still so popular today, even though we can easily send voice and video to one another. But they're easy to type and still serve a purpose, so they survive. If the world decides that :-) and friends are no longer fun or useful, they will go away, and there's not much that anyone could do to prevent that."

In a post on his web page, Professor Fahlman writes, "Many people have denounced the very idea of the smiley face, pointing out that good writers should have no need to explicitly label their humorous comments. Shakespeare and Jonathan Swift and Mark Twain got along just fine without this. And by labeling the remarks that are not meant to be taken seriously, we spoil the joke. In satirical writing, half the fun is in never being quite sure whether the author is serious or not... But in defense of the idea, let me say two things. First, not all people who post on boards have the literary skill of Shakespeare or Twain, and even those luminaries had bad days… Second, and more important, these authors were publishing their words in a different medium, with different properties. If 100,000 copies of a novel or an essay were distributed in printed form, and if one per cent of the readers didn't get the joke and were outraged at what they had read, there was nothing these clueless readers could do to spoil the enjoyment of the other 99 per cent."

But does he use emoticons in messages sent out on mobile phones or e-mails? "I don't use text messaging on my phone, but I use :-), :-(, and ;-) in e-mails. Only the first two are my creations, but I wish I had thought of the winking face as well!" rounds off Professor Fahlman.