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MONEY, MONEY, MONEY

GO CASHLESS?

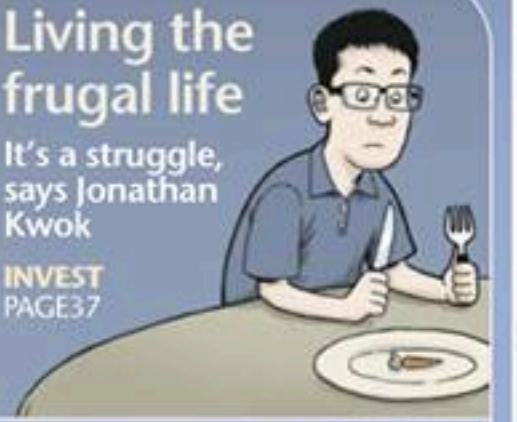
It's harder than you think

SPECIALREPORT: TOPNEWSPAGES8&9

Living the frugal life

It's a struggle, says Jonathan Kwok

INVEST PAGE37



Almost bankrupt

How one man bounced back from the brink

INVESTPAGE36

UNDERWATER SCIENTISTS

They go in search of corals

THINKPAGE46

FANDI DEMOTED

Johor picks a Spanish coach

SPORT PAGE56

ZURAIDAH IBRAHIM

Clean ceilings? PAP-WP bust-up is about much more

THINKPAGE43

JOHN LUI

I'm a member. So why do they ask me who I am?

THINKPAGE44

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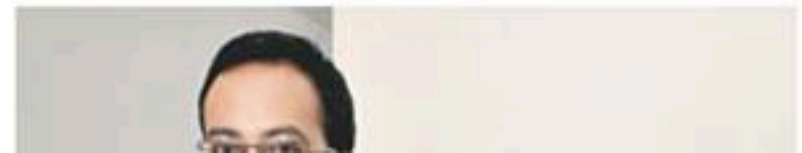
IN sundaylife!

HAPPY IN

SAF to recruit



[I AM A SCIENTIST]

Corals are nature's own archives

Reefs serve as records of environmental change, aiding climate and ocean research

Feng Zengkun

Q: Most scientists spend much of their time in the laboratory. Do you?
Dr Intan Nurhati: We actually spend about 10 per cent of our time in the water, and our work calls for scuba diving qualifications. We dive to coral reefs and take coral samples to study past environmental changes, like how the climate and ocean chemistry have changed.
Ms Jani Tanzil: We also look into how these changes have affected the corals and coral reefs.

Q: Ever had any close shaves?
Ms Tanzil: We haven't had any close shaves, but there have been a few times when we reached the shore after a diving trip just before a huge storm hit.

Q: Why study corals?
Dr Nurhati: Most climate research requires data from a long period of time, say hundreds of years, if you want to understand what nature is doing versus what people did.

Current measurement instruments may not have existed back then. Some sites may also be too remote for sensors. To study (the climate phenomenon) El Nino, for instance, we need long temperature records from the Central Pacific ocean, but who on earth would have put sensors there 100 years ago?

So we need to be creative and look at nature's own archives. Just like trees have rings that are annual markings, some corals also have growth rings, which can be seen with X-rays and under ultraviolet light.

This means we can study corals to learn more about past events.

Corals can grow for 10, 20, even hundreds of years, and some can grow relatively fast, so you can even get monthly data, like what happened in September 1984.

Q: What are some of the things that you can learn from corals?
Dr Nurhati: The coral bands vary in their thickness and composition due to changes in factors such as water temperature, clarity and nutrient availability.

You can study many things from the coral skeleton's chemistry. It can tell us about changes in temperature, which are important if you want to know the rate of ocean warming and global warming.

We also study how ocean chemistry has changed by measuring heavy metals such as lead in our corals, and rainfall changes by measuring the chemistry proxy for salinity in corals.

If you have more rain, the ocean becomes more diluted, so the salinity falls.

PHOTO: SEAH KIANG PENG

Dr Intan Nurhati (left) and Ms Jani Tanzil, of the Singapore-MIT Alliance for Research and Technology, with a coral sample and the drill they use to collect specimens from reefs. "We actually spend about 10 per cent of our time in the water, and our work calls for scuba diving qualifications," says Dr Nurhati.

JANI TANZIL & INTAN NURHATI

Ms Jani Tanzil and Dr Intan Nurhati, who are both in their early 30s, have been researching corals around Singapore as part of their work at the Singapore-MIT Alliance for Research and Technology (Smart).

By examining the corals, which can grow for hundreds of years, they can detect how the climate here has changed over time.

A marine ecologist by training, Ms Tanzil is currently completing her University of Amsterdam doctorate, which is focused on corals around the Thai-Malay peninsula.

Like trees, corals add layers or bands over time.

Ms Tanzil uses luminescent and density banding patterns in corals to date and reconstruct the corals' past growth rates, in a method known as sclerochronology.

Dr Nurhati is an Indonesian climate scientist with a doctorate from the Georgia Institute of Technology in the United States. A postdoctoral associate at Smart, she studies corals around Singapore to answer questions such as whether the monsoon seasons are changing, and how industrial activities have altered marine chemistry.

Coral reefs occupy less than 0.1 per cent of the world's oceans, but scientists believe that the reefs account for and support more than a quarter of the oceans' biodiversity.

Singapore's reef area covers less than 10 sq km, but it is home to over 250 hard coral species, almost one-third of the global total.

Q: How are the rings or bands formed?
Ms Tanzil: For corals around Singapore, the luminescent bands are related to salinity changes.

Trees shed leaves, which decompose and create humic acids. When you have many trees near rivers, the highet river flow during the wet season washes the humic acids into the reefs and corals absorb them. In dry seasons, there is less river flow and therefore less humic acids flowing into the reefs.

The exact cause of the bandings and rings in corals is still being investigated, but my research has found that bright bands usually correspond to the south-west monsoon and the dull bands correspond to the north-east monsoon.

We also verify this by staining the coral in the reef with a harmless calcium dye. You stain it multiple times, and then collect a specimen later. The stain bands, which show up as pink lines in the coral skeleton, will allow you to infer the growth rate and pattern. I have stained corals over a two-year period just to make sure the natural bands are somewhat annual.

Q: How do you get the coral specimens?
Dr Nurhati: We core the corals using a long barrel with diamond-dusted teeth at one end, and we use pressurised air to power the drill, which rotates the coring barrel into the coral. This gives us long columns of coral.

Q: Doesn't this harm the corals?
Dr Nurhati: We don't kill or collect the whole coral, but sample only a small portion. If you look at a coral, the living part is only the outer layer, which is about 0.5cm thick, covering the coral like a blanket. Beneath this is dead skeleton.

Our samples are just 5cm in diameter, so we take only a small, thin slice of living material. Everything else is skeleton.

Ms Tanzil: To the living coral, it's like a fish taking a bite out of it. We fill the hole with epoxy, which is like plasticine but hardens like cement. With time, the living tissue will grow over the epoxy and cover it up. We also monitor the holes we patch up, and we do need a permit from the National Parks Board to core corals in Singapore waters.

Q: What do you do with the coral specimens?
Dr Nurhati: We "slab" it into two to three slices. Most of the time, we use the middle slice for analysis, and the rest we keep for our records and in case someone wants to collaborate and study other things with it.
Ms Tanzil: Then I take the slices and date the various bands. Different corals grow differently, so it's important to understand what causes the banding.
Dr Nurhati: Once the dates are assigned, I put a tracking mark in each section and drill a small portion into powder. We collect this very fine powder, weigh it, and then dilute it in acid so we have a solution, which we put into machines for different analyses.

Q: What's the experience of studying corals like to you?
Dr Nurhati: It's like having a history book of the environment, and you even get chapters.

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Beautiful science

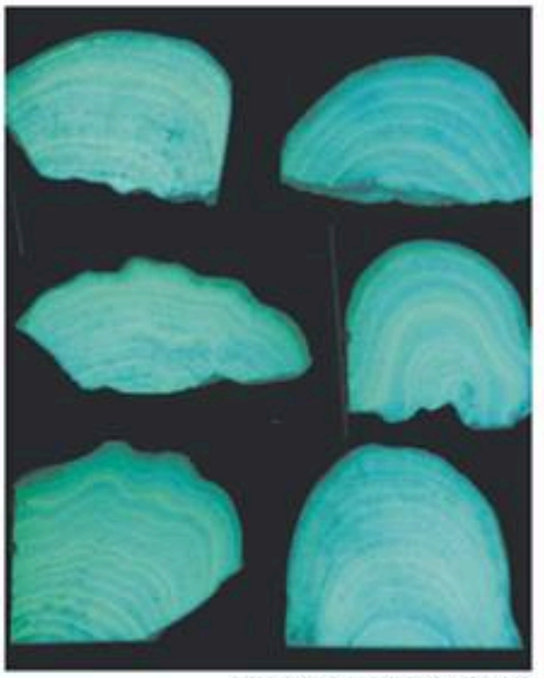

PHOTO: SINGAPORE-MIT ALLIANCE FOR RESEARCH AND TECHNOLOGY

Ultraviolet light revealing annual luminescent growth rings in sliced coral heads collected from around the Thai-Malay Peninsula.

Corals grow by forming layers, similar to trees that form growth rings each year.

Because these coral layers "lock in" certain chemicals under different environmental conditions, they can serve as archives of past environmental changes, according to researchers from the Singapore MIT-Alliance for Research and Technology.

Studying these coral bands can provide information on environmental changes such as regional climate change and heavy metal pollution over the years.

"Coral reefs are essential spawning, nursery, breeding and feeding grounds for numerous organisms. In terms of biodiversity, the variety of species living on a coral reef is one of the most diverse on the planet, yet coral reefs cover less than one-tenth of 1 per cent of the ocean floor. By one estimate, biodiversity value accounts for

IN BRIEF

Making self-destructing electronics

Urbana (Illinois) – Good news. One day there may be no need to worry about safely throwing out your old cellphone because it will self-destruct.

That's the idea behind a project at the University of Illinois, where researchers are investigating how to build electronics that vanish in water.

Their "born to die" programme hopes to design transient technology that can dissolve at the end of its useful life, thus saving space in landfills and reducing waste, says materials science and engineering professor John Rogers.

The research team isn't quite there yet, but it has designed a chip built on a thin film of silk that dissolves when hit with water.
AP

Fracking may mean more quakes

New York – Disposing of wastewater from hydraulic fracturing – fracking – for oil and natural gas may make fault zones more prone to earthquakes.

Researchers from Columbia University and the University of Oklahoma found a "profound" increase in the number of earthquakes at three sites where wastewater from fracking was injected back into the ground, said Dr Nicholas van der Elst, a scientist at Columbia's Lament-Doherty Earth Observatory in Palisades, New York, and lead author of an article published in the journal Science.

The researchers say disposing of wastewater and other fluids by permanently injecting them may have a greater impact on fault lines than fracking itself, which typically involves pumping the liquids into the earth and then extracting them.
Bloomberg

Study sheds light on 'obesity gene'

London – Scientists have unravelled how a gene [illegible] with obesity makes people fat by [illegible] increased hunger.

[illegible] variation in the FTO gene affects [illegible] the population, making them 70 per [illegible] to become obese but, until now, [illegible] not know why.

[illegible] led research team said they had found [illegible] Previous research has shown that ghrelin can be reduced by eating a high-protein diet.
Reuters

Winning take on nature's numbers

Singapore – Kuo Chuan Presbyterian Primary School's interpretation of "Numbers in Nature" won the Shell Singapore Youth Science Festival Stage! Drama Competition held last weekend.

Their take on 2013 as the year for "Mathematics of Planet Earth" celebrated the wonders of geometry in nature through the exploration of shapes and patterns that exist in the ecosystem.

More than 500 pupils from 21 primary schools competed in 22 teams, with skits illustrating scientific and mathematical concepts revolving around numbers.

The second prize was awarded to River Valley Primary School, and Yew Tee Primary School was placed third.

New Neptune moon discovered

Washington – A tiny new moon has been spotted circling Neptune – the 14th known to be orbiting the faraway planet.

US space agency Nasa says the moon, measuring about 19km across, is the smallest ever glimpsed around Neptune, based on observations from the Hubble Space telescope.

Neptune is the farthest planet from the sun, and Nasa said the moon, named S/2004 N1, is about 100 million times fainter than the dimmest star that can be seen with the naked eye.
AFP

Rare fossil find in Brisbane

Sydney – Australian road-builders have uncovered a rare urban trove of crocodile and other fossils thought to be around 50 million years old.

The fossils, trapped 15m down in a layer of oil shale, were found during excavation works near a Brisbane railway station, according to city mayor Graham Quirk.

"The bones have been identified as from ancient crocodiles as well as other significant material including fish, freshwater shells and plant impressions," said Mr Quirk.

Queensland has some of Australia's richest fossil deposits, including a famous dinosaur dig in the