

ABSTRACTS OF FOS PUBLIC LECTURES 2004

GENE DISCOVERY FOR CELL PROLIFERATION

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Map-based cloning was used in soybeans to discover a gene controlling proliferation of pluripotent stem cells. The gene encodes a leucine-rich-repeat receptor kinase similar to that found in animals and humans. This suggests that the basic mechanisms of cell regulation are preserved.

BREATHING FROM BOTH ENDS: THE DIVING FEATS OF A BIMODALLY- RESPIRING TURTLE, *RHEODYTES LEUKOPS*

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The Fitzroy turtle, *Rheodytes leukops*, is a bimodally-respiring turtle that extracts oxygen from the water chiefly via two enlarged cloacal bursae that are lined with multi-branching papillae. By rhythmic ventilation of these structures *R. leukops* is able to extract oxygen from the water and supplement oxygen obtained via pulmonary routes. *R. leukops* occurs in riffle zones that are well oxygenated, thereby providing a habitat that is rich in dissolved oxygen.

This seminar will provide an overview of the diving behaviour and physiology of this remarkable species of turtle. Field and laboratory-based studies have been conducted to examine the diving performance of *R. leukops* in relation to season, temperature, oxygen levels and water flow.

R. leukops has been listed as threatened and the results of our studies indicate that habitat alteration and destruction through mining and agricultural activities will impact upon the environmental requirements and fitness of this species.

RAIL TRACK DEVELOPMENTS

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The traditional cross-tie rail track has transverse sleepers at intervals along its length, and the system is usually supported by substantial gravel ballast and extensive earthwork en route. However, there are now very different rail systems either in place or under development, which may be particularly suitable for future projects in Brunei Darussalam and Borneo.

Longitudinal sleepers consisting of reinforced steel or pre-stressed concrete beams provide superior rail support, and this alternative is already exploited in monorail and skytrain structures in several countries in the region.

The ladder sleeper, a rigid framework where two such longitudinal sleepers are maintained at fixed distance apart by transverse connectors, has significant advantages. Loads are much better distributed so that, unlike the traditional cross-tie rail track, there are no longer points of intensive load. Thus local stresses on the underlying support structures are considerably reduced, which can be quite important if either train loads are large or the rail route must go through areas where the ground is soft or unstable (or both). The underlying bed may of course include traditional ballast, when ladder tracks provide an important additional safety factor if the ground is soft and unstable, and they also produce significantly less vibration and noise if rigid support structures are incorporated.

Research and development on rail tracks continues in various countries in the region. A very fast magnetically levitated passenger train, safely guided by a substantial rigid structure, now operates between the airport and city centre in Shanghai. A floating ladder track has been implemented at a commuter station and also proposed for the fast rail passenger systems (Shinkansen) in Japan, to provide a better ride and less vibration and noise. Free vibrations in rail tracks may be investigated by mathematical modelling, to help ensure the safety and comfort of passengers.