Kākāpō Oestrogen

A VICTORIA SCIENCE TEACHING RESOURCE

WHO?

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WHAT'S THE PROBLEM?

New Zealand's only flightless parrot, the critically endangered kākāpō, only breeds during mast years when our native trees produce large quantities of fruit. This slows down efforts to increase their numbers which are already very low - just under 160.

WHAT'S THE HYPOTHESIS?

Why it is that kākāpō only breed during mast years isn't fully understood. One hypothesis is that compounds found in the fruit act as a trigger for breeding.

SOMETHING IN THE FRUIT?

Researchers have discovered that New Zealand fruit, particularly that of the rimu tree, are rich in phytoestrogens. These have a similar effect as the oestrogen made by the body.

WHAT IS DIFFERENT ABOUT THE KĀKĀPŌ?

The gene coding for the oestrogen receptor (the molecule that recognises oestrogen and signals its presence to the rest of the body) of kākāpō, as well as many other parrots, is different to that of other birds. It contains a unique sequence of eight amino acids, and by using computer models, the researchers are predicting that this may make parrots more sensitive to plant-based oestrogens.

WHAT DOES OESTROGEN DO?

Oestrogen is the primary female sex hormone for all vertebrates and even some insects. Like all hormones, it acts as a communicator, telling parts of the body how to grow or what to produce. It is responsible for the development of female sex organs and is crucial to the production of eggs.

EXPLORING THIS DISCOVERY

- What should the next step be for the researchers to support their hypothesis?
- Do you think this is strong evidence for their hypothesis?
- What kinds of evolutionary processes may be responsible for the unique oestrogen receptor found in parrots?
- Suggest one benefit to the kākāpō's hypothesised reliance on the mast seasons for breeding.
- What impacts could this finding have on kākāpō conservation efforts?

PHYTOESTROGENS IN NATIVE PLANTS

On the following page are two graphs showing the oestrogenic activity of leaves and fruit from common kākāpō foods. Rimu is a major source of fruit during mast seasons, while inaka is a more regular food source for kākāpō.

Before you look at the graphs, what do you expect to see?

- Why did the researchers use two methods of extraction - methanol and cellulose?
- What might the results from each method of extraction tell us about the availability of phytoestrogens?
- Which year was a mast year?
- What should researchers investigate to further support their hypothesis?

PARROT OESTROGEN RECEPTOR NUCLEOTIDE SEQUENCE

On the following page are the aligned nucleotide sequences for the kākāpō, kākā, kākāriki, kea, Australian cockatiel, chicken, and Japanese quail.

Before you look at the data, what do you expect to see?

- What is the most notable difference between the nucleotide sequences?
- What does this represent, based on the information presented on the previous page.
- How many differences are there between the nucleotide sequences.
- Build a phylogenetic tree using this nucleotide sequence as a guide.

Exploring the Data

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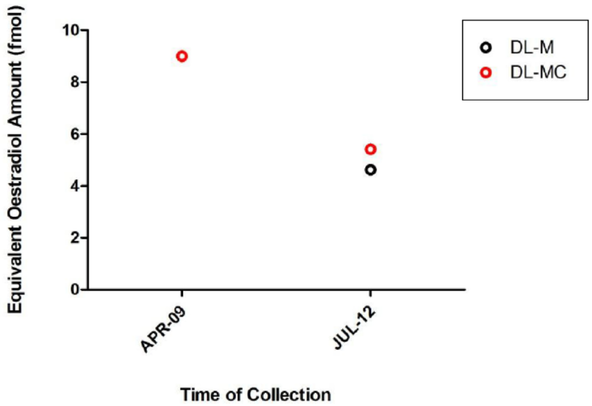
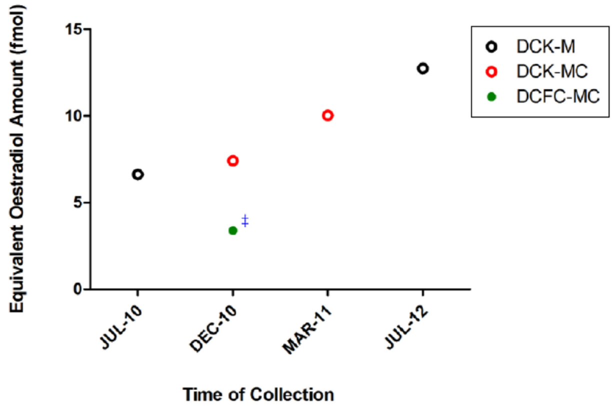
PHYTOESTROGENS IN NATIVE PLANTS





EXPLANATION

This graph represents the oestrogenic activity of leaves of Dracophyllum longifolium (inaka), a food source for kākāpō.

M = Methanol extraction

MC = Methanol and cellulase extraction

EXPLANATION

This graph represents the oestrogenic activity of leaves (DCK) and fruit (DCFC) of Dacrydium cupressinum (rimu).

M = Methanol extraction

MC = Methanol and cellulase extraction

OESTROGEN RECEPTOR NUCLEOTIDE SEQUENCE

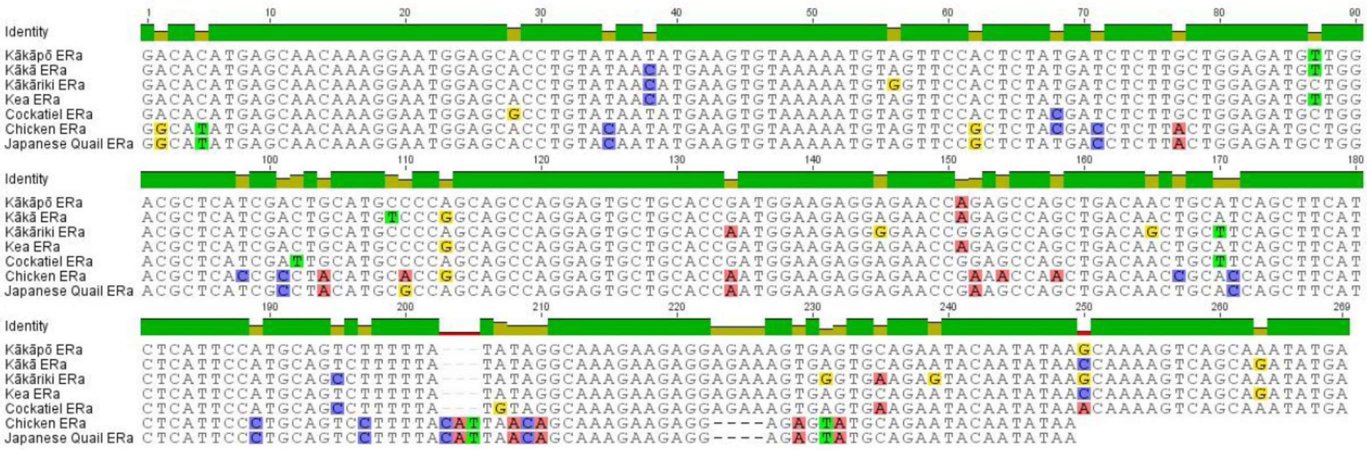


Figure 3.5 Nucleotide sequences that span the remaining amplified region of the ligand binding domain (LBD) of oestrogen receptor α (ERa) of New Zealand parrot species, Cockatiel, Chicken and Japanese Quail. Highlighted nucleotides (red = adenine, blue = cytosine, yellow = guanine and green = thymine) depict a change in the base.