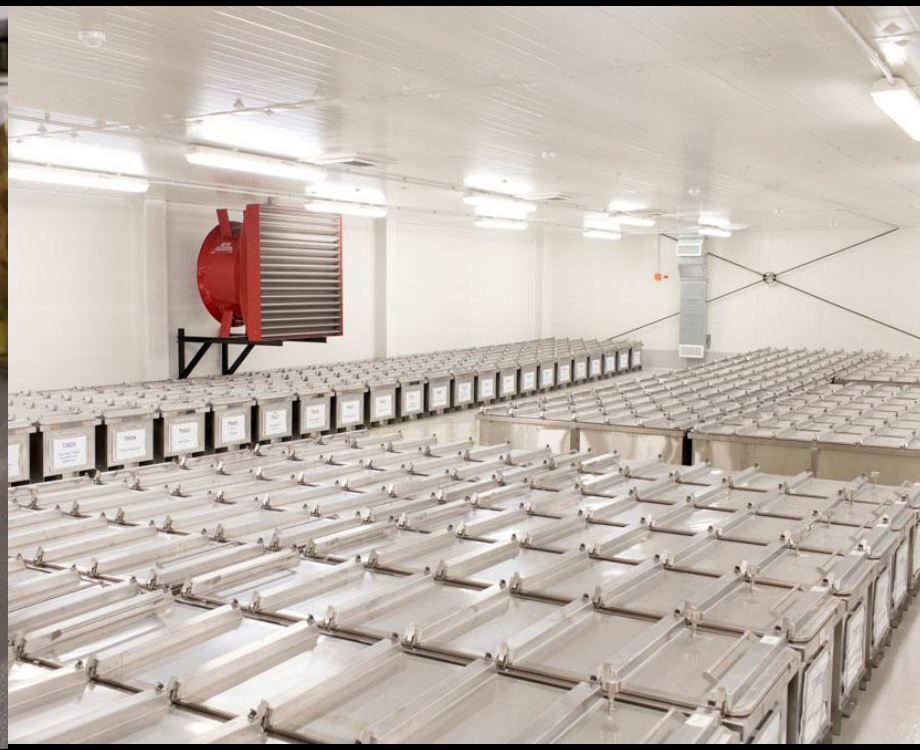
How DNA from museum collections is informing our understanding of New Zealand's plants and animals

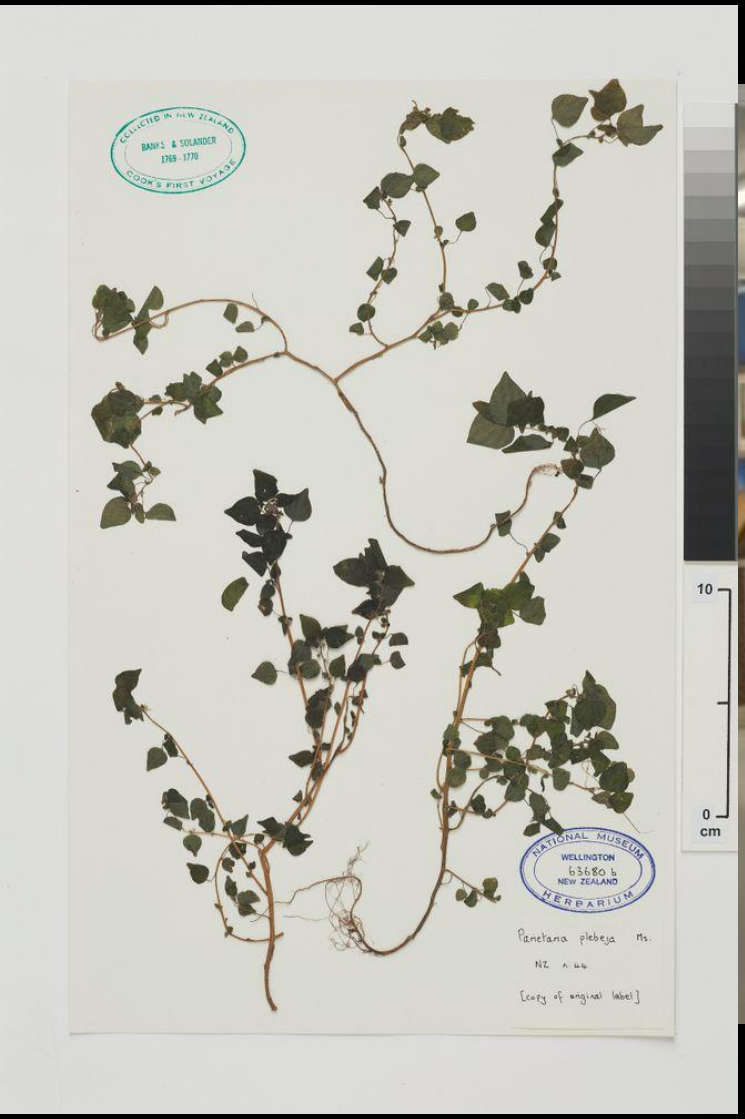
Dr Lara Shepherd
Te Papa


kaltis
732

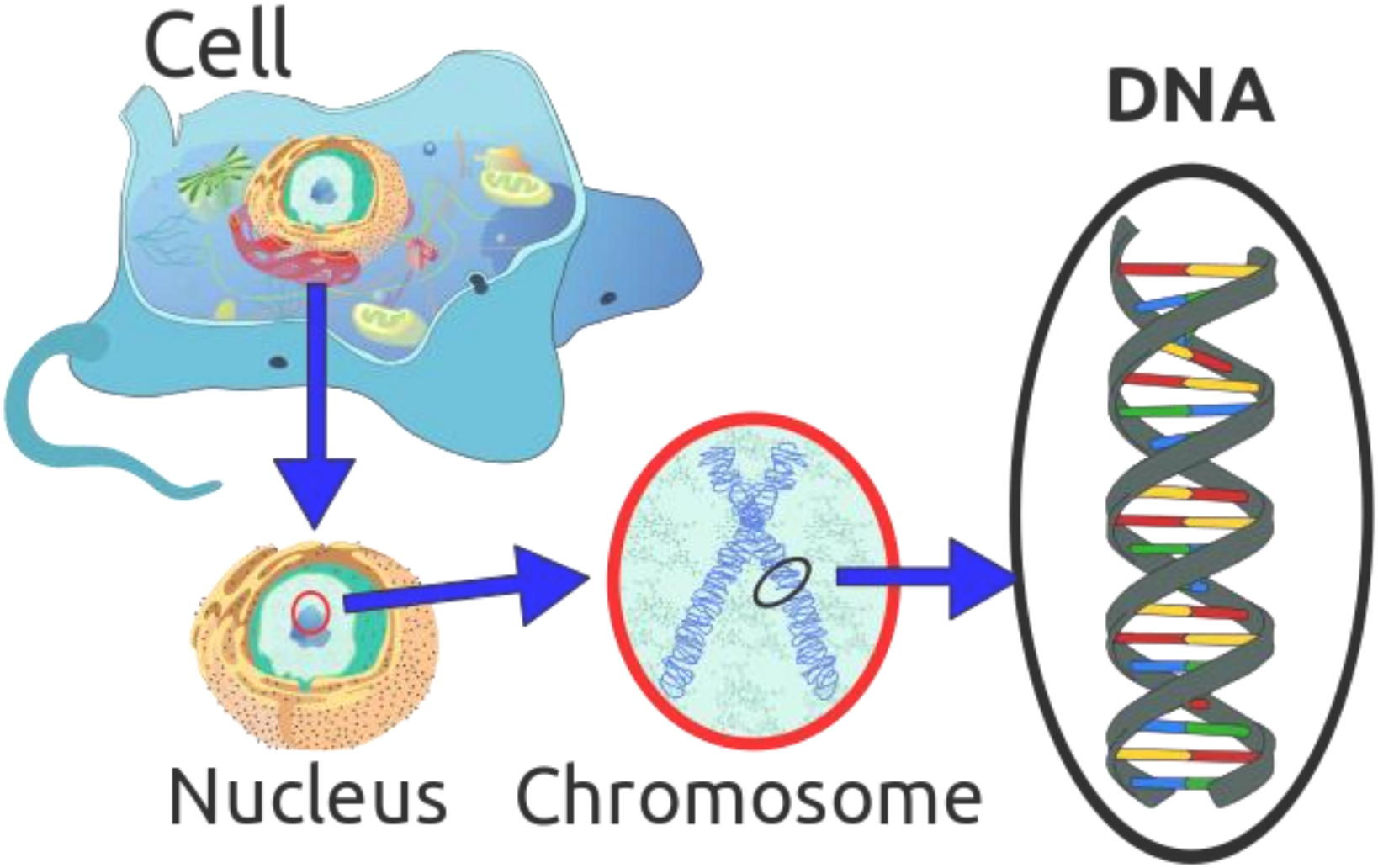
Photo: Chip Clark

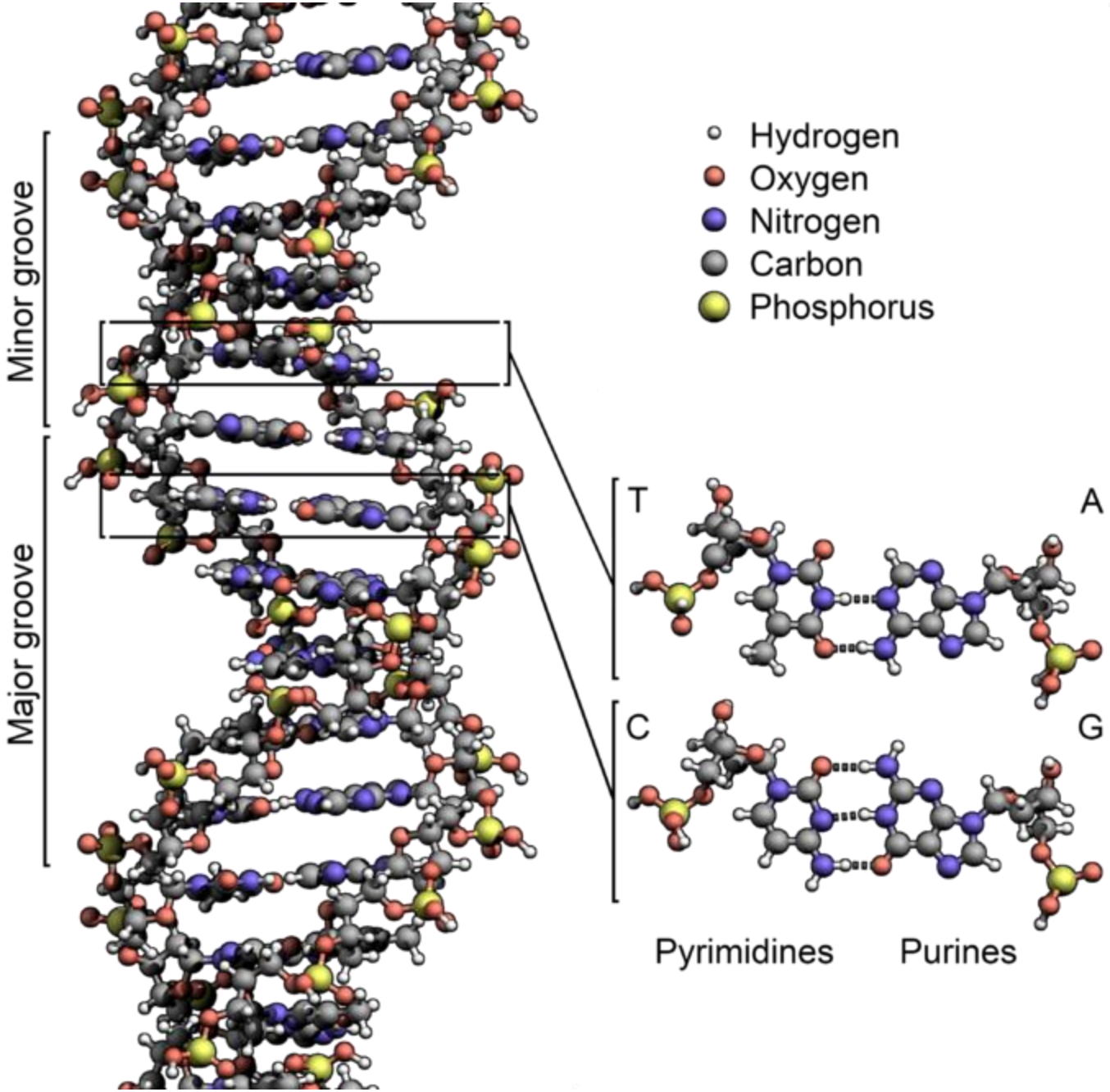

Unsorted
DM I CAVE
RUAKOKAPATUWA
R-2A11-01GC
Martinborough Cave No. 1
Unsorted (1920)
Martinborough
R-2A11-01GD
MARTINBOROUGH
1977

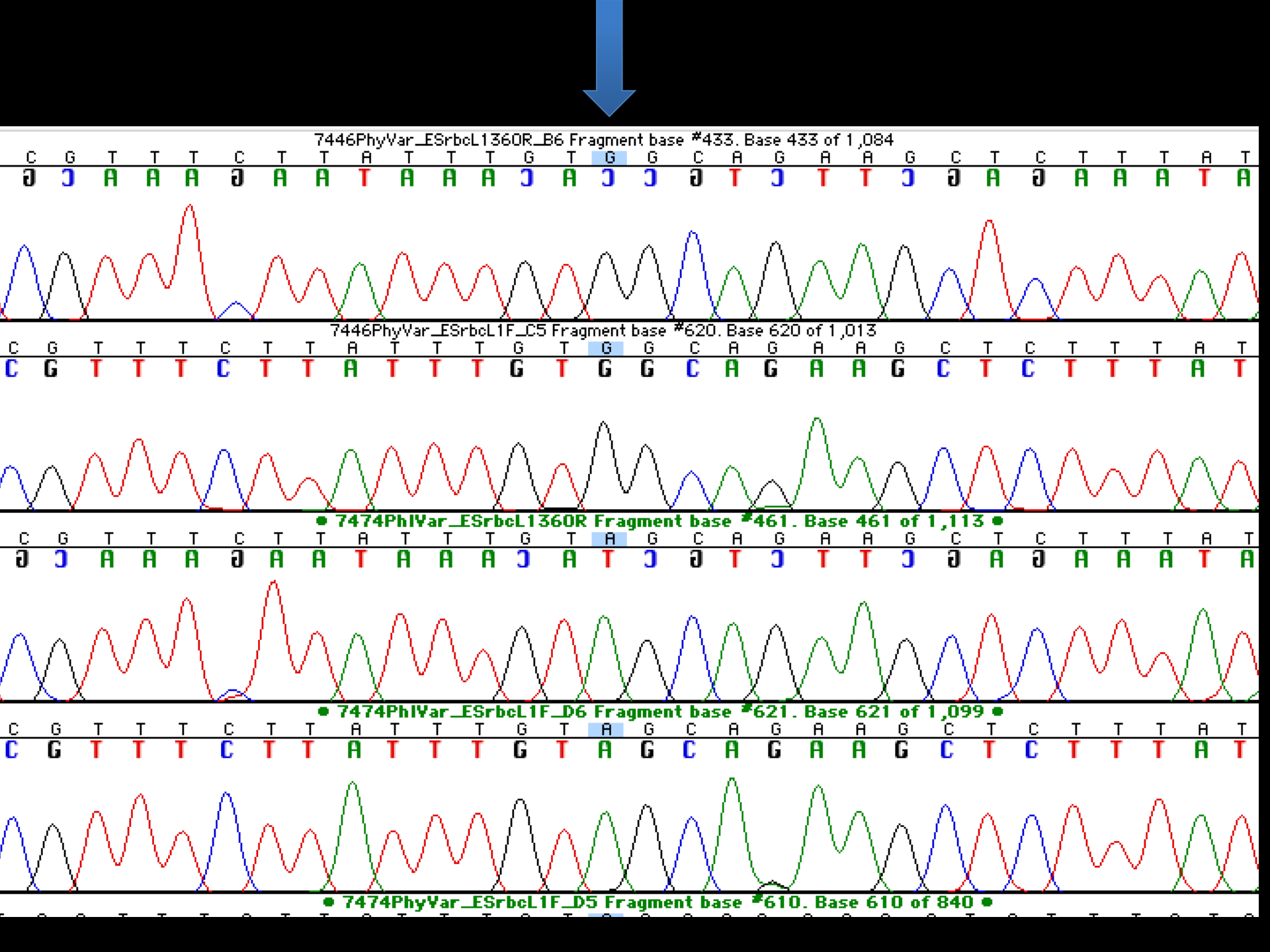


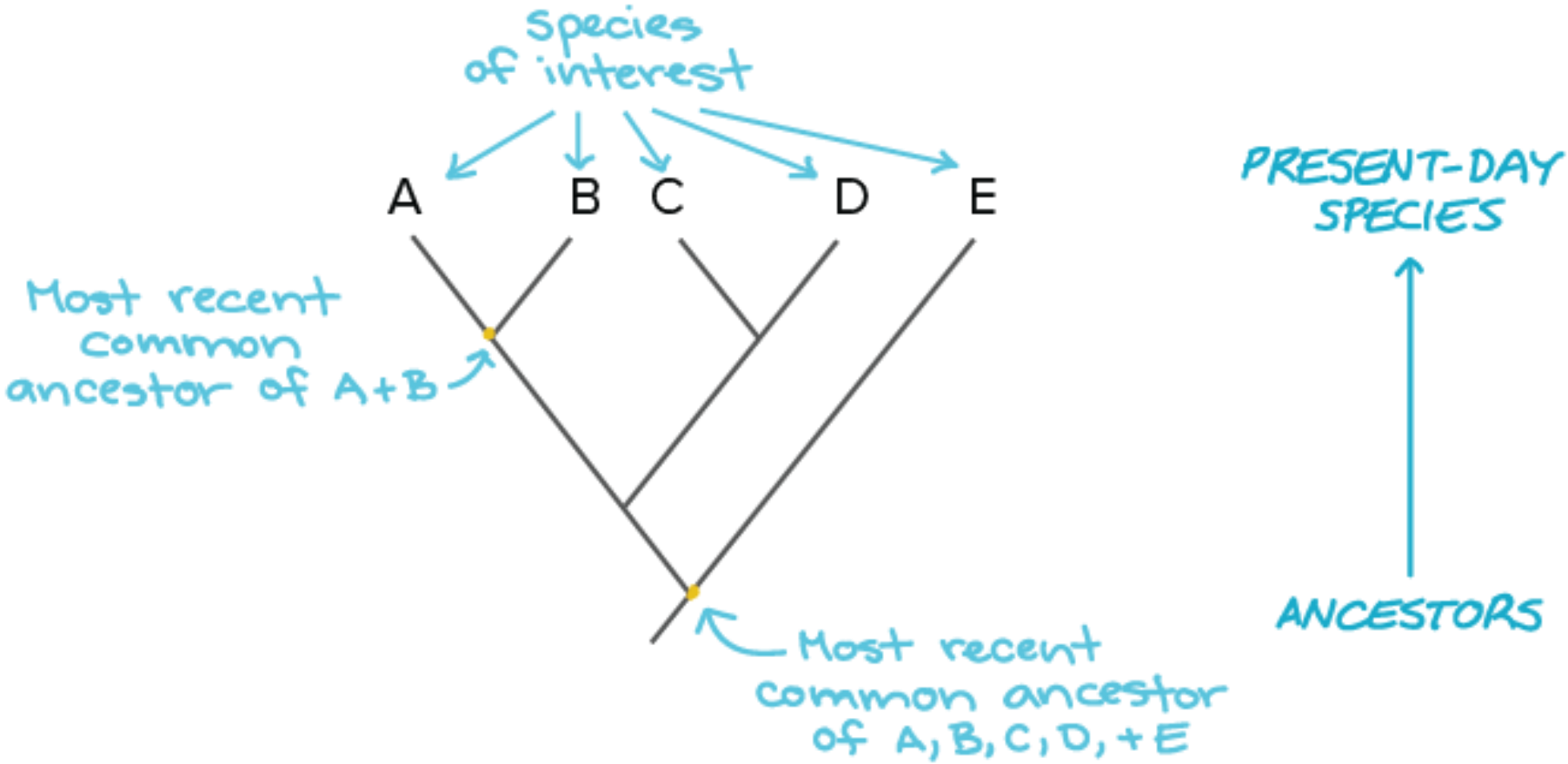

COLLECTED IN N.Z.
BANKS & SOLANDER
1769 - 1770
COOK'S FIRST VOYAGE
NATIONAL MUSEUM
WELLINGTON
63680 b
NEW ZEALAND
HERBARIUM
Panetana plebeja Ms.
NZ n 44
[copy of original label]
10
0
cm

What is DNA?



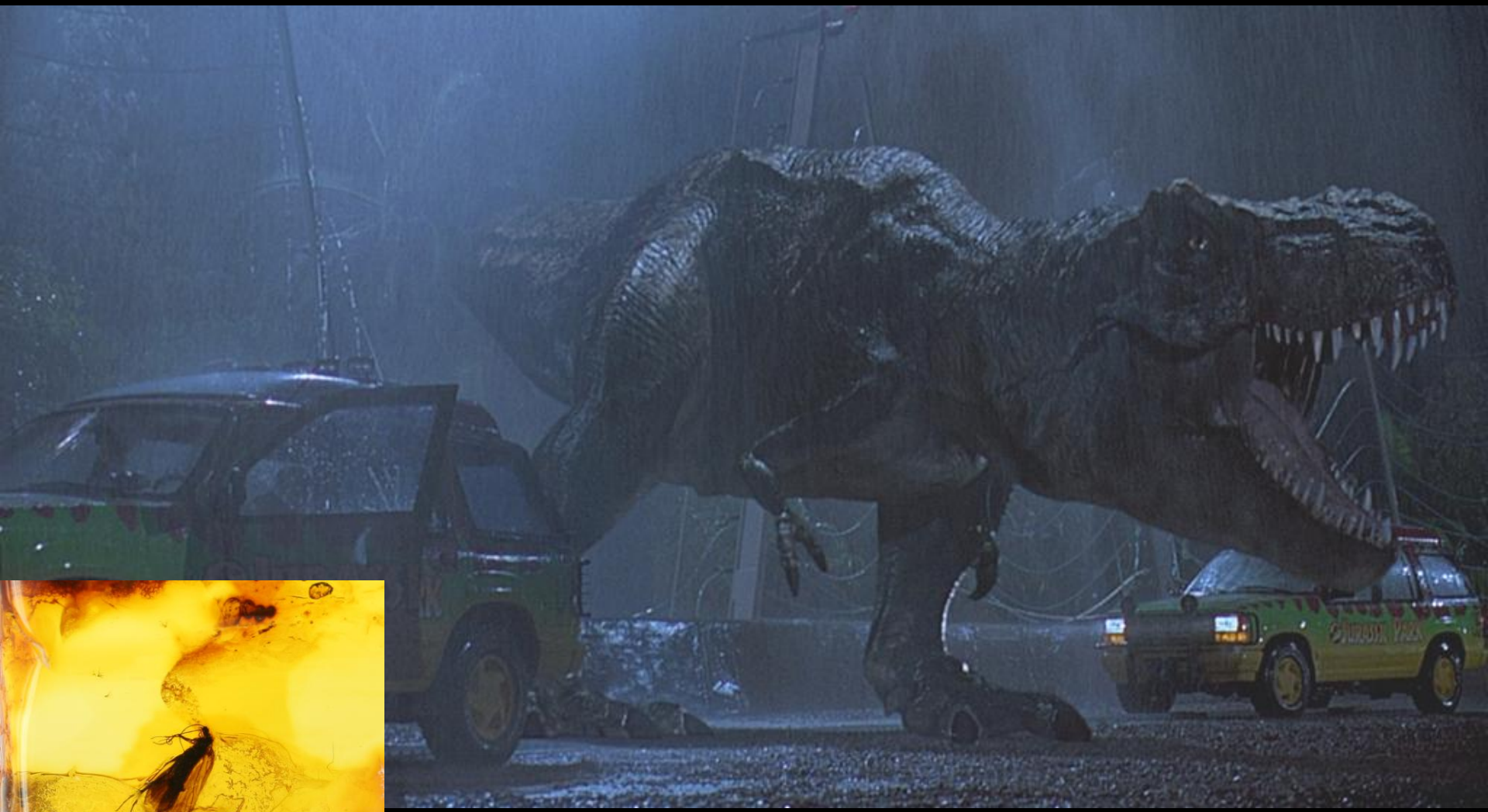

Minor groove
Major groove
Hydrogen
Oxygen
Nitrogen
Carbon
Phosphorus
T
A
C
G
Pyrimidines
Purines


7446PhyVar_ESrbcL1360R_B6 Fragment base #433. Base 433 of 1,084
7446PhyVar_ESrbcL1F_C5 Fragment base #620. Base 620 of 1,013
7474PhlVar_ESrbcL1360R Fragment base #461. Base 461 of 1,113
7474PhlVar_ESrbcL1F_D6 Fragment base #621. Base 621 of 1,099
7474PhyVar_ESrbcL1F_D5 Fragment base #610. Base 610 of 840


Species of interest
A
B
C
D
E
Most recent common ancestor of A+B
Most recent common ancestor of A, B, C, D, + E
PRESENT-DAY SPECIES
ANCESTORS

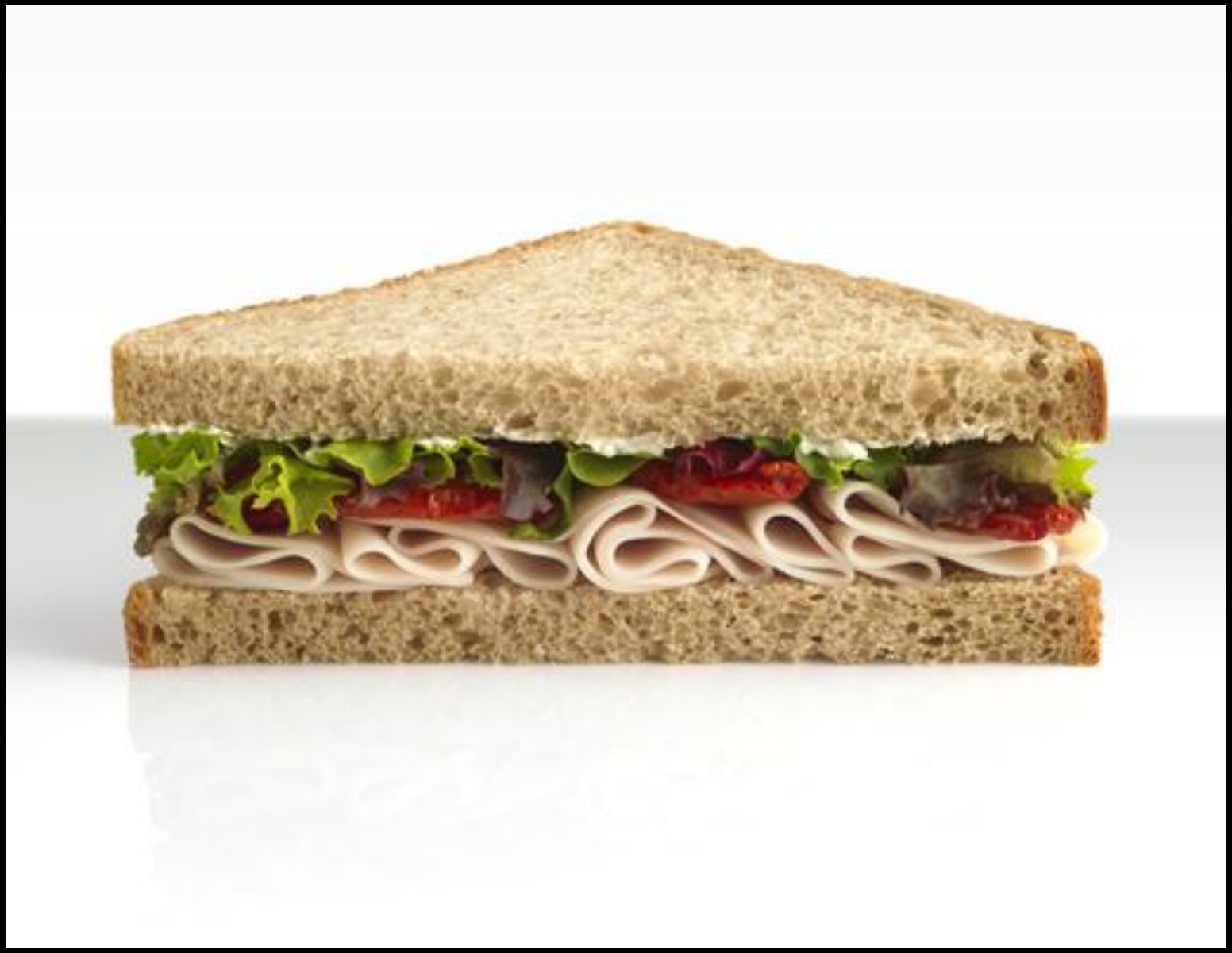
What contains DNA?

- All living tissues (blood, bone, skin, hair, saliva, leaves, pollen, wood……)
- SOME long dead animals and plants
- NOT fossils



Universal Pictures


Dinosaurs!
OLDEST DNA
230
millions of years ago
65
15
5




PENN STATE UNIVERSITY

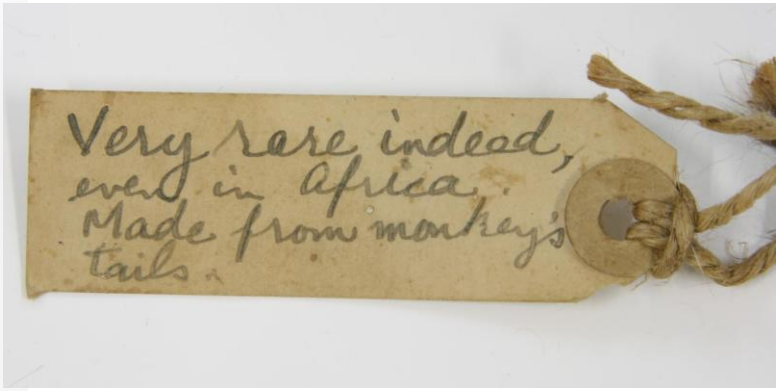
What can DNA tell us?

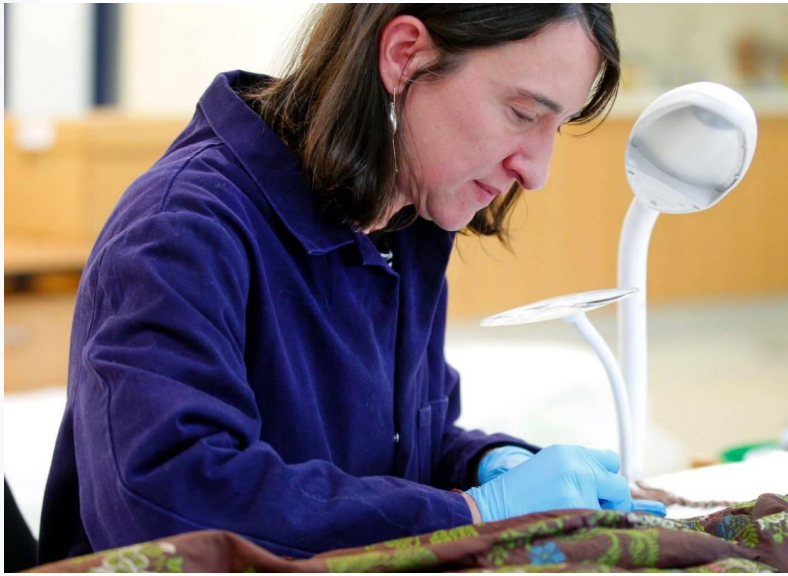
- What species is this?
  - Is it a new species?
  - Where did the species used to occur?
- What lived here?
- Is this a different individual from that individual?

What species is this?


20 30 40 50 60 70 80 90 100 110 120 130

Photo: Brook Whylie

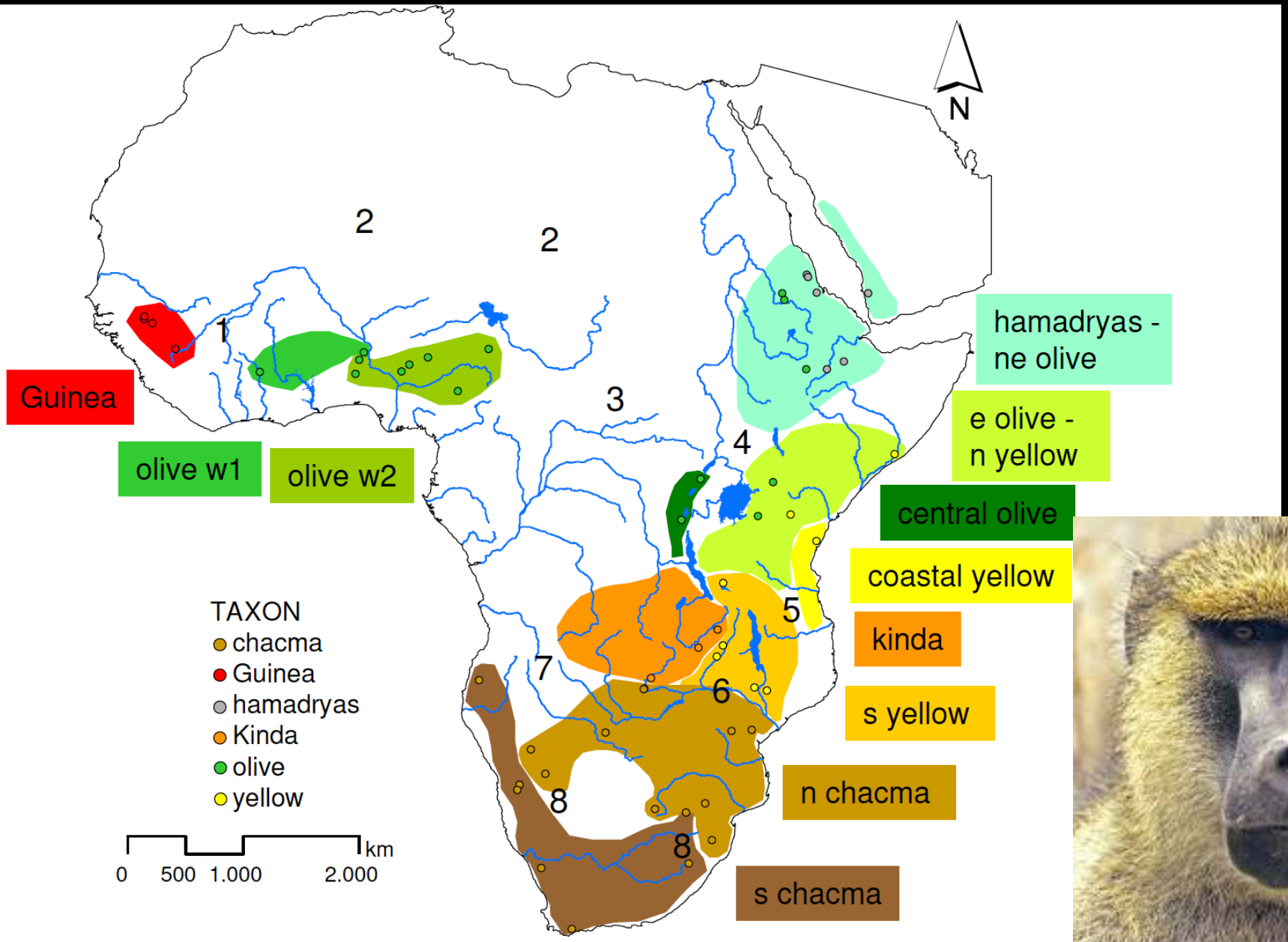

Very rare indeed,
even in Africa.
Made from monkey's
tails.




A
B
C
D
E
H
I
J
K

Results

- 7 different animals skins
  - Vervet monkey
  - Baboon
  - African wildcat
  - Serval
  - African civet
  - Cow
  - Slender mongoose


N
2
2
1
3
4
5
6
7
8
8
Guinea
olive w1
olive w2
hamadryas -
ne olive
e olive -
n yellow
central olive
coastal yellow
kinda
s yellow
n chacma
s chacma
TAXON
chacma
Guinea
hamadryas
Kinda
olive
yellow
0
500
1.000
2.000
km

Is this a new species?


MOA
Aboriginal Art

Chatham Island petrel

Taiko

?

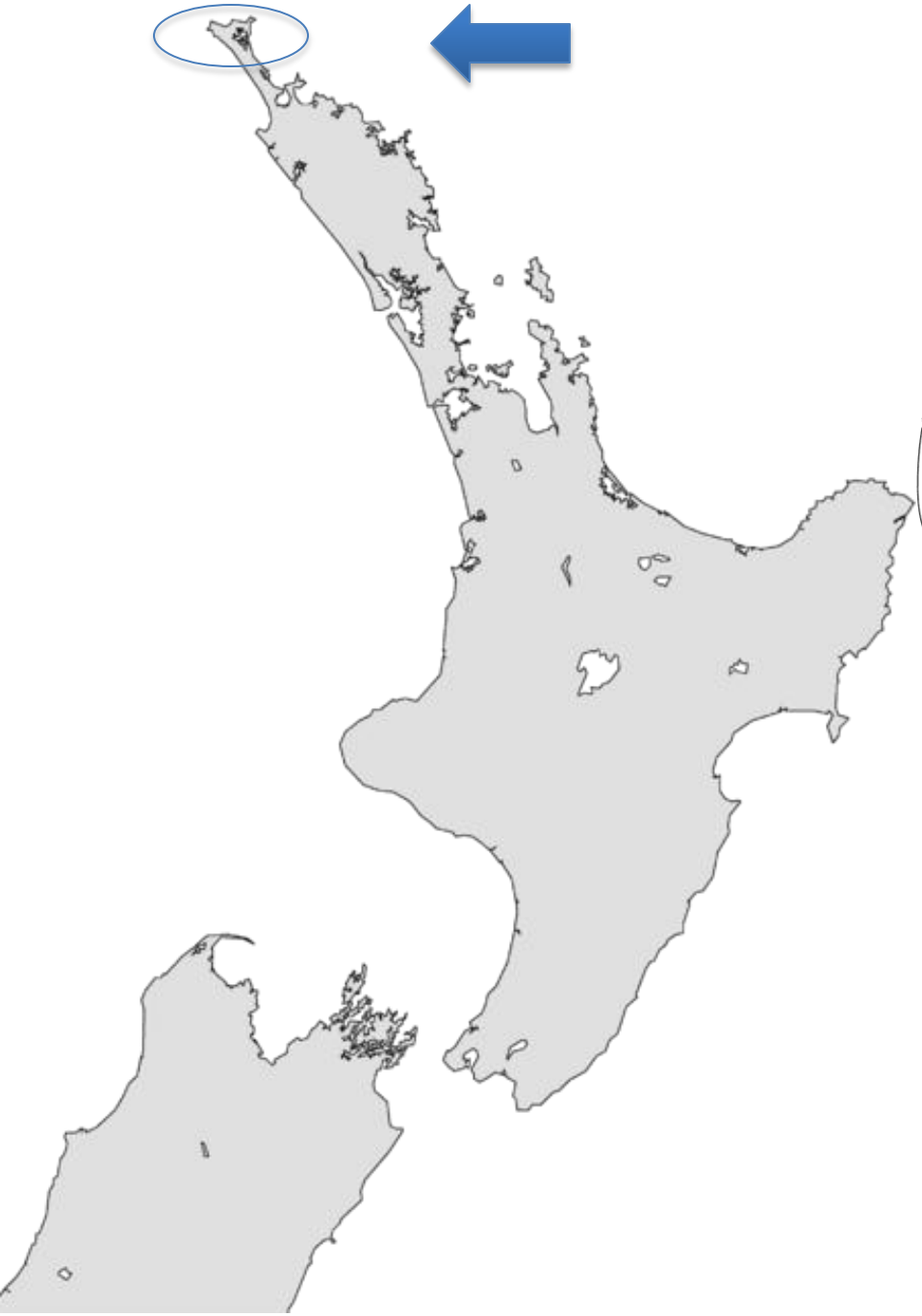
Frequency

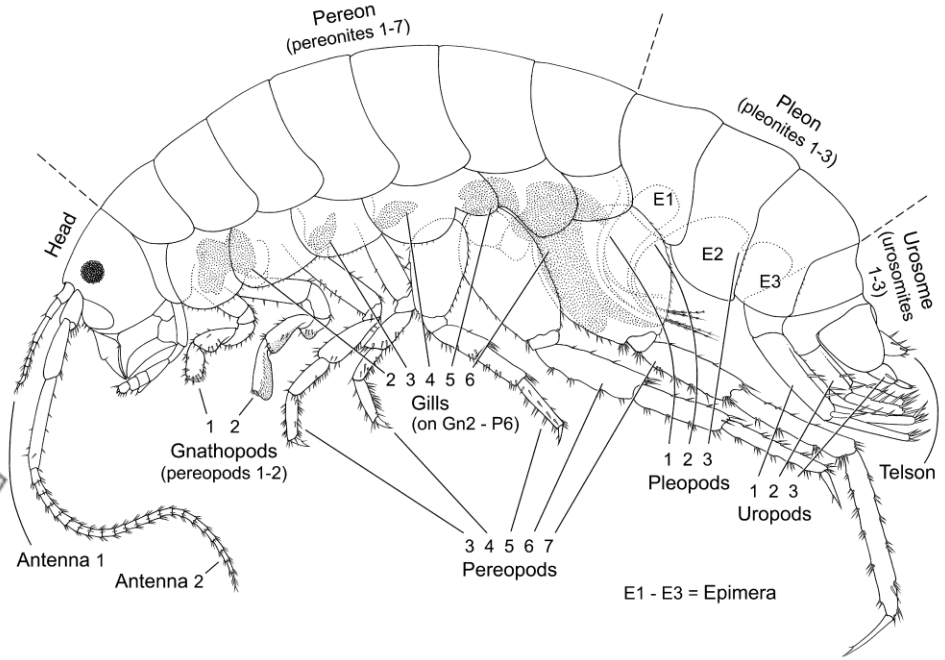
55
50
45
40
35
30
25
20
15
10
5
0

60 62 64 66 68 70 72 74 76 78 80 82 84 86 88 90 92 94 96 98 100 102 104 106 108

Bone length

Imber's petrel – a new (extinct) species of petrel from the Chatham Islands

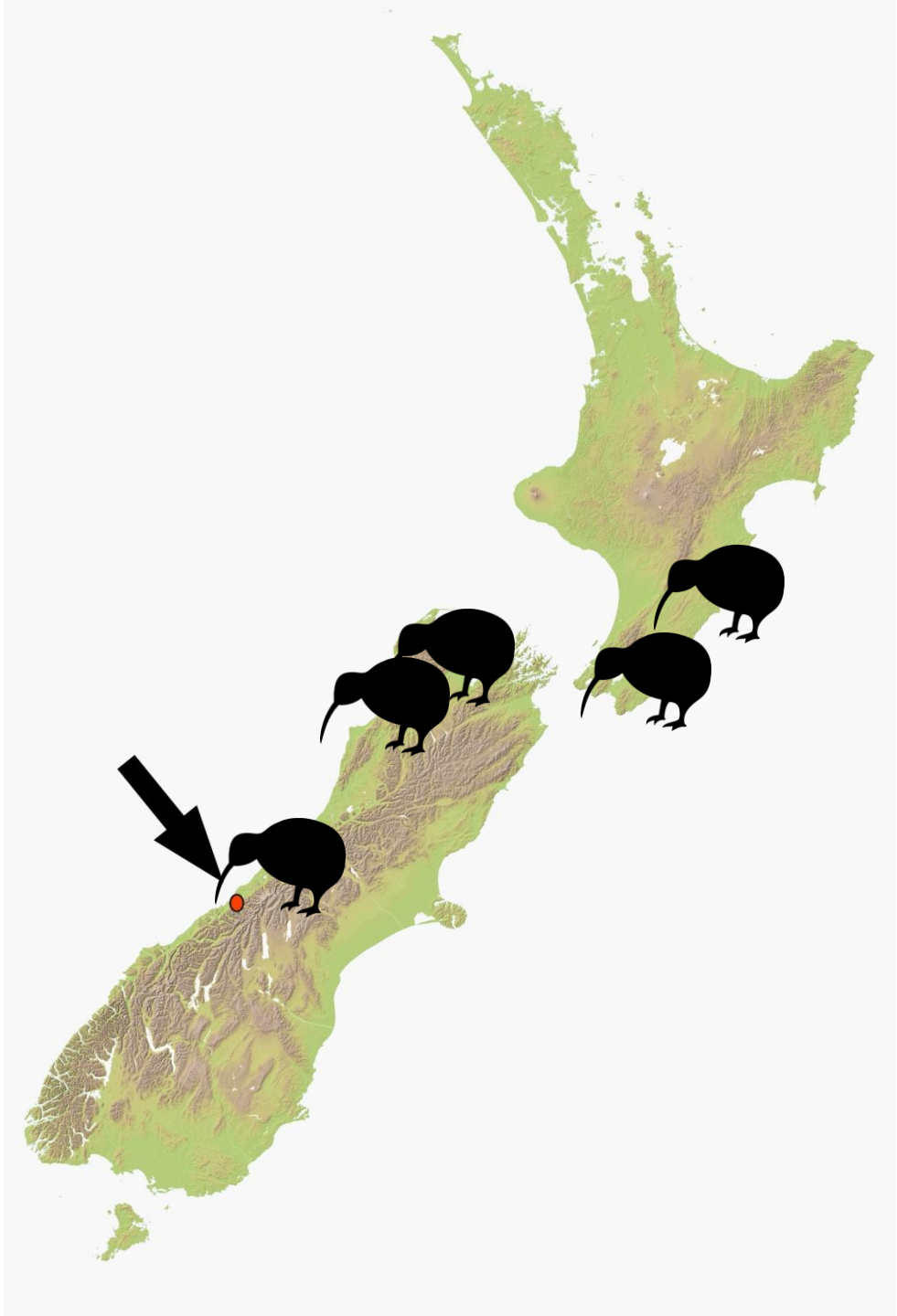



Pereon
(pereonites 1-7)
Pleon
(pleonites 1-3)
Urosome
(urosomites 1-3)
Head
E1
E2
E3
1 2
Gnathopods
(pereopods 1-2)
2 3 4 5 6
Gills
(on Gn2 - P6)
1 2 3
Pleopods
1 2 3
Uropods
Telson
Antenna 1
Antenna 2
3 4 5 6 7
Pereopods
E1 - E3 = Epimera

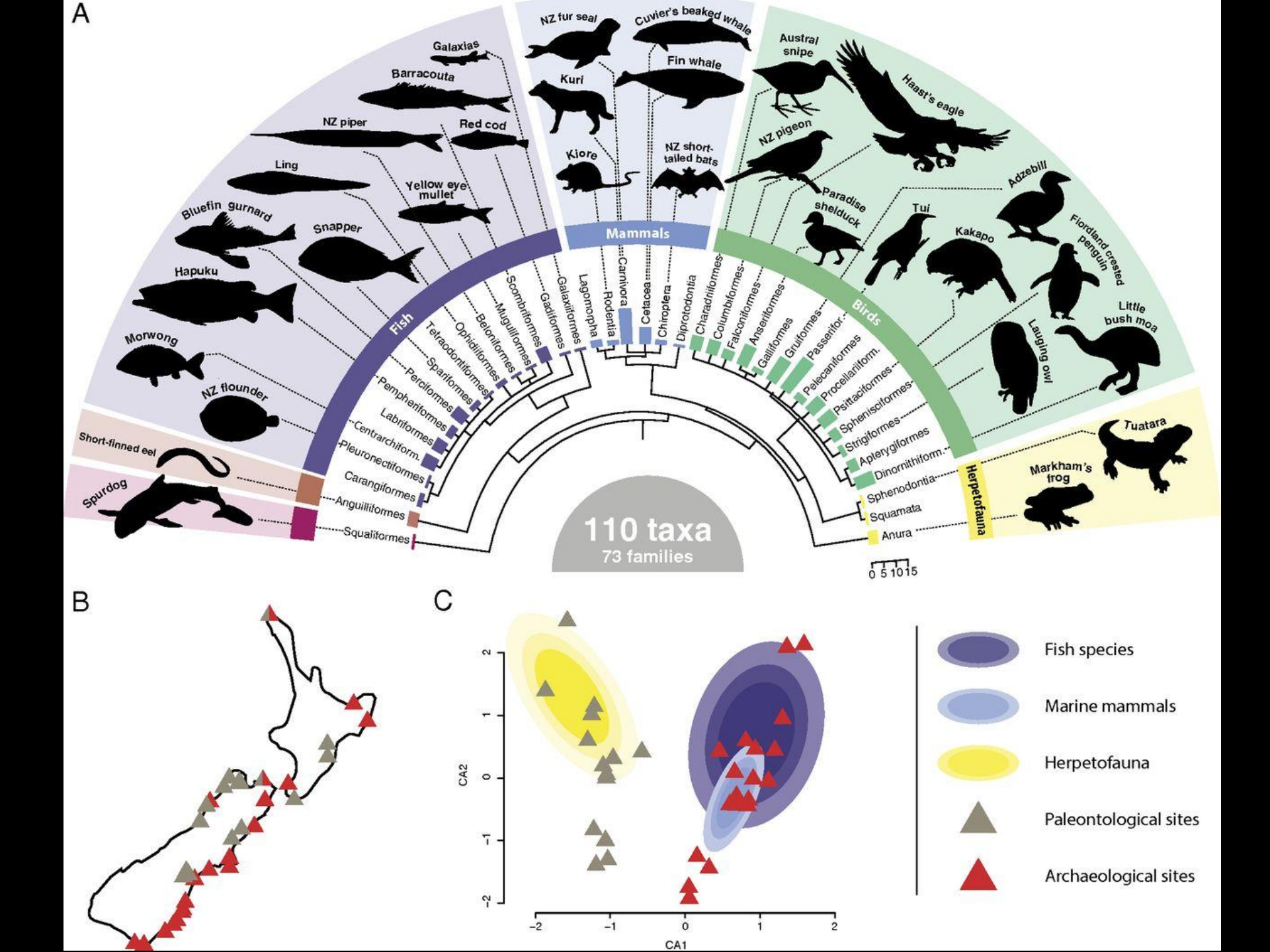
Where did a species occur?

Photo: Chris Crowe

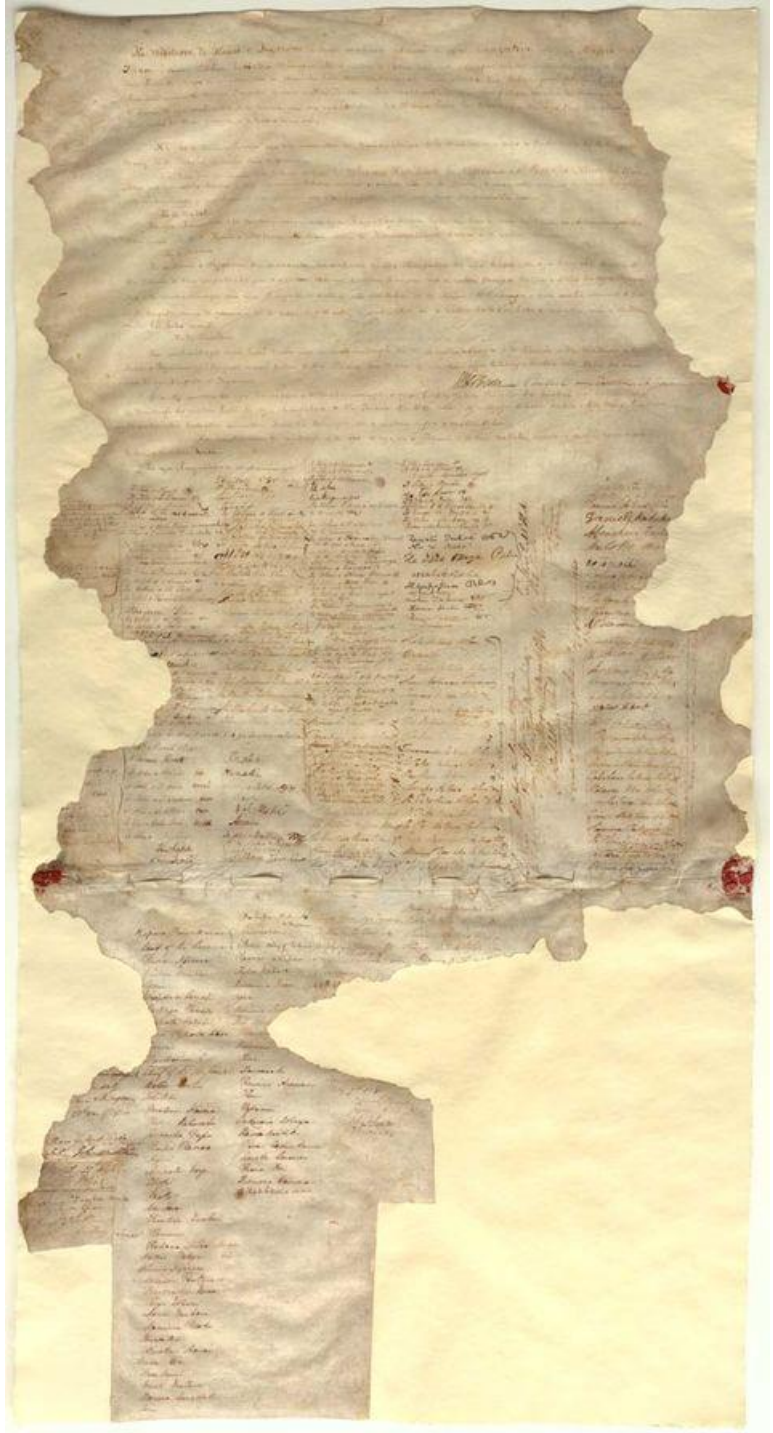
Where did rowi used to occur?

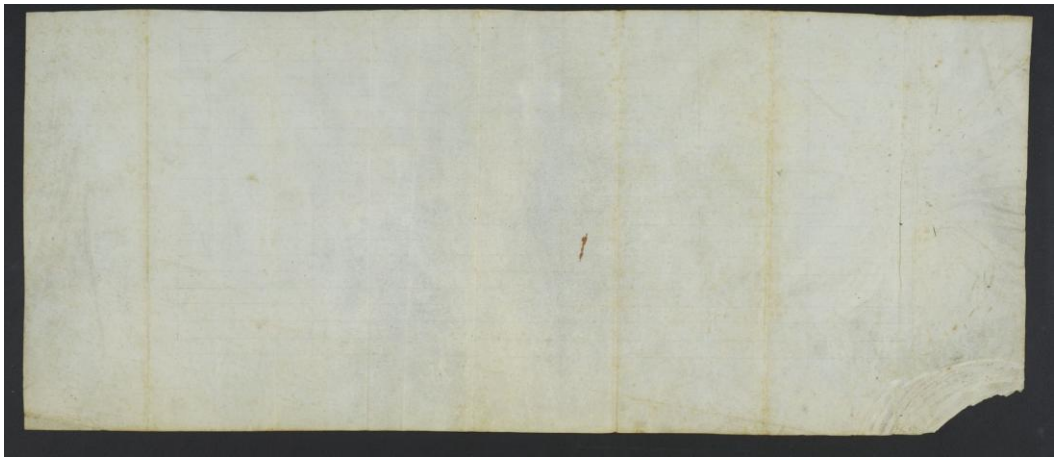


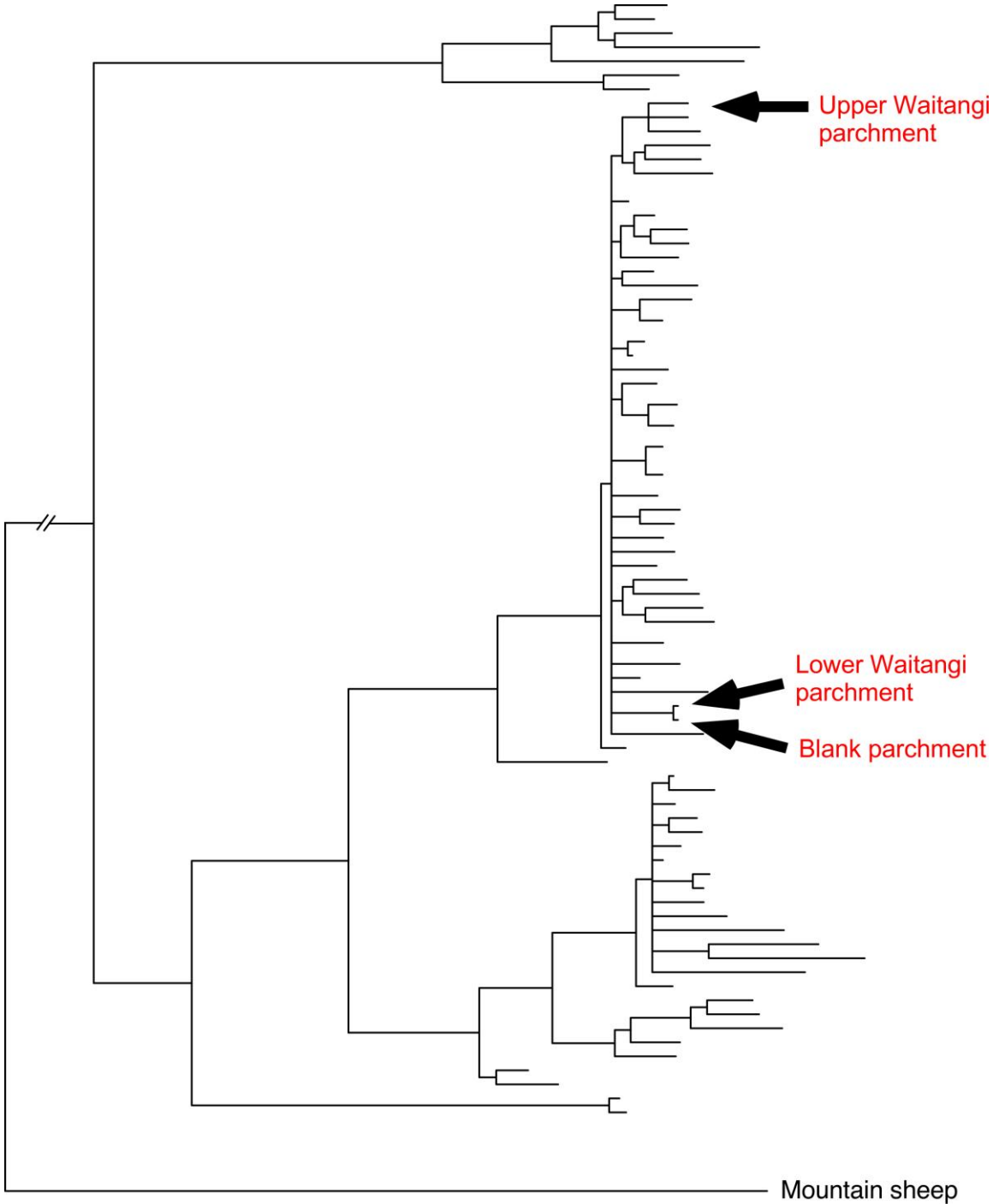
What species were here?


A
Galaxias
Barracouta
NZ piper
Red cod
Ling
Yellow eye mullet
Bluefin gurnard
Snapper
Hapuku
Morwong
NZ flounder
Short-finned eel
Spurdog
NZ fur seal
Cuvier's beaked whale
Kuri
Fin whale
Kiore
NZ short-tailed bats
Austral snipe
Haast's eagle
NZ pigeon
Paradise shelduck
Tui
Adzebill
Kakapo
Fiordland crested penguin
Laughing owl
Little bush moa
Tuatara
Markham's frog
Fish
Mammals
Birds
Herpetofauna
Scombriformes
Gadiformes
Galaxiiformes
Lagomorpha
Rodentia
Carnivora
Cetacea
Chiroptera
Diprotodontia
Charadriiformes
Columbiformes
Falconiformes
Anseriformes
Galliformes
Gruiformes
Passeriformes
Pelecaniformes
Procellariform.
Psittaciformes
Sphenisciformes
Strigiformes
Apterygiformes
Dinornithiform.
Sphenodontia
Squamata
Anura
Muguiliformes
Beloniformes
Ophidiiformes
Tetraodontiformes
Spariformes
Perciformes
Pempheriformes
Labriformes
Centrarchiform.
Pleuronectiformes
Carangiformes
Anguilliformes
Squaliformes
110 taxa
73 families
0 5 10 15
B
C
CA1
CA2
Fish species
Marine mammals
Herpetofauna
Paleontological sites
Archaeological sites

Is this individual different from that individual?

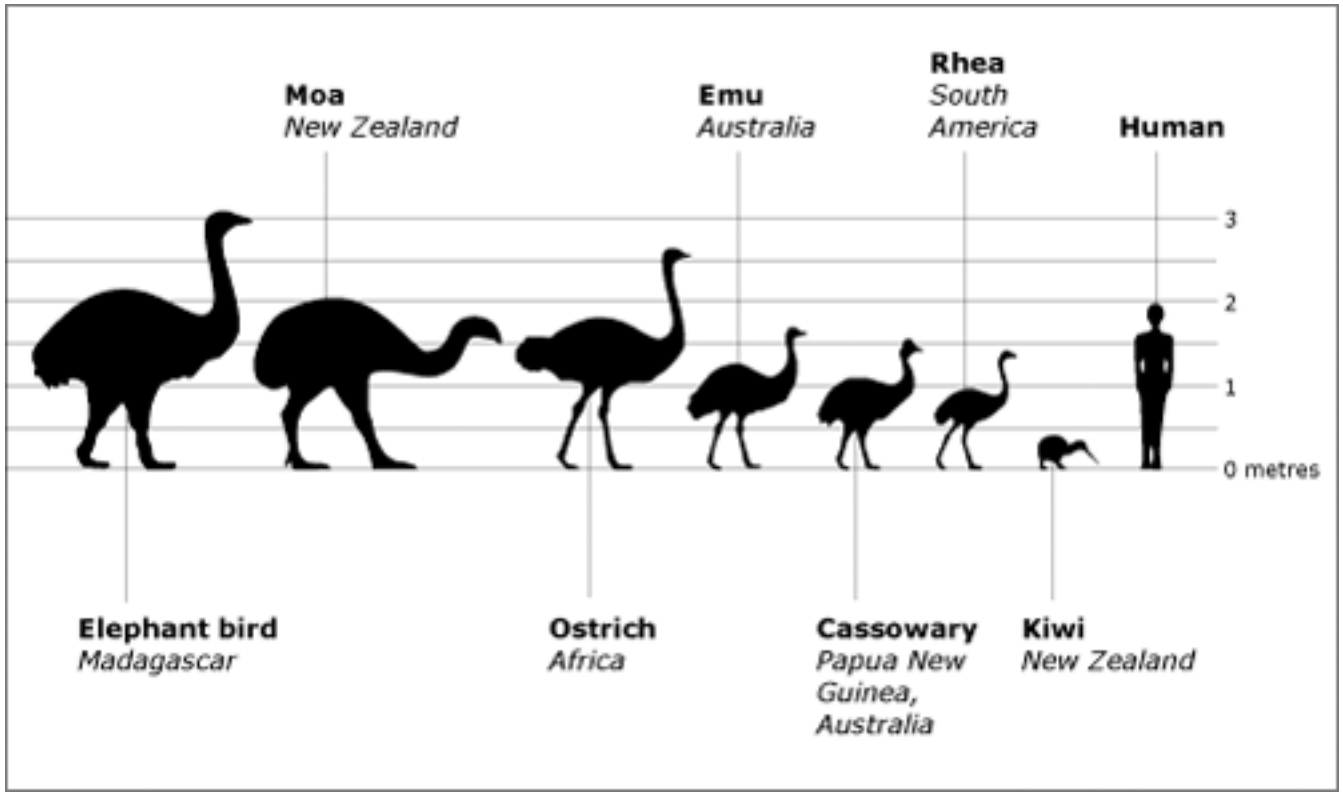




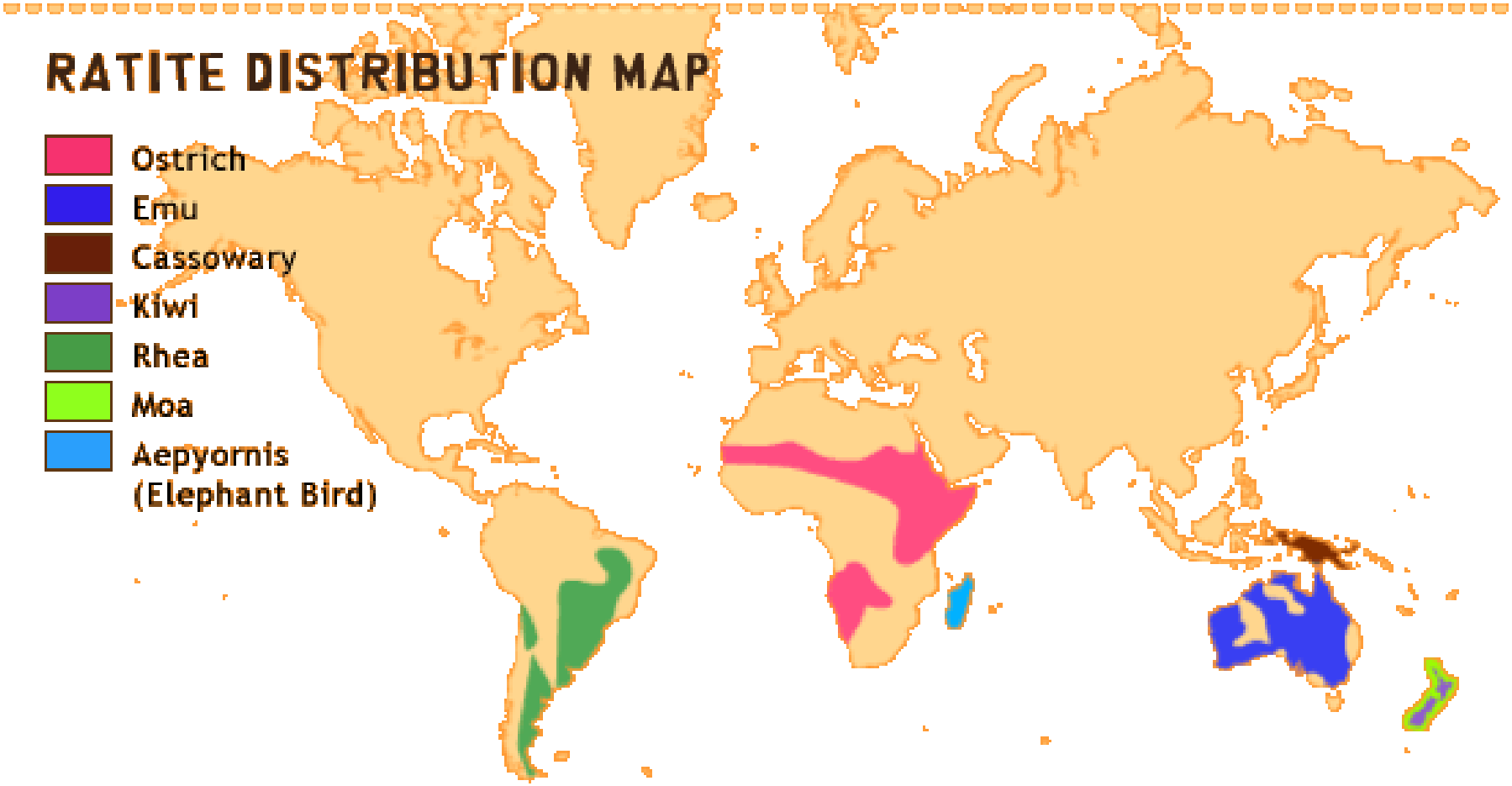


Domestic sheep

How are these species related?

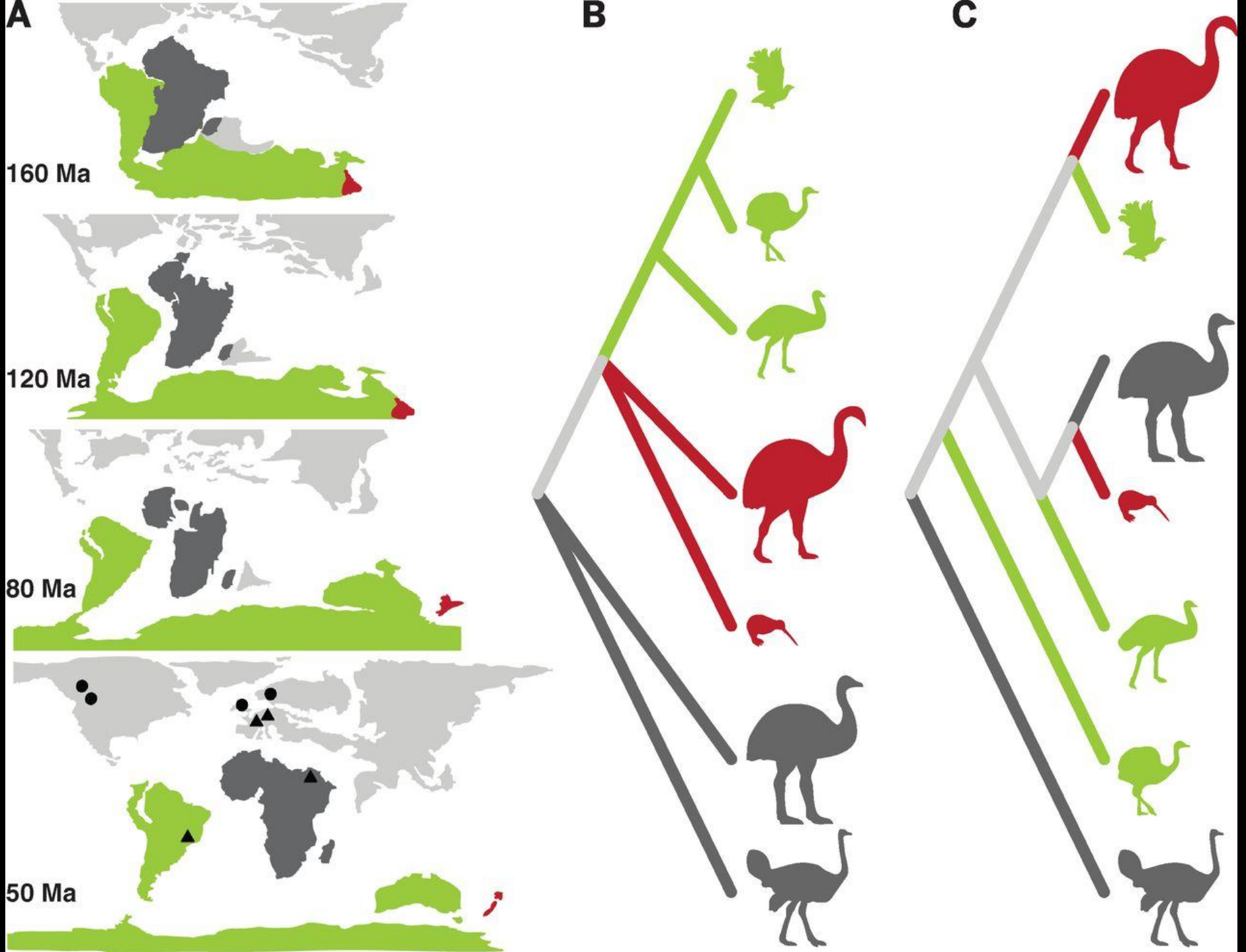


RATITE DISTRIBUTION MAP




Mulleornis agilis (sud de l'île)
Beloha
S.38300
Beloha
Mulleornis agilis

10 cm


A
160 Ma
120 Ma
80 Ma
50 Ma
B
C

Acknowledments

- My colleagues in Natural History at Te Papa
- Collaborators from elsewhere in NZ and overseas
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