# Placental & Marsupial Animals Mammals

- · Placental mammals · long-lasting procentas, developed offspring
- · Marsupials: pouch, 2 vaginas
- · Massipials found in Australia & America [New World]
- · Convergent adoptations of planertal & marsupial mammals

#### Molecular Genetics:

- . DNA is now the side of universal coverer of general cools
- The code is universal every organism britains the same cellular mainlinery for decoding and copying genetic information.
- · Strong evidence for common ameritar
- . Possible to track evolution by comparing genetic equences directly / looking at proteins

# Molecular Clock: [DNA, RNA, protein can be compared ]

Ly pair of species compared for the same protein: Looking differences highly correlated with chargence derived from fossil data. Genetic difference accumulate at a postantial.

Ly Evolutionary tree of the cytochrome c general mities and closely correlates with morphological trees en 100 200 86

Evidence: O collagen extracter for Grannosaur & mammain Fossils extracter for Grannosaur & mammain Fossils extracter

Supports morphological datas

- (2) Birds close to alligator than to mammals
- (3) T. rex closer to brok

Falkland Island wordput " Wolf " [ Dustryon australis]

Lo only native mammal on the Falklands

Ly recent study looked at ancient Pusityon awas mitochandrial DNA (7800-3000 year BP)

Ly 2 species split around 16,000 years ago, around last glacial

wolf walked to Falklands,

## Speciation and Its Mechanisms

Species - Biological Definition (Mayr, Dobhansky) L) a population of reproducing organisms there is isolated from other populations

- Plokaryotes & eukaryotes that are not strictly sexual/eq most plants) fit less easily
- impossible to use with extinct agranisms

#### Requirements of spaciation

#### Speciation

- · Appearance of reproductive isolation
- · Exploitation of changing evological nithe
- \*Ecological Areas effects (eg predators 1 diversity)
- (1) time
- (1) Isolation
- ② Selection

· Species can appear

La. In time along a lineage (eg: humans / chimps } our common ancestor)

Lym space due to isolation eg: animals on an island

Ly various genetic effects (selection, diff, bothenedics) play a rave

Lo there can be identified to be population genetics [measuring allere frequency] K

Modes of Speciation:

(1) Allopathic speciation [ allo - other

(2) Allopathic speciation [ allo - other

(3) Allopathic speciation [ allo - other

(4) Allopathic speciation [ allo - other

(5) Allopathic speciation [ allo - other

(6) Allopathic speciation [ allo - other

(7) Allopathic speciation [ allo - other

(8) Allopathic speciation [ allo - other

(9) Allopathic speciation [ allo - other

(10) Allopathic speciation [ allopathic speciation [

Moder of Speciation:

· Classic & videspices have of speciation 8 of 86

· not necessianly diff. throw · not necessarily diff. selection preserves is adaptations in 2 zones, leading to speciation

· I diff. species of antelope squirrels on either side of Grand Conyon count interpreed birds show no such effect on either side

(D) Endough Exception

a) Objectional Selection

Obruptive

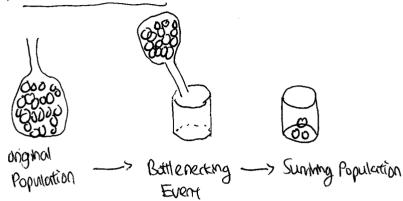
Statutisma Selection

Stabilising Sejection

#### Genetic Diff

L> In large randomly-mating populations, large fluctuations are unlikely Ly random effects can cause major changes in small populations

## Founder effects / battle necks



Li sampling & statistical effects such as difft & bottlenecks, combined with long periods of isolation can lead to speciation

In This does not implement the power of northead selection as the CO.UK only way to consistently creating adapted to testion as the CO.UK

Lo speciation is X an extration, metal, an event to consequence of particular extents conditions, which can must the sy-products of subsequent selection

List species are accidents, taking a long time to occur. # SPECIATION is not the goal of a nintran liner a concernence La Portly because selection is often not directly involved

of other events of

L7 100,000 - 5 million years

Coyne & or: mean time tencen to go from single individual to 2 reproductively isolated individuals ( NDT in bacteria)

Lo speciation is a branching process — to get 100,000,000 spaces today, sparation occur every 200,000,000, year

Lo speciation occur more rapidly of frequently than this

### Sizkle (all Angemia

La homozygates are anaemic h Anagmiz variant still exist

La stade cell anaemia, variant of 46 gene is advantageous in malanal zones — only hererozygotes are 'fitter'

- if homozygotes, die of a sickle-cell

Ly Heterozygores less likely to get malaina

Wat is selected?

Helena (runin: gene's are being selected

- adultion is a change in allow frequencies

Dizk Lewontin: phenotypes being selected

-> phenotype & genotype often not

Bill Hamiton:

directly linked, can get selection

introut evolution

- -> Genes can be linked together possible to have increased frequencies of deleterious gene due to 'hitchniking' - physically close to a solected gene
- -> Selection aperates on holhiduals who expresses phenotypes the Consider
- -> these holviduals interact & transmit their part of the tentially
- -> where their phenotypes we tall least partly alexander by genes, there is possibility of Evolution

Where's The Fither?

L7 some characters appear to have maladaptive and to reduce fitness

Is in many cases: Sexual Selection

Generally female choice

5" Runaway sexual selection" up to a point

Lo underlying the character are good genes Lydirect / indirect correlates

Lo Peacock -> ether survival ('handicap')

-> colours show no parasites

- · Uligin I newly marted queen
  Laidentical genotype to her workers staters
  La Mates, find patential nests of loses unligs
- mates, finds patential nests, loves wings,
   gues underground & never see light again
   Ly make dies, female can live for decades
- · Queen raise 1st generation, then forage
- · Lanae fed by their sisters who can be more closely related to them than to their own offsping

# Preview from Notesale.co.uk Preview from 17 of 86 Page 17

Mistoperalution: evaluationary events within a species/population Lygues rise to macroevolution

Makeneutration: 'evolution on a grand scale! - major evaluationary events above the large of the species eg: evolution of major animal graps [mammals, birds, reptiles]

#### **Poffnition**

U Microevolution -> changes in the gene pool of an eigenism over time (D) Gene pool is all alleles of genes of all individuals in a population

L) represents all of the genetic variation - raw moterial of evolution within a population

Evalution by natural selection requires...

· Olifferential reproductive success

· garetiz differences between individuals (garetic variation)

Evolution changes the genetic structure of a population/speiles

On the argum of Ferelly [Charles Cambred]

Dornin's Darke Ferelly [Charles Cambred]

Early 20th Century: Macanmutationist us. Paramians

7 JBS Handane, Sewall whight & burns and

pulotion Genetics

Population Benetics: The Study of microevolution a "New Synthesis" or "New Darwinism"

La a synthesis of Darwin's theory of evolution by natural selection in Mendel's theory of inheritance.

DiBacteria — antibiotic resistance (MRSA) poeunt development of resistance Latton humans lare evolving?

(2) VMuses - resistance to antimizal charge (HIV)

(3) Engerging new pathogen eg: avian influenza

Lis How humans were quality have awared in response to partnogens - resistance to humans the growing Move courses in establishments blood borne

L- thatassenia -> lack of L-globn | Some individuals | parasites |

B- thatassenia -> lack of B-globin | mutations due to heterozygiste advantage

Mitoris: Nuclear division associated in somatic (ells, produing 2 genetically identical)

doughter ceru

Appenduy in plants:

(ellular legametophyte)

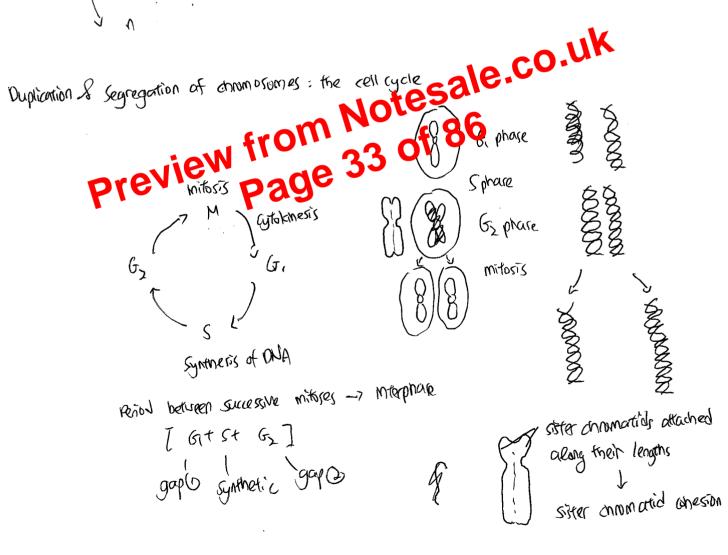
La some gametes undergo mitoric ceru

Diploid Matrice 2 2n Cells

division

Meioris: nuclear division that produces cells that develop into gametes

2n In 4 hoppid doughter coils



# Mendelian Genetics

F belived a loga barum's time

How are traits transmitted? Blanding us. particulate inheritance

Mendel's Expannental Approach (1865)

Ly true | Pure breeding

write Runde Flower Colour

Teminal Flower Position Axial

Yellow Seed wow

whikled Round Seed shape

constrict ed influted Rod Brape

Yellow Green Pod whoir

Dwarf Tall From length

Sunmay of Mendel's Experiment

Ly the morphyonid cross Etrains controlled by

YY (yellou seeds) x yy (green seeds)

3:1 phanotypic ratio in F2 generation

Mandels 1st jaw: Rimagle of segregation

to Alleles of a single gene segregate randomly &

equally into gametes.

RRyy (Tound, green seeds) × MYY (withkeled relighted \$310.00.UK)
9:3:3:1 phenotypic ratio in a management of the seeds of Obylonial cross: traits out Latituers gare love of 2 different consomosomes

9:3:3:1 phenotypic ratio in motily generation of 86
2016:10:10 phenotypic ratio in motily generation of 86

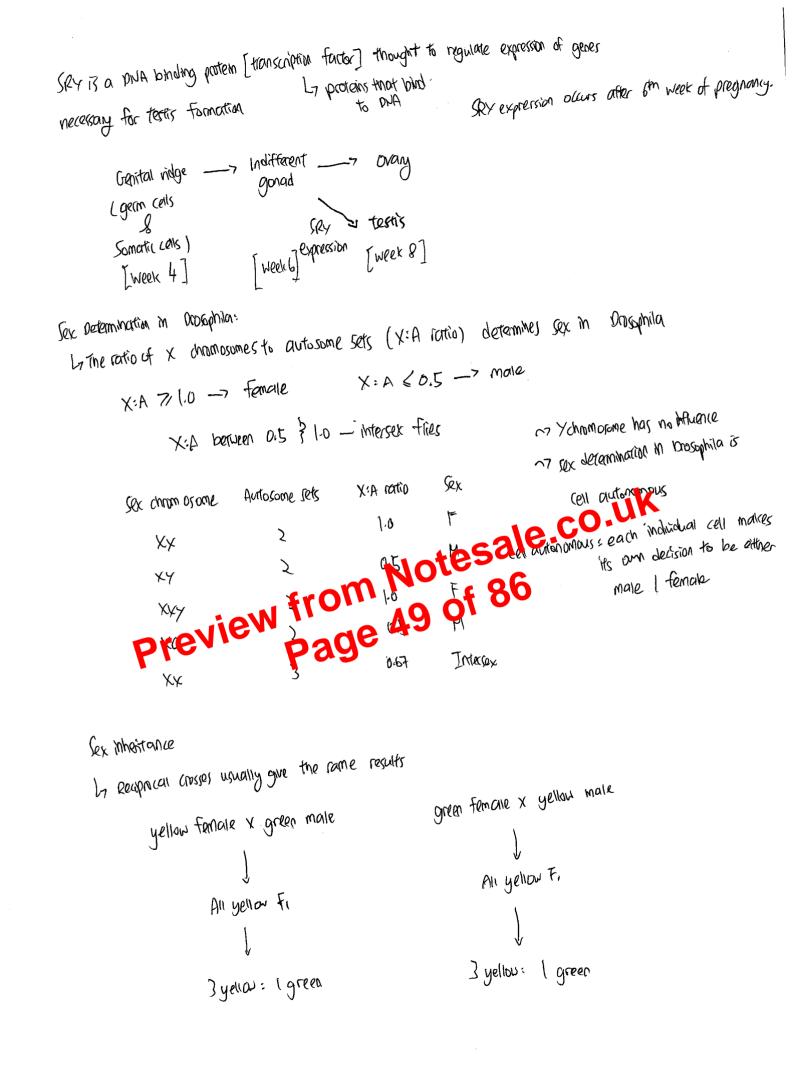
Green

Le Alieles from different gene regregate randomly into gometer

The chromosome theory of inheritance: In 1907-1904, Walter Sutton & Theodor Bover recognised parallels between render's laws & benaviour of chromosomes during meiosis & fatilisation

Sutton - Boron Theory Boven

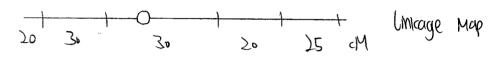
Genomic Imprinting is an Example of epigenetics: 70% of CPG almudestides are NM2 Mz and methytransferal metry lated in verteborates 5-metry (ytasine Cytoshe CTCF protein bind to a sequence of ICR, preventing enhancers on switching on the (NOW o Same, Epigenetics: Study of heritable mutant 19Fz alleles in maternal maternal ONNOWNE CTCF AF0 esale.co.uk Page 47 of 86 Chromosome 00 419 ICR Enhances [ Imprinting Control Region]



physical Maps: show distances between gener / DNA markers based on the direct measurement of DNA (base pars, b)

Cytogenic maps: indicate gene positions with respect to cytogenic markers eg. banding pattern

Unkage maps: show relative position of genes or maker markers on a chromosome based on meiotic recombination frequencies (certiflogon, CM)



Cytogeniz map scannog

I certi Mocgon ( cH) is

25 50 75 160 DEFROM Notes ale.

The 15th ware made using restriction enzymes that an DNA at specific situs— restriction enzyme

The Human Grenome project her provided the ultimate physical map of

the human chromosomes—their DNA sequence

From Image to disease gene: "positional doning"

Once linkage with (1) DNA marker has been found:

Ly repeat linkage analysis in absely spaced ANA markets to obtain linkage to within ICM (~(Mb)

Identify candidate gener by inspection of the human generie sequence by looking for mutations in affected individuals, while mutation is absent in unaffected

Extranuclear genomes of mitograndia & chiooplassis

Many pholagotic features:

- · crawor okoua genomes
- · niborames of mt & Ex diff. From mose in cytoplasm & are sensitive to

Endogmoiant meany: Ancertran host cen took up a prokonyote which become inflochandra La to become plant cell', chlooplast is took up.

Gener Fondin organist Genemer:

· components required for translation en Personal, neva & Struction yes to Content involved in minuted in minu · Shurtia per la Protent involved in axi a per phydianism

ey: Woortone Oxidate, LADH denydmyenose, Athase

- · gener encoding trus & rruss involved in anionoplass familiation
- · Structural gener for proteins involved in photosynthesis eg: large subunit of inbulore bisphosphote

[rubiscs = most alandant Eusque ]

HeritainTity

La con be weful to know the proportion of the total phenotypic variance due to genes.

Here Heritability (H²)
$$H^2 = \frac{Vo}{Vp} \quad b < H^2 < 1$$
Unoad sonse heritability

A more useful measure of heritability is

narrow-sense heritability (h²)

 $h^2 = \frac{V_A}{V_o}$  predicts the response to selection

Why is knowledge of heritability, useful? of attain

\* 1 heintalatives 1 effect of relection only norman-sense heritability shows effect to selection \*

· Animal & Plant breeding:

If a trait has a high his then phenotype of an individual more accurately reflects its genotype.

Artificial solution for a trait of economic importance will be forth for Strawing high  $h^2$ .

Medical Genetics:

If a trait has high  $h^2$  that it may be easier to identify gener associated in the trait

Estimation of heitability:  $h^2 - n.r$   $h^2 - n.r$ 

. Medical Genetics:

 $h^2 - 0.5 - 50/$  " 50/.  $h^2 - 0 - 0$  " 100/.

regression line: y=atbol

b: h2 = gradient

Hentablishy in Humans:

U-fertilization

Timh Studies:

. Identical (Monoxygotic, MZ) twos share their

environment & all of their genes latteres

[relatedness = 1]

7 (2) fortilisation

Monidentical turns (dizygotic 102)

· share their environment but only half of their genes [ = 05]

tor a trait, if 10% twins resemble each other more than do 07 twins, then generic factors contribute to variation In the grait, assuming equal environments.

Emoryanic stem cells as the bant for a donad generic approacher in the mou	1se -
Making targeted knockout of genes using ES (ells	
), Merth Evans	
Led to Mbel Disze in Medicina in 2007 Capeachi	
Final breek-twough -> reprogramming afferentiated cells back to a pluripol	rent ambyonic State without
having to use nuclear transplantation	KH-4) Overexpression of those factor.in
having to use nuclear transplantation  normally Approblasts  Pla Pluriptiony genes  Place anto feeder  M strittable vector  Anmal or -> 1° cell -> most acis receive -> culture	oct 4 } ips. [yamanalia factors] Myc
Anmal or > 1° cell -> most acts receive -> culture human mollidual culture the gene mes	Jung
Abtoul of Induced plumpstent  Stem cells CiPS) by Shinga Yammaka Conny out to bona-fide iPS  phonotype	Subscriture individuo Colonies ests far
-have adapted the protocoly succeeded in making Notesale human its cells	iviale use
stem (ells CiPs) by Shinya Yamanaka Cany out to bong-fide iPs  -house adapted the protocol & Succeeded in making phonotype  human iPs cells  thuse implications  (an induce Polyhytemit stem cells from parients from all replacement that a large and induce pluripatent stem cells from parients from all replacement that a large an induce pluripatent stem cells from parients from all replacement that	diseases in vita
21 can include phinipaters stem cells from patients from cell replacement the eg: regenerative mediane, no immunological rejection	apies