POLA PEWARISAN SIFAT
(HUKUM MENDEL)

Animal Genetics

- **Is the study of the principles of inheritance in animals.**
- Animal breeding is the application of the principles of animal genetics with the goal of improvement of animals.
- **Study and application of Animal Genetics involves several disciplines: Mendelian, Cytogenetics, Population, Quantitative & Molecular Genetics**

Mendelian Genetics

Gregor Mendel is recognized as the father of genetics.

Mendel, who was not scientifically trained, developed his theories in the 1850's and 1860's, without any knowledge of cell biology or the science of inheritance.

Photo courtesy of Wikipedia.

In later years, genes, chromosomes, and DNA were discovered and people began to understand how and why Mendel's theories worked.

Gregor Mendel:
1822-1884

- Mempelajari k. ercis
- Perbedaan sifat
- Percobaan persilangan
- **1865: paper ilmiah**
- (1900) diakui sebagai bapak Ilmu GENETIKA

basic genetic principles
used pea plants
not well understood
during his life

Mendel, G. 1866. Experiments on Plant Hybridization. Transactions of the Brünn Natural History Society.

Robert Bakewell:
1725 - 1795

- Coba-coba persilangan ternak
- Memelihara ternak tujuan produk tertentu
- Menyewakan pejantan: progeny test
- Kawinkan ternak2 terbaik: inbreeding
- Bapak Ilmu PEMULIAAN TERNAK

English Breeder of:
Shire horses
Leicester sheep
Longhorn cattle

Used
inbreeding
progeny testing

MENDELISME

Mendel proposed three principles to describe the transfer of genetic material from one generation to the next.

- **The Principle of Dominance** : in a heterozygous organism, one allele may conceal the presence of another allele.
- **The Principle of Segregation**: in a heterozygote, two different alleles segregate from each other during the formation
- **The Principle of Independent Assortment** : the alleles of different genes segregate, or assort, independently of each other.

Later studies have shown that there are some important exceptions to Mendel's Principle of Independent Assortment, but otherwise, these principles are recognized as the basis of inheritance.

Mendel's experiments dealt with the relationship between an organism's genotype and its phenotype.

Genotype – the genetic composition of an organism.

Phenotype – the observable or measurable characteristics (called traits) of that organism.

The relationship between phenotype and genotype is expressed as the following equation:

P = G + E

P = phenotype,

G = genotype, and

E = environment.

POLA PEWARISAN SIFAT (HUKUM MENDEL)

DASAR : POLA PEWARISAN SIFAT

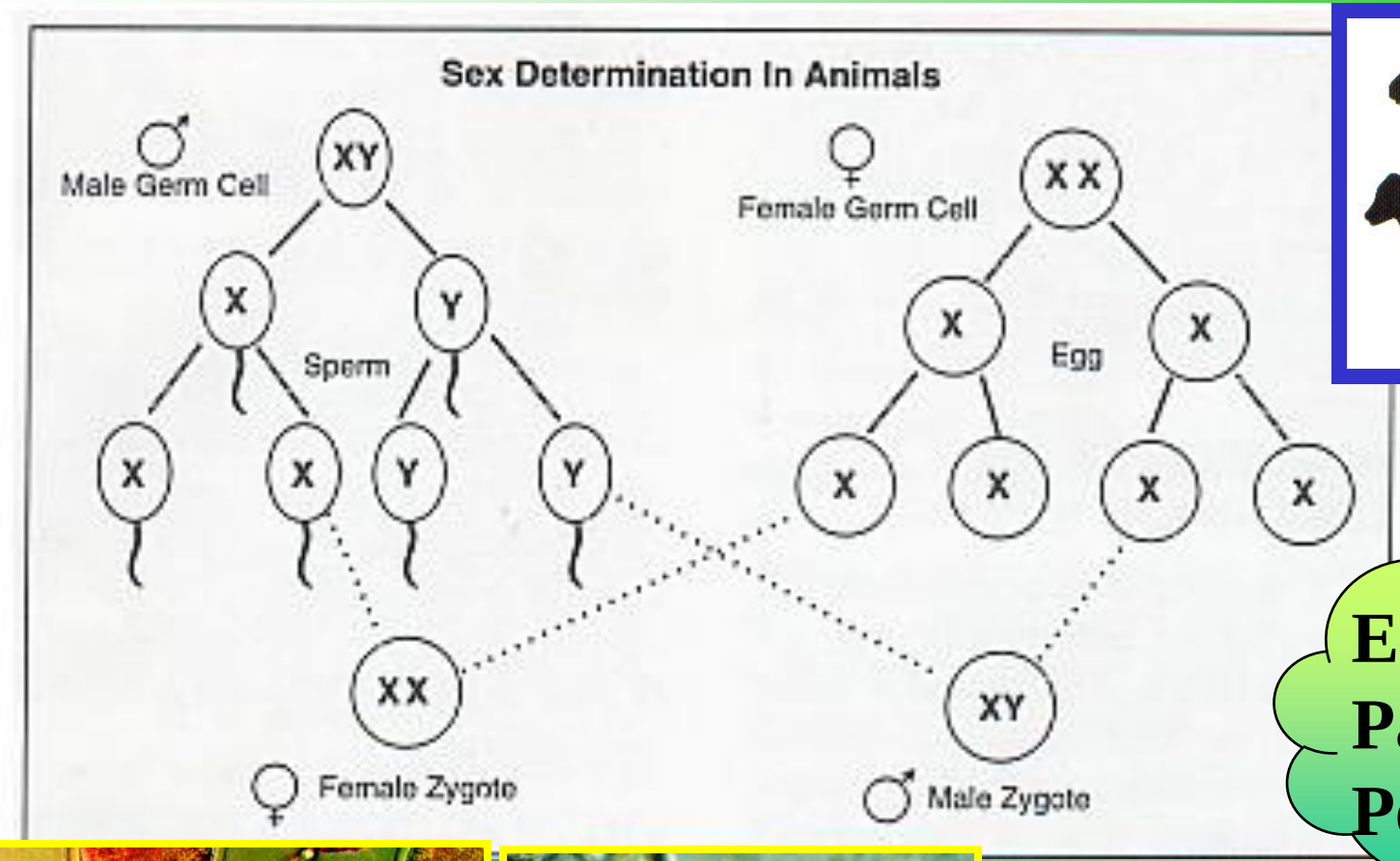
Pada MH tingkat Tinggi (Pembiakan Generatif/Reprod Sexual)

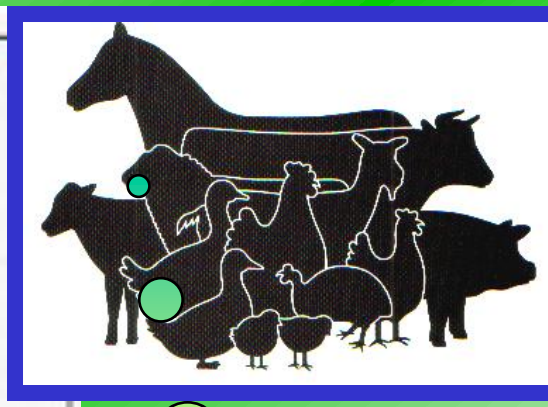
Parent: ♂ Spermatozoa X ♀ sel telur

Filial 1 (keturunan 1)

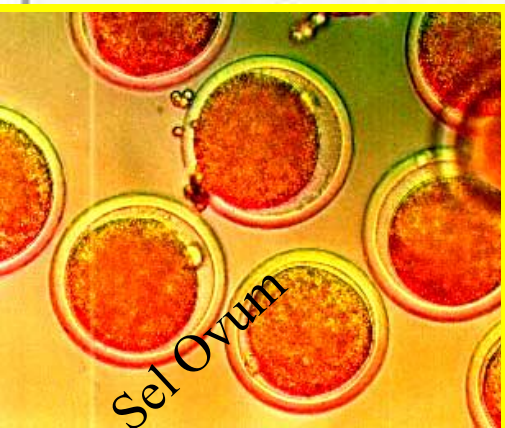
Menjadi penting: karena memungkinkan pengaturan perkawinan atau persilangan
Menghasilkan HIBRIDA

Contoh :Sex Determination



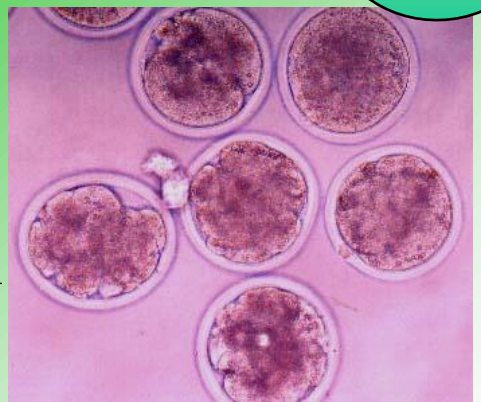


Ekspresi :Proses Panjang Pewarisan Sifat



Ferlilisasi dan Fusi Sel

(Ovum + Spz.)



Teori teori Hk. Pewarisan Sifat

Ovisma: pemilik sifat keturunan adalah ovum (♀),
fungsi jantan menghasilkan cairan untuk perkembangan ovum

Animalkulisma: pada cairan jantan ditemukan hewan2 kecil (Spz),
sbg pembawa sifat keturunan

Preformasi: Loewenhook: (mikroskop)
ada MH kecil dalam spermatozoa atau ada manusia kecil dlm ovum

Epigenesis: Ovum terfertilisasi oleh Spz, kmd. tumbuh sedikir demi sedikit

Pangenesis (Darwin): dalam sel kelamin ♀ ♂ terdapat tunas 2 tumbuh menjadi MH baru setelah fertilisasi

Plasma benih (Weisman): Gamet ♀ ♂ dibentuk oleh jar.khusus,
bukan jar. tubuh

Penelitian dan Peneliti Genetika

Mendel:

- **Penelitian pada kacang ercis**
- **(hidup tak lama, mudah tumbuh, mudah disilangkan,**
- **unya alat repro jantan/betina, penyerbukan sendiri,**
- **sifat perbedaan menyolok**
- **HASIL:**
- **Menyisakan pertanyaan:**
- **Bentuk/bahan sifat keturunan**

Faktor keturunan ?

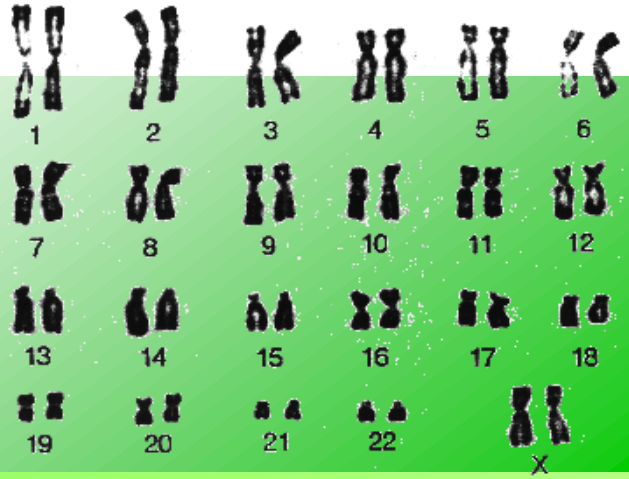
W. ROUX (1883): Kromosom

T. Bovery (1902): Gen bagian dari kromosom

Faktor Penentu (Gen/Kromosom) di wariskan lewat GAMET (pada Anafase Meiosis I saat Separasi Kromosom homolog)

Muncul: HIPOTESA SUUTTON-T. BOVERY

HIPOTESA WS SUTTON-T . BOVERY:



Animal Chromosomes

1. **Gen dibawa oleh kromosom**
2. **Satu pasang kromosom asal maternal+paternal**
3. **Pemindahan 1 ps kromosom saat meiosis**
4. **Sel benih mengandung kombinasi gen jantan dan betina**
5. **Kromosom homolog secara genetis berbeda, sehingga sel benih scr genetis berbeda**
6. **Tiap kromosome terdiri lebih dari 1 gen, gen-gen dalam kromosom pindah bersama-sama**

TEORI PEWARISAN SIFAT : DOMONANSI-RESESIF

Sifat Tinggi : Dominan (gen T)

Sifat rendah/kerdil: Resesif (gen t)

Parents (P)	**TT** **Gamet:T**	**X**	**tt** **Gamet: t**
Filial 1 (F1)		**Tt** **HIBRIDA**	

Monohibrid: 1 sifat beda

Di hibrid : 2 sifat beda

Tri hibrid : 3 sifat beda

Fenotip: 3:1

Genotip : 1 : 2: 1

tt: homosigot

TT: homosigot

Tt: heterosigot

F2 ?

♂/ ♀	T	t
T	TT	Tt
t	Tt	tt

HK.MENDEL I: Pemisahan Gen se alel

Dominansi penuh dan semi dominant

Dominansi Penuh

Parents (P)	**TT** **Gamet:T**	**X**	**tt** **Gamet: t**
Filial 1 (F1)		**Tt** **HIBRIDA**	

Bedanya ???

Kodominant: Pada warna kulit sapi

RR x rr

Merah putih

Rr

Roan

MONOHIBRID HEWAN

Warna rambut hitam (gen dominan A, pigmentasi melanin)

AA Hitam	X	**aa albino**
F1	**Aa Hitam**	

Pada F2:
Fenotip : 3: 1
Genotip : 1 : 2 : 1

Macam sistim Persilangan

1.Resiprok: Kebalikan ♀/♂

♂♂ HH x ♀ hh

↓

Hh

Hasil sama

2. Back cross:

F1 dng parent ♂/♀

Hasil:
Fenotip/genotip ttt.

3. Test Cross:

F1 dng P resesif

Pembuktian F1 homosigot /heterosigot

Dihidrid pada hewan

Pada marmot:

- Rambut Hitam (gen H) vs putih (gen h)
- Rambut Kasar (gen K) vs rambut halus (gen h)

HH KK x hh kk

Gamet HK Gamet : hk

F1: Hh Kk x Hh Kk

F2

Gamet	HK	Hk	hK	kk
HK	*	*	*	*
Hk	*	+	*	+
hK	*	*	=	=
kk	*	+	=	O

Rasio fenotip : 9 : 3 : 3 : 1

Perhitungan Matematis (Rumus estimasi)

Juml. Sifat beda	Macam gamet F1	Kombi nasi F2	Fenotip F2	Kombi nasi F1	Kombi nasi homosi got	Genotip F2	
n	2^n	$(2^n)^2$	2^n	2^n	2^n	3^n	
1	2	4	2	2	2	3	
2	4	16	4	4	4	9	
3	8	64	8	8	8	27	

Macam Gamet:

Monohibrid (Aa) : $2^n = 2^1 = 2$ = (A/a)

Dihibrid (AaBb) = $2^2 = 4$ = (AB, Ab, aB, ab)

Tri hibrid (AaBbCc) $2^3 = 8$ = (ABC, ….., abc)

Kombinasi:

Mono hibrid : (AaxAa)=$(2^1)^2$ =4 = (AA,Aa,Aa,aa)

Dihibrid (AaBbxAaBb) = $(2^2)^2 = 16$

Trihibrid $(2^3)^2 = 64$

Dominansi penuh dan semi dominant

Dominansi Penuh

Parents (P)	TT Gamet:T (Tinggi)	X	tt Gamet: t (rendah)
Filial 1 (F1)		Tt (Tinggi)	

Bedanya ???

Semi Dominant:

Bunga pk 4.

Merah X Putih

Merah Muda

Kodominan

RR x rr

Merah putih

Rr

Roan/coklat

Perkawinan Intermedier

(Dominansi tak sempurna)

Pd *Mirabilis jalapa*

P mm X MM

putih *merah*

Mm X Mm

Merah muda (pink)

MM 1

Mm

Mm 2

mm 1

Perkawinan Kodominan

(dominansi parsial)

Pada sapi Shorthorn

P : RR X rr

Merah putih

Rr X Rr

Coklat

RR 1

Rr

Rr 2

rr 1

Implementasinya pada ternak:

Jika jumlah gamet (gen)
sama dengan jumlah kromosom
Maka Kombinasinya*

Sapi $2^{n} = 2^{30}$ kombinasi gamet = 1.07×10^{9}

Kuda $2^{n} = 2^{32}$ kombinasi gamet = 4.29×10^{9}

Manusia $2^{n} = 2^{23}$ kombinasi gamet = 8.3×10^{6}

APLIKASI GENETIKA KARAKTER PRODUKSI TERNAK (teori sederhana)

Mis sifat PBB (kg) dikontrol 4 pasang Gen ABCD

Kalau ada persilangan sapi lokal x import

Asusmsi: AABBCCDD X aa bb cc dd atau AA BB CC Dd X aabbccDD

((0.8) (0.0) 0.7 0.2
?????

(0.4)

AaBbCcDD =0.5

AaBbCcDd = 0.4

Apa mungkin lahir anak yang PBB lebih