

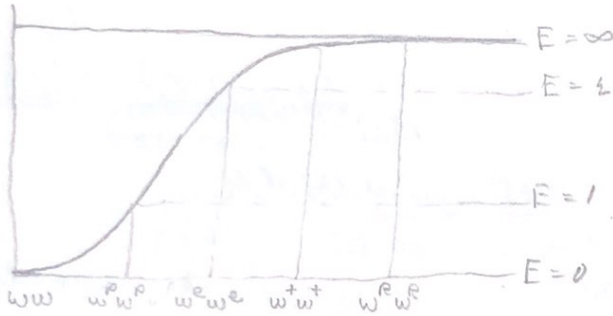
Physiol. Dominance

vs presence-absence

1. Multiple alleles
2. Reverse mutation $w^+ \rightleftharpoons w$
3. bl piled up in Y chromosome

Inactivation - inactive phase tend thus to be recessive & actual Dominant.

1. bl & multiple alleles support idea



w = amorphous uses no substrate
 w^e = hypo- " little "
 w^+ = type " normal amt "
 w^p = hyper+ " more "
 w^p with w^e = anti-morph uses up substrate for other products makes color lighter than w . does
neo-morph = brachmia

2 series alleles - one on substrate

when enzyme = ∞ get multiplicat. effect
 " " = $\frac{1}{2}$ " ceiling "

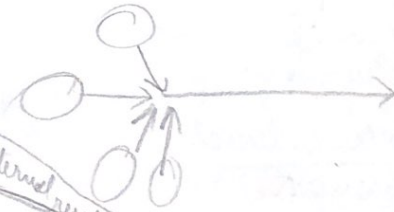
Heredity & Environment

Genes & Morphology

Ultimately genes & external cause internal reactions
 minimum for esser.

How genes act once gradients set up

Array of enzymes
Determines constraints
Complicated



cause qualit. gradients, cytoplasmic line

Cytoplasmic Heredity

Criteria

Ontogeny

Heredity

not cyto cases

same cases

taxonomic diffe
species
indiv.

Cases that so.

Physical Heredity

nt. pres.-absence

1^o inactivation

how accounts

diagrams & graphs

1 morphs

Relatin Gene & Char

Diag. 1

Direct conn.

Secondary

morphologic

General

Local

loc-fun-chordato

loc-loc

Factor interact.

Purifying

Complex patterns - simple

How genes act.

Heredity & Envir

diagram

all resolve to gene & ^{env}envir.

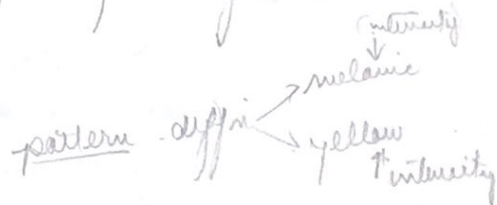
How genes act once
gradient set up

Relation Genes to Enzymes

no diffusion = cellular char. easily seen.

Chromagen + O₂ enzyme pigment
 extracts from black & white Rabbits produce pig. on mt.
 enzyme diffuses from skins of diff. colored rabbits.
 sub work, meal worm.
 take enzyme to chromagen or chromagen to enzyme
 alcaptonuria, hyperphemia, waxy/starchy corn

Factor Interaction



Coat color g. sp.

1) Genes for distribution

SS → imperfect migration
 also transforms black → yellow.

2) " " intensity acts on both xanthin & melanin series

C, c^A, c^d, c^r, c^a

c^cc^c = complete albinism

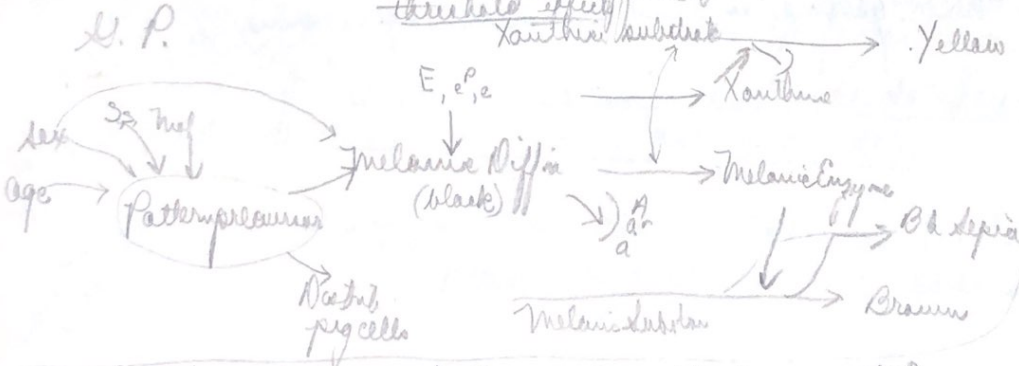
3) " " quality of color
 S, E, A, F, B, P, F

Final patterns from complicated interaction of ①②③ types of genes. (Best illustrated diagram)

competition effects - for xipia & yellow

co-pigmentation effects - flower

O₂ - reduction effects -
threshold effects Xanthin substrate → Yellow



Drosophila

ophthalidia
 yellow red at distal
 brown & proximal
 end of ommatidia
 white affects whole
 pigment process
 same act on distal
 others " " proximal
 autonomy of eye
 color except 4 & cu

Its interaction of factors - eye produces, utilizes, in lymph.

Sharp pea - sap pigments - chem. known.
 anthocyanin
 anthoxanthins

threshold, compet., co-pig., & O₂-red. effects. = best case of relation gene & cell char.
 I vary 2-4 3 effects

Nature Gene Action Intra-cellular Char. IV

Growth = increase protein content

Genes as models, same as reduplication (does not occur emulated cells)

Difies

1. Cells grow exponential small genes - linear
2. Products have to pass thru membrane.
They do Haemmeking's alga *Antithalassia* & graft
3. Intrinsic cytoplasmic heredity is proteins duplicate outside

Explan. haemolysins. Genes produce haptens w/ combine.
protein $\begin{matrix} \text{H} \\ | \\ \text{---} \\ | \\ \text{R} \end{matrix}$ = haptens which determines specificity
for precipitating proteins & hapt
free haptens won't do it

Growth, size = mendelian

Differentiation: Irreversible prot. ③

3 theories: germ line constant

1. Weismann
somatic

2. Controlled mutation, min. in wings

3. Cytoplasmic heredity. (germ line isolated to protect neutral cytoplasm)

mutations somatic

Pericarp color corn = random.

Delphinium rose α = constant

" low α = slight control

{ Control of mutability by another gene Δt . $\alpha \rightarrow A_1$
(Min. gamma in wings (controlled) not in germline) Δt ends of corn

Answers to old ?s

①

Criteria cyt. no. Mendel.

Mend. = ratios & linkage tests — ^{rapid fixation} ^{rapid variation} apparent blending mult. factors + recip. feedback

Cytoplasmic = no chromosomal relat, no ratios, or linkage tests
 recip. crosses + repeated backcrosses to ♂ gives diff results
 tests no disease etc. cell division only.

Cytoplasmic no. Mendel. at diff't levels

a. early stages → no diff in nucleus of cells except in somatic
 i.e. = cytoplasmic.

not for animal as whole, however, — the apparent cytoplasm effect doesn't ff main / generation, breeds out immediately — schist frog larvae — char.s depend on immediate ♀ parent, not previous.

effect of parent egg shape, size, color — genes work before germination & fertil.

b. racial, specific & generic diffes. Very difficult to find cytop. inheritance effect in phylogeny — incredibly mendelian as far as details of pattern. The farther apart relations as in species & genera, are usually sterile so can't test to F₂. The cytoplasmic effect in animals = general effect of compatibility.

In racial crosses the range of cytoplasmic is illustrated by one case Lymnaea

In plants have cytoplasmic.

- 1) Plastid effects + barcorn many Mendel, however
- 2) Pollen sterility corn inherited 3 out of 13 = ratio
- 3) Bark, plastids perpetuated — wanted adjust to H. cytoplasm.
- 4) Beans m + M in cyto factor carried over.

Degree of taxonomic diff. holds thru-out in correlation

w. degree of cytoplasmic heredity.

c. Indiv. diffes — no cytoplasmic effects. ↑ 13-3

great majority of recip. crosses in Drosophila

d. C. hirs. C. levis Big marked doms

e. Diff't g all linkages, w in organism 32 of 33 genes = cell lethal all working all time Drosophila plus genes & others end, all genes carried thru so all there OK. Bar. no " controlled mut.

② lethal due diff. cross + diff.
 ③ Gametes normal body color & genes are early action & genes
 ④ sex ratio ♀'s dis genes in it + same in early.
 AA with ag in one eye or no
 ♀'s dis genes in it + same in early.
 many cases of good species recip. crosses give no
 most recip. crosses no effect

Possible Relations Gene & Observed Char.

- cell char. of direct
- 1) Animal. Pis direct dupl. of gene - traced to single gene factors in doves.
 - 2) Prod. enzymes also direct char. rabbits & g.p.o + silk worm joints + beetles (metabolism expert)
 - 3) Somatic mutations - Cell division Dt can increase mutation androgen ^{red spots}
 - 4) Hormones v^+ cu^+ substances hormones produced in cells effect eye color rose x lavender ♀.
- indirect
- 5) Inter-cell char.
 - 1) General - size Rabbits & sulphurane size (phenocopies)
 - 2) Rasal - neural crest ss.
 - 3) Gen-local - dwarf mice
 - 4) Rasal-Gen - creeper, polydact, short-tail.

color no. albinism rabbit.
 chrom + enzyme = cell product.
 dom. wh. spot - color rabbit

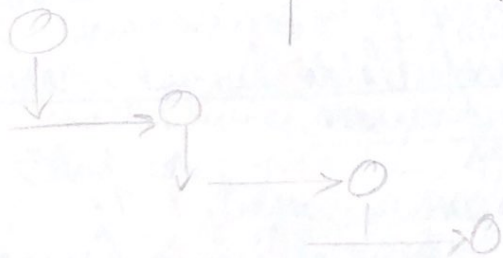
snail
 oocyte gene
 blood cells

cytopl. char of red cells det'd by nuclei ones had.
 antigens in r.b.c. direct reflectin

+ no wh & v in Drosophila

$r = \square$ wh = absence eye & other places.
 $v = v^+$ substance produced (not autanous)

Pattern not in gene



Pattern depends on complicated system of Pis.

IV. Nature of the Gene = a breeding unit

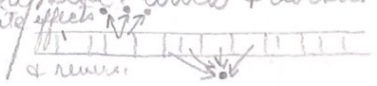
A. From breed's eyes

1. Effects depend on conditions ^(genetic & environmental) but are constants for given conditions.
2. Persistence & Duplication irrespective of conditions - effects differ but gene itself doesn't Δ . In acquired organs
3. Subject occasional abrupt Δ 's wh. thereafter duplicated as of the new sept.
4. Rate of mutation varies directly w. conjugation
5. Not resolvable into smaller entities w. these props
6. Arranged in linear unbranched systems of which there are def. no.

B. Physical-chemical

1. Direct // to above in cell itself down to visible bands in chromosomes.
2. Size of small viruses - large protein
3. Molecular not colloidal
4. High % nucleic acid.
5. Continuity = simple protein, not nucleic acid.
6. 5000 - 10,000 in *Drosophila*
7. Chromosome not polarized.

(a) Correspondence physical & physiol. cross-over units

In general, cross-over units act as physiol. units & doesn't matter what their position, ^{completing effects} but same position effects noticed: 

1. Heterozygous repeat > homozygous normal $\frac{BB}{+} > \frac{B}{B}$
2. Rethal effects transfer.
3. New effects - pale, baroid, roughest
4. Weakening of dominance (if normal alleles over recessives)
5. Unstable dominant mutations Plum
6. Unstable effect when heterozygous

over

C. Physiological properties

1. Autotrophic - (Haptens)
 2. Behaves like indep. organism
 3. Controlled by cell division
 4. Double-ness (in many cases)
- Synchronous No. of genes to cell conditions

- a. Duplic. & separation
- b. Picking up chrom. = synthesis
- c. Synapsis

diff. meiosis & mitosis
in type of separation

Asynchronous

- a. Centromeres duplic. & separ.
- b. Chromatids of parts, chromos. } sciera
- c. Differential insight non duplicitous }

genes in turn may
influence cell division

Indication from crossing-over

Factors influencing

1. Interference cross-over, inversion, trans.
2. Sex
3. Age
4. Temperat. (most interesting) rise or fall increases
5. X-rays

frequency	male	♀ gamia	♀ gamia	oocytes
	rare	rare		customarily
	X-ray	X-ray	X-ray	X-ray
	H. temp. (quadrants)	H temp		H. temp. age.

Theories of Crossing-Over:

1. Belling:

duplic. in pachytene, connectis formed along shorter route.

2. Darlington:

breakage due spiral strain & chance reconnection

Nature Gene Action - Intra-cellular char.s

1. Immunological Ris specificities

Expts: Def. Mend. ratios in recesses shown = Mendelian, not cytoplasmic

donor

	AA bb	aa BB	F ₁ Aa Bb
AA bb	+	-	-
aa BB	-	+	-
F ₁ Aa Bb	+	+	+
F ₂ 9 A-B	+	+	+
3 A-b	+	-	-
3 a-B	-	+	-
1 a b	-	-	-

12:4 12:4 9:7
= 3:1 = 3:1

+ = take
- = rejection

* Dominant factors in graft cause hostile Ris in host that doesn't have 'em.

2-factor

Ratios of takes of F₂ back into parents & F₁

Strong L.C.

	AA	aa	F ₁ Aa
AA	+	+	+
aa	-	+	-
F ₁ Aa	+	+	+
F ₂ 3 A-	+	+	+
1 aa	-	+	-

3:1 100% 3:1 = takes of F₂ into parent

1-factor

* In case of alleles neither is recessive & host has to have all that graft has.

	AA	A'A'	F ₁ AA'
AA	+	-	-
A'A'	-	+	-
F ₁ AA'	+	+	+
F ₂ 3 AA	+	-	-
2 A'A'	+	+	+
1 A'A'	-	+	-

3:1 3:1 2:2

Cris cross ♀ x ♂ → F₂ = 1:1:1:1 = 1 sex-linked character
♂ x ♂ → F₂ = 3:1

Transplanting Red Cells - Human Blood

host serum	donor serum	O	A	B	AB
O		+	-	-	-
A		+	+	-	-
B		+	-	+	-
AB		+	+	+	+

+ = OK
- = aggl.

= Allelic series i, i^a, i^b
M+N = 2 alleles also

antigens of r. cells = direct reflection of gene specificity. *Species Lemna x Riccia*
Crinia & Cole - Tiger, Dove / species cross
got pure Mendel. ratios. Found to have 1 factor. by repeated backcrossing.

Rabbits

	hh	H ₁ H ₁	H ₂ H ₂	H ₁ H ₂
hh	+	-	-	-
H ₁	+	+	-	-
H ₂	+	-	+	-
H ₁ H ₂	+	+	+	+

+ = OK
- = aggl.

Family cross *Ring Dove x Pouter* just a new substance
genes in F₂ not in either parents. gene products combine to form new substance. got a couple genes common.

+ & - zygospores in plants. Tobacco sensitivity to 3 of 'em. } alleles behave independently in stigma
ABCDEF
SS₁(1/2)(1/2)(1/2)(1/2)(1/2)

Prime, Onset, of Gene Action III

May act in oocytes, sp. cytes (?) and, ... Draxop II C, & Rymmea
Garnetes

Animals

1. Bulk of evidence indicates no gene action, deficiencies make no diff. - As a ^{lethal C} stimulate seems as if defic. chromosome causes death of sperm.

Plants (generally) O.S

1. Waxy in corn caused by action in 3-2+ cell stage of gametophyte
2. Moulting causing sterility in beans acts on pollen.
Camelophytocarpum lethal = sieve for lethals.

Zygotes

- 1) Plate & brown eggs of silkworm
- 2) Yellow mouse - morula stage
- 3) G.p. & creeper female
- 4) Draxophila

hatched & die in egg	} homo-deficiencies die in egg
Hanz. pleokate P ₂ dies in egg	
YY " " "	
no TV " " "	
XXX " " larva	} excess not as serious as deficiency
excess IV IV IV IV " " "	

Defies in single cell:

Homo-Deficiencies in somatic cross-overs kill

3/2" out of 33 = cell-lethal

so all genes acting all time to same extent

Genes play more in superficial role.

Oocyte gene action given to show need of F_2 in reciprocal crosses

- 1) Helix warm - nutrition
yolk color } maybe
egg shape
egg shell color
- 2) Lammaria green & white body color larvae & gene
- 3) fruit in Brachyph. gene in II w. Curly such that if fertil by \overline{XX} = lethal
- 4) Snail Lymnaea
pat. gene acting in oocyte wh. determines cleavage left or rht.

Indus variat. & cyto vs. gene

Corn 73 ~~of~~ chars = mend.
3 chars = cytopl. due chlorophyll.

Craig over = best end of gs = discrete units

that breaks tend to occur at same places
scattered all ways along chromosome

excepts = mult. alleles that can't be arranged as linear series
that phys = physical.

Neomorph = hairy dominance
Brachyria in mice

Time action

Aristopodia - antenna into foot

antenna begin to diff. segment at same time as legs

Hymenotria patterns

Cytoplasmic plant cases = chlorophyll, pollen self sterility

Maternal effect

AA testis trap acts thru blood stream on oocyte

Interspecies crosses between mice & corn showed
variability due entirely to genes & tobacco Hemotria cyt
recovered pure Sylvestris from tobacco cyt.

Case $YY, Yy, Yy, YYY =$ direct quantitative relation gene & phenotype
Y affects mt. A content each dose adds units of mt. 4.

Correlate gene w. delicate specific chemis. diffcs w/in cell

Daphnia rap pigments (best case of cell char's we have)

co-pigmentation effect - antho's ^{blue red} cyanins + ^{waxy yellow} xanthins
threshold effect - added doses I add 3 months

competition effect - I & Y

Or-reduction effects - Y, I, A, B.

Quant. + Qual. diffcs

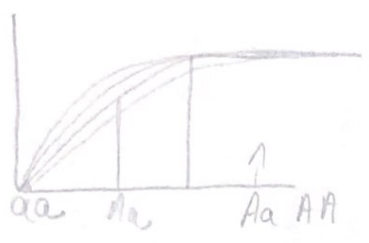
Series of alleles for pericarp color that mutate easily
in range

Neutral cytoplasm is modified by kaptens, then the
cytoplasmic proteins duplicate themselves.

Neutral cytoplasm in germ line has to be protected (isolated)

11. Physiol. & diag. & graphs

Dominance due inactivation of gene bobbed



Enzyme enters in

Factor interaction

Patterns

- 1) SS
- 2) age
- 3) sex

Melanic process sepia
Xanthic process brannon

Intensity

- substractors
- modifiers
- blockers
- competition effect

Combin. Mult white series