DICTIONARY OF GENETICS

KNIGHT

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OF

GENETICS

Including Terms used in Cytology, Animal Breeding and Evolution

compiled by

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PREFACE

Because genetics is a young science, its workers still often have to coin their own technical terms. This dictionary is an attempt to define and standardise these terms. The first edition will doubtless contain errors and I would be grateful to readers for suggestions as to additions or corrections.

The dictionary is not limited solely to modern terms because students still read, and need to understand, the older books. Also, it is hoped that the inclusion of both older and modern terms will help the coiners of new words to avoid putting an entirely new meaning on an old established word. Moreover, the provision of a full glossary of genetic and allied terms may have the altogether desirable effect of preventing authors from continuing the present trend towards complication of vocabulary. Genetic literature would be more readily understood if writers had, where possible, used an existing term instead of coining a new one. This would have avoided the use for one and the same thing of centromere, kinetochore, kinomere, kinetic constriction, primary constriction, centric constriction, spindle attachment, insertion region, attachment region and attachment constriction. There is much to be said in favor of simplification, and even if simplification of the present vocabulary of genetics is not immediately possible,

at the least it is to be hoped that writers will not continue to coin new words where suitable recognised terms already exist.

In compiling the dictionary, use has been made of the books and scientific papers listed in the bibliography.

I wish to make grateful acknowledgement to Dr. C. D. DARLINGTON, F.R.S., and to Messrs. J. & A. Churchill Ltd., for permission to reprint a number of definitions from their book "Recent Advances in Cytology"; I am also indebted to the Macmillan Co. of New York for permission to reprint a number of definitions from "The Cell in Development and Heredity" by E. B. WILSON. In addition, a few definitions have been taken direct from "An Ecological Glossary" by J. R. CARPENTER (published by Messrs. Kegan Paul, Trench, Trubner & Co. Ltd.), "A Dictionary of Scientific Terms" by J. F. & W. D. HENDERSON (published by Messrs. Oliver & Boyd Ltd.), "The Chromosomes" by M. J. D. WHITE (published by Messrs. Methuen & Co. Ltd.), "Animal Breeding" by L. M. WINTERS (published by Messrs. John Wiley & Sons, Inc.) and from Volume 28 part 2 of the "Journal of Heredity", and I am grateful to the authors and publishers concerned for permission to do this.

I am indebted to Prof. R. A. FISHER, also to Messrs. Oliver & Boyd Ltd. of Edinburgh, for permission to reprint in abridged form (in Appen-

dix 4), Table No. IV from their book "Statistical Tables for Biological, Agricultural and Medical Research." I am also grateful to Mr. A. J. BATEMAN, and to the Editors of Nature for permission to reproduce in Appendix 9, a table from "Genetical Aspects of Seed Growing" which appeared in Nature Vol. 157, p. 752.

Finally I am deeply indebted to my wife for her constant help in checking the numerous typescripts which marked the gradual evolution of this book.

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CONTENTS

Å. — Ångström, 0.0000001 mm.

AI, AII. — The first and second anaphases, respectively, in meiosis.

Aberration. — An irregularity in chromosome distribution during heterotypic or homotypic cell division (WINTERS).

Abiogenesis. — Spontaneous generation of living organisms from non-living matter.

Abiogeny. — Abiogenesis, *q.v.*

Abortion. — A miscarriage; arrested development of an organ.

Acarpous. — Devoid of fruit.

Acceleration. — The speeding-up of the time of action of a gene so that the character it controls develops earlier in the life cycle than it did in ancestral forms.

Accessory Chromosomes. — Sex chromosomes, *q.v.* *See*, also, under W-, X- and Y-chromosomes.

Accidental Evolution. — Evolution which confers no selective advantage and which owes its origin to mutations of more or less neutral effect.

Acclimation. — Adaptation to climatic change on the part of the individual. The physiological adjustment or increased tolerance shown by an individual organism to a change in the surrounding environment. *See* Acclimatization (CARPENTER).

Acclimatization. — The adjustment or increase in tolerance shown by a species in the course of several generations in a changed environment. *See* Acclimation (CARPENTER).

Acentric. — Lacking a centromere.

Acentric-dicentric Translocation. — Aneucentric translocation, *q.v.*

Acentric Inversion. — An inversion of a segment of a chromosome which does not involve the centromere. *cf.* Paracentric Inversion.

Achievement Quotient. — The "educational age" divided by the "mental age". (The child is assigned to an "educational age" on the basis of tests made on subjects taught in school; for "mental age" *see* under Intelligence Quotient).

Achlamydeous. — Possessing neither calyx nor corolla.

Achromasie. — The expulsion of chromatin from a nucleus.

Achromatic Figure. — The frame-work of 'fibres', or striations, which is formed between the two poles and the equatorial region, or between the two centrioles and the equatorial region, during cell division.

Achromatin. — The non-staining basic substance of the nucleus excluding the chromatin.

Achromatoplasm. — The non-staining protoplasmic reticulate cell-matrix.

Achrosome. — The structure forming the apex of a mature spermatozoon. *cf.* Acroblast.

Acidophil. — Having the property of staining heavily in the presence of acid dyes.

Acquired Character. — A structural or functional modification which is impressed on the organism in the course of individual life, but which is not the result of the action of hereditary factors.

Acroblast. — A body, or group of bodies, in the spermatid, derived from the substance of the idiozome and Golgi-bodies, from which arises the acrosome. Variously called 'Idiosome', 'sphere', 'archoplasm', etc. (KING; WILSON).

Acrosome. — Achrosome, *q.v.*

Activity-range. — The area within which individuals of a single generation may move.

Adaptation. — (i) Any structural or physiological change on the part of the individual, species, etc., which makes it more fitted to survive under given environmental conditions. (ii) The process of changing in this way.

Adaptive Radiation. — (i) The evolution of several closely related but morphologically and ecologically divergent forms (Cain, 1944). (ii) The presence, within a systematic group, of various types modified to suit mutually exclusive ways of living.

Additive Factors. — Cumulative factors; non-allelomorphic factors affecting the same character and enhancing each other's effect. Such factors are said to show **Additive Effect.**

Adermin. — Vitamin B_6.

Adrenosterone. — An androgenic substance first extracted by Reichstein from the suprarenal cortex.

Afterbirth. — The placenta and foetal membranes when expelled from the uterus following parturition; decidua.

Agamete. — An undifferentiated cell used for reproductive purposes, as opposed to a sexually differentiated reproductive cell or gamete.

Agameon. — A species consisting of only apomictic individuals (CAMP & GILLY).

Agamic, Agamous. — Having no pistils, stamens nor true seeds; reproducing asexually by apomixis, *q.v.*

Agamobium. — The asexual generation of an organism having an alternation of generations.

Agamogenesis. — Asexual reproduction by buds.

Agamogony. — Reproduction by means of undifferentiated cells (agametes), as occurs in *Protista* and *Thallophyta,* as opposed to reproduction by means of sexually differentiated cells (gametes).

Agamospecies. — Species which lack true sexual reproduction.

Agamospermy. — Seed production without fertilization.

"Age and Area". — WILLIS's hypothesis that, other things being equal, species which have existed longest will occur throughout a greater area than species of more recent origin. Thus the localized distribution of an endemic species is explained on the basis of its not having had time to spread, rather than on the theory that it arose as an adaptation brought about by peculiar local conditions.

Agnation. — Relationship through the male line.

Agonisis. — Certation; competition, as between pollen grains of different genotype, in the rapidity with which they can grow down the style.

Agro-ecotype. — A group of agrotypes all having similar environmental preferences.

Agrotype. — An agricultural race.

Akaryote. — A cell lacking a nucleus.

Akinete. — A resting cell.

Albinism. — The absence of chlorophyll in a plant, or of pigmentation in an animal.

Albino. — An animal lacking pigmentation or a plant lacking chlorophyll.

Albinotic. — Affected with albinism.

Alecithal. — Of eggs: having little or no yolk.

Aleurone. — The peripheral thick walled cells of the endosperm of a seed particularly in *Gramineae.*

Allaesthetic Characters. — Characters which become effective via the sense organs and brain of other organisms (HUXLEY).

Allantoin. — A substance which stimulates cell growth; it occurs naturally in the allantoic fluid of mammals, in the urine of sucking calves, etc. and in comfrey roots and it can readily be synthesised. *cf.* Traumatin.

Allautogamia. — The state of having a facultative method of pollination in addition to a normal method.

Allele. — An allelomorph, *q.v.*

Allelic. — Allelomorphic (*see* Allelelomorph).

Allelism. — Allelomorphism, *q.v.*

Allelomorph — (i) One of a pair of characters which are alternative to each other in inheritance being governed by genes situated at the same locus in homologous chromosomes. (ii) One of a pair, or series, of genes which are alternative to each other in inheritance because they are situated at the same locus in homologous chromosomes. Adj. **Allelomorphic.**

Allelomorphism. — A relationship between two factors such that they are of necessity separated into sister gametes in germ cell formation (*see* Allelomorph).

Allen's Rule. — In warm-blooded species, the relative size of exposed portions of the body (limbs, tail and ears) decreases with decrease of mean temperature (HUXLEY).

Allesthetic Characters. — Allaesthetic characters, *q.v.*

Allocarpy. — The production of fruit following cross-fertilization.

Allochronic Species. — Species which do not belong to the same time level, as opposed to contemporary, or synchronic, species (*cf.* MAYR, 1942).

Allochthonous. — Acquired, extraneous, exotic. Opp. Autochthonous.

Allogamous. — Reproducing by cross-fertilization.

Allogamy. — Cross-fertilization. Opp. Autogamy.

Allogene. — PEARSON's term for a recessive allele, as opposed to protogene.

Allogenous Flora. — Relic plants of an earlier prevailing flora and environment; epibiotic plants (CAIN, 1944).

Alloheteroploid. — A heteroploid resulting from the combination of specifically distinct genoms, or chromosomes from such genoms. *cf.* Autoheteroploid.

Alloiobiogenesis. — An alternation of a sexual with an asexual form, or, cytologically, the alternation of a haploid with a diploid stage; alternation of generations.

Alloiogenesis. — Alloiobiogenesis, *q.v.*

Allometry. — The relation between the growth-rate of a part of an individual and the growth-rate of the whole or of another part; the relationship between growth-rates of different groups, races, genera, etc.

Allomorphosis. — The relation of parts of organisms at some definite age to wholes or parts also at some definite age but of different groups (races, varieties, species, genera) *e.g.* egg size or hatching weight to adult size or weight (HUXLEY, NEEDHAM, & LERNER).

Allopatric. — Inhabiting distinct separate areas.

Allopatric Hybridization. — Hybridization between incompletely differentiated species, in a border zone, owing to the premature breakdown of a geographic barrier. *cf.* Sympatric Hybridization.

Alloplasm. — Highly differentiated protoplasm.

Alloploidion. — A species derived by allopolyploidy; its individuals, although usually highly variable, are interfertile (CAMP & GILLY).

Allopolyploid. — An organism with more than two sets of chromosomes in its body cells, derived from two or more species (extant or extinct), by hybridization. *cf.* Autopolyploid.

Allosomal Inheritance. — The inheritance of characters governed by genes located in an allosome, *q.v.*

Allosome. — Any a-typical chromosome (especially if its behaviour is a-typical), *e.g.* a sex chromosome. *cf.* Autosome.

Allosynapsis. — Allosyndesis, *q.v.*

Allosyndesis. — Of polyploids: the association, in pairs, of homologous chromosomes derived from different parents. *cf.* Autosyndesis.

Allotetraploid. — An amphidiploid, *q.v.*

Allotriploid. — An organism having three sets of chromosomes in the body cells, one set being distinct from the other two.

Allotropous Flower. — A flower so shaped that its nectar is easy of access to insects.

Allozygote. — PEARSON'S term for an organism homozygous for a particular recessive gene, as opposed to protozygote, *q.v.*

Alternate Dominance. — A theory of sex-determination which supposed all individuals to be heterozygous for sex but that the male determiners were dominant in male offspring and the female determiners dominant in female offspring.

Alternation of Generations. — An alternation of a sexual with an asexual form, or, cytologically, the alternation of a haploid with a diploid stage.

Alternative Inheritance. — Allelomorphism; a relationship between two or more factors such that they are of necessity separated into sister gametes in germ-cell formation; the alternative relationship shown by characters governed by such allelomorphic factors.

Altmann's Granules. — Mitochondria, *q.v.*

Ambisporangiate. — Hermaphrodite (flowers).

Ameiosis. — The replacement of normal meiosis by a single nuclear division so that the chromosome number is not halved.

Ament. — A unisexual, generally bracteate, spike of flowers; a catkin.

Amitosis. — The division of a nucleus by cleavage without separation of daughter chromosomes, so that the latter are not necessarily equally distributed between the daughter nuclei.

Amixia. — Cross-sterility.

Amixis. — The absence of any fertilization process by reason of the absence of sexual differentiation.

Amnion.— One of the fœtal membranes.

Amniotic Cavity. — The space between the fœtus and the amniotic membrane, which is typically filled with the amniotic fluid.

Amniotic Sac. — The embryo-sac, female gametophyte or megaspore.

Amphiapomict. — An organism which normally reproduces both sexually and apomictically.

Amphiaster. — The spindle and its two asters collectively.

Amphibivalent. — An interchange ring of four chromosomes.

Amphiblastic. — Having the bulk of the yolk in one hemisphere; telolecithal.

Amphicarpous. — Producing two kinds of fruit.

Amphidiploid. — The result of hybridization between two plant species or genera where the chromosome set contributed by each parent undergoes doubling and produces in the hybrid a chromosome number which is the sum of the diploid numbers of the two parent forms.

Amphigenesis. — The fusion of gametes to form a zygote.

Amphigony. — Reproduction in which two individuals participate.

Amphikaryon. — A nucleus containing two haploid sets of chromosomes.

Amphimict. — An individual which reproduces by amphimixis.

Amphimictic Population. — A population with free crossing and vital and fertile descendants. Equivalent to panmictic population (CAIN, 1944).

Amphimixis. — The union of maternal and paternal elements in gametic fertilization. Opp. Apomixis.

Amphinucleolus. — A double nucleolus consisting typically of a basophilic and an oxyphilic component in close association (WILSON).

Amphiont. — A zygote; the cell which results from gametic fertilization and, by extension, the individual which grows from this cell.

Amphiplasty. — The loss of a satellite from a chromosome.

Amphitene. — Zygotene; the stage in the prophase of meiosis when homologous chromosomes come together in pairs; the paired chromosome threads at this stage.

Amphitoky. — Parthenogenetic multiplication by both sexes.

Amphogenic. — Producing offspring consisting of approximately equal proportions of either sex. N. **Amphogeny.**

Ampulla of Henle. — An enlargement at the distal end of the vas deferens which acts as a storage place for spermatozoa.

Amyloplasts. — Leucoplasts which take part in the conversion of sugars to starch granules.

Anaboly. — An evolutionary change arising at the end of ontogeny. The adding, by a descendant, of a new stage on to the last stage of morphogenesis of the ancestral type: a modified form of overstepping, *q.v.* "Anaboly differs from 'overstepping' only in that it is the final stage of morphogenesis instead of the definitive adult stage of the ancestor which is passed through in the ontogeny of the descendant" (DE BEER).

Anachromasis. — The changes which take place in a nucleus during prophase.

Anamorphism. — Anamorphosis, *q.v.*

Anamorphosis. — The evolution of one type from another by continuous variation as distinct from evolution brought about by saltation.

Anandrous. — Having no stamens.

Ananthous. — Having no inflorescence.

Anaphase. — The stage in nuclear division when the daughter chromosomes diverge and begin to move towards the poles.

Anaplast, Anaplastid. — Amyloplast, *q.v.*

Anaschistic. — Bivalents that are said to split "longitudinally" at the first meiotic division; these are bivalents with chiasmata close to the spindle attachment (as opposed to diaschistic) (FARMER & MOORE; DARLINGTON).

Anastomoses. — The fine threads which appear to connect the chromonemata giving a net-like appearance in the resting nucleus.

Androecium. — The stamens collectively.

Androgenesis. — Male parthenogenesis; development from a fertilized egg followed by disintegration of the maternal nucleus so that the resulting individual possesses only paternal chromosomes and is typically haploid.

Androgenetic. — Of an individual whose cells contain only chromosomes of paternal origin.

Androgenic. — Stimulating the growth or production of male characteristics.

Androgens. — A group of hormonic substances which can induce the development of the secondary sexual characters in a male. The following are included in this group: Testosterone, - propionate, - acetate, - dipropionate, and methyl testosterone.

Androgynary. — Having flowers whose stamens and pistils are petaloid.

Androgyne. — Hermaphrodite.

Androgynism. — Bisexuality; hermaphroditism; possessing both stamens and pistils.

Androhermaphrodite. — A plant in whose flowers the male organs are developed more strongly than the female; towards the close of the flowering season such a plant may show only male characteristics.

Andromonoecious. — Having both perfect and staminate flowers on the one plant but no pistillate flowers.

Andropetalous. — "Double" flowered; with petaloid stamens but pistil unchanged.

Androsomes. — Chromosomes which occur only in nuclei of the male germ-line, never in somatic nuceli of either sex and never in the nuclei of the female germ line; male-limited chromosomes.

Androstenediol. — An androgenic substance which also has oestrogenic effects.

Androstenedione. — One of the androgens, said to be more effective than testosterone in maintaining the seminiferous function of the testes.

Androsterone. — A katabolic product of testosterone which is excreted in the urine and which has androgenic properties.

Anemophilous. — Pollinated by wind-borne pollen.

Anemophily. — Wind-pollination.

Aneucentric Translocation. — A translocation involving the centromere so that an acentric chromosome and a dicentric chromosome result.

Aneuploid. — An organism whose somatic nuclei do not contain an exact multiple of the haploid number of chromosomes, one or more chromosomes being represented more times than the rest; an irregular, or unbalanced, polyploid. *cf.* Orthoploid.

Aneurin, Aneurine. — Vitamin B_1 ($C_{12}H_{18}N_4SOCl_2$) the anti-neuritic vitamin; thiamine, thiamin.

Ångström. — .0000001 mm.

Anhydro-hydroxy-progesterone. — Pregneninolone; a progesterone-like substance which retains its activity when administered orally.

Anisogamete. — A gamete which differs morphologically or in size from its partner; heterogamete.

Anisogamy. — (i) Conjugation of anisogametes; heterogamy. (ii) The state of having anisogametes.

Anisogenomatic. — Of a chromosome complement: composed of two, or more, non-homologous sets.

Anisogenous. — Of plants whose male and female gametes behave dissimilarly in the transmission of inherited characters. N. **Anisogeny.** *cf.* Isogenous.

Anisogeny. — *See* Anisogenous.

Anisoploid. — (i) Having an odd number of sets of chromosomes in the somatic cells. (ii) An individual of this type.

Anisopolyploidy. — The state of having an odd number of sets of chromosomes in the somatic cells.

Anisotropy. — Of ova: having a predetermined axis.

Anlage. — Foundation or 'scaffolding' of embryo. Primitive elements out of which a cell, organ or organism is formed (BEADNELL).

Anoestrum, Anoestrus. — The resting period, or period of absence of sexual desire which recurs between heat periods in mammals; the period when the female is not 'on heat'.

Anorthospiral. — Having a spiralization of such a type that a secondary compensational twisting occurs in the substance of the thread, in addition to the straight-forward twist of the spiral. *cf.* Orthospiral.

Anovular Menstruation. — Periodic uterine bleeding similar to that of menstruation but occurring in the absence of ovulation and, consequently, of any corpus luteum.

Anther. — The upper, fertile, part of a stamen, containing the pollen.

Antheridial Mother-cell. — A cell within the pollen grain of flowering plants which divides to form the male gametes (BOWER).

Anthesis. — The bursting of the anthers; the expansion of the flower; the time when fertilization takes place; the period from the bursting of the bud to the setting of the fruit.

Anthropogenesis. — The evolutionary descent of man.

Anticipation. — A tendency for a character to become manifest at an increasingly early age in each successive generation.

Anticipation, Law of. — The age of onset of dementia tends to be earlier in each successive generation of the family, until it finally culminates in amentia. (Later work casts considerable doubt on this "Law".)

Anti-haemorrhagic Vitamin. — Vitamin K.

Anti-neuritic Vitamin. — Vitamin B_1.

Anti-nyctalopia Vitamin. — Vitamin A.

Antipodal Cone. — The cone of astral rays opposite the spindle (VAN BENEDEN; WILSON).

Anti-rachitic Vitamin. — Vitamin D.

Anti-recapitulation. — The resemblance of an adult descendent to an ancestral embryo so that the descendent loses from its life-history the adult ancestral characters.

Anti-scorbutic Vitamin. — Vitamin C.

Anti-sterility Vitamin. — Vitamin E.

Antithetic Generations. — Alternate generations of haploid and diploid type which are morphologically distinct.

Antithetical Dominance. — *See* Dominance, Hypothesis of Antithetical.

Anti-xerophthalmia Vitamin. — Vitamin A.

Apatetic Coloration. — Protective coloration.

Apetalous. — Lacking petals.

Aphallism. — The state of having no penis. Adj. **Aphallic.**

Apocarpy. — The condition of having the carpels separate.

Apocyte. — A multinucleate mass of protoplasm arising either by nuclear division or cell fusion. *cf.* Coenocyte and Syncytium.

Apogameon. — A species containing both apomictic and non-apomictic individuals (CAMP & GILLY).

Apogamogony. — Agamospermy when followed by an alternation of generations.

Apogamous. — *See* Apogamy.

Apogamy. — The production of seed or progeny by sexual organs or related structures without fertilization, the embryos being formed from haploid nuclei (but not from ova). Typically the embryo is formed by the development of two fused embryo-sac cells. (*See* Apomixis). Adj. **Apogamous.** *See* under Reproduction.