1) The characteristic color of Palamino horses is a result of co-dominance of two alleles

  A. True
* B. False

  A Palamino is a cross between a Chestnut and a Cremello. The palamino color is due to incomplete dominance, not co-dominance. Consequently, all hairs are a lighter shade of chesnut. If it were co-dominant, some hairs would be chestnut while others would be cremello. <p>A palomino crossed with a palomino may result in a palomino (about 50% of the time), but could also produce a chestnut (25%) or a cremello (25%).

2) Pronuclear microinjection is a bit like the lottery because the outcome is highly uncertain

* A. True
  B. False

  Pronuclear microinjection (the insertion of small bits of DNA into a developing cell) usually creates unique individuals because the injected DNA could insert anywhere, thus modifying DNA uniquely. <p>Some of the disadvantages of pronuclear injection include : Low efficiency (mice - 10%, livestock <1%) High level of skills required Expensive (mice - $2k; pig - $10k, cow - $100k) Inability to control transgene insertion results in each independently derived transgenic animal being unique (the site of transgene integration, number of copies, the level, time and place of transgene expression)

3) A point mutation is a change in a single base pair (bp) of a gene.

  A. False
* B. True

  The impact will depend on the type of mutation and where it occurred. For example, if it occurs in an intron (section of DNA that will be spliced out after transcription), there will be no impact. Additionally, a bp substitution may not affect the protein being transcribed because multiple bp sequences can result in the same amino-acid. <p>Example : Porcine stress syndrome

4) A chimera has genetically distinct cells from 2 or more zygotes.

* A. True
  B. False

  Mosaics and chimeras are animals that have more than one genetically-distinct population of cells. The distinction between these two forms is quite clearly defined, although at times ignored or misused. In mosaics, the genetically different cell types all arise from a single zygote, whereas chimeras originate from more than one zygote. <p>Chimeric cattle are not at all rare. When a cow has twins, it is almost inevitable that anastomoses (areas of joining) develop between the fetal circulatory systems early in gestation. This leads to exchange of blood between the two fetuses. Fetal blood contains hematopoietic stem cells, and each fetus is permanently "seeded" with stem cells from its twin. The result is that both animals are hematopoietic chimeras. A variable fraction of all their cells that are derived from hematopoietic stem cells (peripheral blood cells, Kupffer cells in the liver, lymphocytes and macrophages in lymph nodes and spleen, etc) are from the twin.

5) Karyotyping is usually accomplished by using stable cells like nerve cells

  A. True
* B. False

  Karyotyping need cells in metaphase so that chromosomes are visible. Consequently, good candidates are rapidly dividing cells like lymphocytes or cells in the skin, testis or bone marrow. Karyotyping usually provides a picture of chromosomes arranged by morphology and size (using an international standard).

6) An allele is a fixed position on a chromosome, such as the position of a gene

* A. False
  B. True

  A locus is a fixed position on a chromosome , such as the position of a gene. <p>An allele is any one of a number of viable DNA codings occupying a given locus (position).

7) The number of genes involved with resistance to complex infectious disease in livestock

  A. 100-1000
* B. 1000-2000
  C. 5000-10000
  D. 10-100
  E. 1-10

8) Gene-expression profiling uses

  A. Western blot
  B. Southern blot
  C. PCR
* D. Micro-array technology

  Gene-expression profiling uses microarray technology to look at many thousands of genes at once. Comparing profiles of a number of individuals, some on whom the therapy is working, others in which it is not, can reveal the genetic makes of 'successful' candidates. This allows efficient candidate selection and avoids wasted treatment (time, effort) on individuals that don't have the required genetic makeup and, thus, will not respond to the treatment in question. <p>PCR is a technique to rapidly duplicate a small segment of DNA <p>Southern blot is used for DNA identification <p>Western blot is used to identify proteins

9) Recessive genes are related to 'gain of function'

* A. False
  B. True

  Recessive genes are related to 'loss of function' because it requires the allele on both chromosomes to exist to prevent the production of the relevant protein. <p>Keep in mind that the recessive trait 'shows' because a protein is not being produced. That will only happen when the 'defective' allele is homozygous.

10) Dogs bred for acromegaly (excessive growth), like the Great Dane, Irish Wolfhound and St. Bernard are most likely to suffer from

  A. Ear mites
* B. Hip/Elbow dysplasia
  C. Eye defects
  D. Aggression

  Some dog breeding defects Achondroplasia - Yorkshire terrier, Dachshund, Chihuahua : hydrocephaly, aggression, paraplegia Acromegaly - Great dane, Irish Wolfhound, St. Bernard : Hip/Elbow dysplasia Spine length - Dachshund - long spine (IVDD); Boxer - short spine (spondylosis)

  A. Oncogenes
  B. Tumor suppressor genes
  C. Telomerase genes
* D. All of the above

  An oncogene is a modified gene (derived from a proto-oncogene), or a set of nucleotides that codes for a protein, that increases the malignancy of a tumor cell. Some oncogenes, usually involved in early stages of cancer development, increase the chance that a normal cell develops into a tumor cell, possibly resulting in cancer. Heterzygous is active. <p>A tumor suppressor gene is a gene that reduces the probability that a cell in a multicellular organism will turn into a tumor cell. A mutation or deletion of such a gene will increase the probability of the formation of a tumor. Homozygous mutation required. <p>Normally, telomeres shorten after each replication cycle. This 'contributes' to ageing because once telomeres disappear, the chromatin quickly breaks down, triggering apoptosis. Telomerase is an enzyme that prevent telomeres from shortening. Many cancer cells are considered 'immortal' because telomerase activity allows them to divide virtually forever, which is why they can form tumors. The goo

12) RFLP testing is used to identify polymorphism (differences) in DNA

* A. True
  B. False

  Restriction Fragment Length Polymorphism or RFLP (often pronounced "rif lip", as if it were a word) is a method used by molecular biologists to follow a particular sequence of DNA as it is passed on to other cells. RFLPs can be used in many different settings to accomplish different objectives. RFLPs can be used in paternity cases or criminal cases to determine the source of a DNA sample. RFLPs can be used determine the disease status of an individual. <p>RFLP produces a series of bands when a Southern blot is performed with a particular combination of restriction enzyme and probe sequence.

13) A pseudohermaphrodite has both male and female gonads, but characteristics of one sex are usually dominant.

* A. False
  B. True

  A true hermaphrodite has male and female gonads. However, a pseudo-hermaphrodite has either male or female gonads along with some genitalia of the other sex. <p>For example, a male psuedo-hermaphrodite has testes along with (parts of) the reproductive tract & external genitalia of a female.

14) DUMPS is a syndrome that affects most university students at some point. For some reason, crocodiles are rarely affected.

* A. False
  B. True

  DUMPS stands for Deficiency of Uridine Monophosphate Synthetase. It is a recessive lethal in dairy cattle - In-utero lethal when homozygous recessive. Detectable in heterozygotes through a blood test.

15) Karyotyping can be used to

  A. Determine an individual's sex and genetic abnormality, especially when genitalia is ambiguous
  B. Investigate if low fertility has a genetic origin
  C. Investigate if congenital malformations have genetic origins
* D. All of the above
  E. None of the above

  A karyotype is a standardized arrangement of all the chromosomes of a cell. The chromosomes are arranged and displayed (often on a photo) in a standard format known as an idiogram: in pairs, ordered by size and position of centromere for chromosomes of the same size.<p><img src="KaryotypeAll.jpg">

16) Melanocytes are derived from

  A. melanin
* B. the neural crest
  C. neuroblastomas
  D. melanomas

  Melanocytes produce melanin, a pigment in the skin, eyes, and hair. <p>The neural crest, a component of the ectoderm, is found in between the neural tube and the epidermis of an embryo. Neural crest cells quickly leave this during or shortly after neurulation. It has been referred to as the fourth germ layer, due to its great importance. The neural crest can give rise to neurons and glia of the peripheral nervous system (PNS), skeletal and smooth muscle, chondrocytes, osteocytes, melanocytes, chromaffin cells, and supporting cells and hormone producing cells in certain organs.

17) Phenocopies are genes on different loci that independently create an identical effect

* A. False
  B. True

  A phenocopy <u>is an individual</u> whose phenotype (generally referring to a single trait), under a particular environmental condition, is identical to the one of another individual whose phenotype is determined by the genotype. For example, polydactyly can be cause by a genetic defect or by teratogen (substance which can cause birth defects) in the environment. The individual who does not have the polydactyly gene but is affected by the environment is the phenocopy.

  A. False
* B. True

  The Lyon hypothesis states that in cells with multiple X chromosomes, all but one is inactivated during mammalian embryogenesis. This happens early in embryonic development at random in mammals, (Brown, 1997) except in marsupials and in some extra-embryonic tissues of some placental mammals, in which the father's X chromosome is always deactivated (Lee, 2003). Barr bodies are named after their discoverer, Murray Barr. <p>The inactivation state of chromosomes is passed on to daughter cells during mitosis. (Hall et al., 2003) Since random chromosomes are selected for inactivation early in embryonic development, this results in different regions of the adult body having different chromosomes inactivated. This can be significant if different alleles of a gene are present on the different chromosomes; in some regions of the body one allele will be active, and in other regions the other will. This is what results in the coloration pattern of female calico cats. <p>The X-chromosome represents about 5% of the tota

19) Reciprocal translocation (rcp) occurs when there is exchange of material between homologous chromosomes

  A. True
* B. False

  Reciprocal translocation (rcp) occurs when there is exchange of material between non-ho chromosomes. <p>Crossing over mistakes during meiosis resulting in karyotypes like 38 rcp (13p- 14q+ ... one of 13's P arms has attached to one of 14's Q arm <p>Affected individual is phenotypically normal, but less fertile (offspring could die in-utero, or be carriers) <p>Do not breed, sell for meat

20) A transgenic contains genes from a different specie

* A. True
  B. False

  Biotechnology often creates transgenics, using genes from one specie to create similar effects in others (e.g. green flourescent pig).

* A. False
  B. True

  A freemartin is a <u>female</u> bovine with a masculinized behavior and non-functioning ovaries. Genetically, the cow is female, but it is sterilized in utero by hormones from a male twin. <p>A chimera is an individual having more than one genetically-distinct population of cells that originated from more than one zygote. <p>Chimeric cattle are not at all rare. When a cow has twins, it is almost inevitable that anastomoses (areas of joining) develop between the fetal circulatory systems early in gestation. This leads to exchange of blood (containing hemapoeitic stem cells) between the two fetuses. Major clinical signifcance is seen when one fetus is a female and one a male. In such cases, the female fetus is exposed to hormones from the male and is masculinized. Such female cattle are called freemartins. The external genital tract of a freemartin looks like a female, although usually infantile. The degree to which the internal genital tract is masculinized varies, but typically, the vagina is

22) Mimic genes exist on separate loci producing similar phenotypes independently

  A. False
* B. True

  Example : The Rex (wavy-haired) cat phenotype can be produced by any of 3 genes at different loci (Cornish, Devon, Oregon) <p>When the mimic gene is recessive - like Rex - then parents showing the phenotype but affected by genes at different loci (e.g. Cornish x Devon) will have unaffected offspring as they will be heterozygous for both genes

23) At least one parent of an individual expressing a dominant trait is usually affected.

* A. True
  B. False

  3 main features of dominant trait Heterozygote or Homozygote for gene will show phenotype At least one parent must show phenotype All previous generations would have one or more individuals showing phenotype. Examples : Polled cattle, Scottish fold cats (ear pinna is folded forward; susceptibile to ear infections, mites)

24) Inherited errors of metabolism are due to absence or reduction in production of enzymes

* A. True
  B. False

25) Resistance is governed by many genes

  A. False
* B. True

26) Goat breeds resulting from minor birth defects include

  A. La Mancha
  B. Pygmy goat
  C. Angora
* D. All of the above

  Goat breeds due to minor birth defects include : La Mancha - selected defect is the absence (homozygouus) of the ear lobe. When heterozygous, is incompletely dominant - 30% of normal length. Acrondroplasia - Pygmy goat Angora - defect in adrenocortical function results in decreased cortisol resulting in absence of guard hairs - hence, a fleece-like coat. A side effect is an increase in abortions.

27) Expressivity describes the extent, in a population, to which the properties controlled by a gene, its phenotype, will be expressed.

  A. True
* B. False

  Expressivity refers to variations of a phenotype resulting from a genotype. It denotes how well the phenotype can be predicted, given the genotype. Genes that always produce the same phenotype have low or non-variable expressivity. Polydactyly has high expressivity because many phenotypic variations exist for the same genotype. Manx cats (short tails) also have variable (or high) expressivity. <p>Penetrance describes the extent, in a population, to which the properties controlled by a gene, its phenotype, will be expressed. <p>For example, the Manx is a breed of cat with a naturally occurring mutation of the spine. This mutation has high expressivity as it can result in a range of tail lengths from close-to-normal to tailless. The trait is highly penetrant as most cats with the manx gene show some tail modification.

28) How many chromosomes does a normal sheep have?

  A. 64
* B. 54
  C. 46
  D. 60
  E. 38

<p>Cat/Pig - 38; Sheep-54; Cow/Goat - 60; Horse - 64; Donkey - 62 ; Dog - 78; Chicken - 78 <p>All X-chromosomes look like X (meta or sub-metacentric), except Goat (acrocentric)

* A. False
  B. True

  Polymerase chain reaction (PCR) is a molecular biology technique, for enzymatically replicating DNA without using a living organism. <p>It can be part of the process of identifying a transgenic, but that isn't its primary purpose. <p>Mullis has written that he conceived of PCR while cruising along the Pacific Coast Highway 1 one night in his car. He was playing in his mind with a new way of analyzing changes (mutations) in DNA when he realized that he had instead invented a method of amplifying any DNA region. Mullis has said that before his trip was over, he was already savoring the prospects of a Nobel Prize. He shared the Nobel Prize in Chemistry with Michael Smith in 1993. <p>PCR is commonly used in medical and biological research labs to replicate DNA material for a variety of tasks, such as the detection of hereditary diseases, the identification of genetic fingerprints, the diagnosis of infectious diseases, the cloning of genes, paternity testing, and DNA computing. <p>Limitation : PCR works readily

30) Heritability is the proportion of phenotypic variation in a population that is attributable to genetic variation among individuals

  A. False
* B. True

  Heritability is often misunderstood when presented in the non-scientific media. Heritability only quantifies how much of the total phenotypic variation in a population is attributable to variation among individual genotypes compared to the variation in the their environment (quite a mouthful!). Heritability does not quantify the extent to which genes and environment actually determine a phenotype, let alone the extent to which changes in genes and environment could change phenotypic values.

31) A chromosome that has a centromere slightly off centre is termed acrocentric.

* A. False
  B. True

  Acrocentric - centromere near one end. Metacentric - centromere in middle Sub-metacentric - centromere half-way between middle and end

32) Some of the autosomal dominant 'breeding defects' in cats are manifested in the Scottish fold, American curl and Munchkin breeds.

  A. False
* B. True

  Lecture 13/14. Some Cat breeding defects Scottish fold (AD) - Ear mites, Limb/Bone dysfunction American Curl (AD) - no related defects (?) Four ears (AR) - Eye defect, undershot jaw, lethargy Munchkins (AD) - achondroplasia - Lordosis, compressed heart/trachea Dermatosparaxis - Collagen defect - laceration, infections Polydactyly (AD) - extra toes Syndactyly (AD) - fused toes Sphynx (AR, mimic) - hairless, many mutations (mimic)

33) When a gene exists in the mitochondria of a male, there is a 50% chance that it will get passed on to his offspring.

  A. True
* B. False

  Mitochondrial genes are always inherited from the mother. Recall the process of fertilization in mammals.

34) A centromere always occurs in the mid-portion of a chromosome (hence the name)

* A. False
  B. True

  A centromere is the region where sister chromatids join in the double chromosomal structure during mitosis, prophase and metaphase. <p>Chromosomes are identified as acrocentric (centromere near one end), metacentric (near middle), sub-metacentric (centromere slightly off centre). <p>X-chromosomes are usually metacentric or sub-metacentric. An exception is the goat, where it is acrocentric.

35) Some of the dangers to the specie of low genetic variability are

* A. May not be able to adapt to sudden environmental variability
  B. May not be able to mount immune response to combat an epidemic
  C. decreased reproductive performance

  Lecture 6

36) Tumor suppressor genes are normal genes that control cell proliferation through apoptosis or cellular repair pathways

  A. False
* B. True

  A tumor suppressor gene is a gene that reduces the probability that a cell will turn into a tumor cell <p>Unlike oncogenes, tumor suppressor genes generally follow the 'two-hit hypothesis,' which implies that both alleles that code for a particular gene must be affected before the tumor suppressor gene is inactivated. <p>Tumor suppressor genes cannot block the effects of an oncogene.

37) 3 co-dominant alleles allows for 6 phenotypes

* A. True
  B. False

  Heterozygotes for co-dominant genes have phenotypic characteristics of both alleles. Example : If a homozygous red bull and homozygous white cow mate, then the calves produced will be roan-colored, with a mix of red and white hairs. <p>3 co-dominant alleles A, B, C can have the following variations AA, BB, CC, AB, AC and BC.

38) Causes of high reproductive losses in horses include

  A. Hydrocephaly (excess CSF in brain due to blockage)
  B. Cyclopia
  C. Color associated lethals (WW-lethal; Ww-White)
  D. Colonic aplasia
* E. All of the above

  Causes of high reproductive losses in horses include :
Hydrocephaly (excess CSF in brain due to blockage), autosomal recessive Cyclopia (one eye), autosomal recessive Color associated lethals (WW-lethal; Ww-White) Colonic aplasia Schistosoma Reflexum (severe vertebral column defect), autosomal recessive

39) The key aim of captive breeding is avoidance of genetic variability so that defects are not 'imported'

  A. True
* B. False

  Lecture 6 <p>The key aim is MAINTENANCE of genetic variability, through Variation - initiate the population with as many founder individuals as possible Rapid multiplication - produce as many offspring as quickly as possible Equalization - each founder must produce the same number of descendants

40) Genetic imprinting is the phenomenon whereby a small subset of all the genes in the genome are expressed according to their parent of origin

  A. False
* B. True

  Some imprinted genes are expressed from a maternally inherited chromosome and silenced on the paternal chromosome; while other imprinted genes show the opposite expression pattern and are only expressed from a paternally inherited chromosome. <p>Examples (human) : Prader-Willi syndrome, Angelman syndrome

41) The Scottish fold cat has ears folded forward. This trait is autosomal recessive.

* A. False
  B. True

  The Scottish fold cat has it ear pinna folded forward. This makes it susceptibile to ear infections and mites. The trait is autosomal dominant.

42) Telomeres are found in all somatic cells

* A. False
  B. True

  Telomeres are found in healthy nuclear material. However, a number of cells in the body don't have telomeres because (1) they don't have nuclei (mammalian blood) or (2) telomeres have disappeared due to ageing. <p>Telomeres normally reduce in size with every replication and, when they disappear, cause instability in the cell that usually results in apoptosis. One of the characteristics of cancer cells is the 'omnipotence' of telomeres, due to the action of telomerase. This appears to grant such cells 'immortalitiy', thus allowing them to proliferate unchecked.

43) A sex-limited trait is one that affects both sexes, but is pre-dominant in one sex

* A. False
  B. True

  A sex-limited trait is only seen in one sex. Quite often, this is because the because the opposite sex does not have that anatomy. However, the other sex can be a carrier <p>Example : Testicular hypoplasia, cryporchidism. In humans, male pattern baldness

44) A mosaic, like a chimera, has genetically distinct cells from 1 zygote.

  A. True
* B. False

  Mosaics and chimeras are animals that have more than one genetically-distinct population of cells. The distinction between these two forms is quite clearly defined, although at times ignored or misused. In mosaics, the genetically different cell types all arise from a single zygote, whereas chimeras originate from more than one zygote. <p>Mosaics are not uncommon; in fact, roughly half of the mammals on earth are a type of mosaic (X-inactivation).

45) The major histocompatibility complex (MHC) plays an important role in the immune system, autoimmunity, and reproductive success.

* A. True
  B. False

  The MHC proteins act as "signposts" that display fragmented pieces of an antigen on the host cell's surface. They may be self or nonself. If they are nonself, there are two ways by which the host cell may acquire this antigen. If the host is a leukocyte, such as a monocyte or neutrophil, it may engulf the particle (be it bacterial, viral, or particulate matter), break it apart using lysozymes, and display the fragments on Class II MHC molecules. On other hand, if a host cell is infected by a bacterium or virus, or is cancerous, it may display the antigens on its surface with a Class I MHC molecule. In particular, virus infected and cancerous cells have a tendency to display unusual, nonself antigens on their surface. These nonself antigens, regardless of which type of MHC molecule they are displayed on, will initiate the specific immunity of the host's body.

46) The "hairless" Chinese crested is a heterozygote while Powder puff is a homozygous dominant

* A. False
  B. True

  At first glance, the "Hairless" and "Powderpuff" varieties of Chinese Crested Dogs appear to be two different breeds, but hairlessness is a dominant trait within a single breed. <p>The Powder puff, which does have hair, is homozygous recessive. <p>The Chinese crested is a heterozygote. <p>The homozygous dominant is lethal; embryos do not survive.

47) A basic difference between microarray data analysis and much traditional biomedical research is the dimensionality of the data

* A. True
  B. False

  A large clinical study might collect, say, 100 data items per patient for thousands of patients while a medium-size microarray study will obtain many thousands of numbers per sample for perhaps a hundred samples. <p>A DNA microarray (also commonly known as gene or genome chip, DNA chip, or gene array) is a collection of microscopic DNA spots attached to a solid surface, such as glass, plastic or silicon chip forming an array for the purpose of expression profiling, monitoring expression levels for thousands of genes simultaneously. <p>Measuring gene expression using microarrays is relevant to many areas of biology and medicine, such as studying treatments, disease, and developmental stages.

48) How does the cattle karyotype differ from that of a goat?

  A. Cattle have a number of acrocentric chromosomes while in the goat only the X-chromosome is acrocentric
* B. The cattle Y chromosome is much larger than that of the goat
  C. The Y chromosome in cattle is almost the same size as the X chromosome; in the goat, the X-chromosome is much bigger than the Y-chromosome
  D. Cattle have 60 chromosomes while the goat has only 54

<p>Cattle have many acrocentric chromosomes. They are all autosomes, 29 pairs, i.e. 58 chromosomes, are acrocentric and only the X- and Y-chromosomes are metacentric. <p>There is a great similarity between cattle chromosomes and the chromosomes from the goat. The goat has 60 chromosomes, which are largely identical with that of cattle, with the exception of the sex-chromosomes X and Y. The X-chromosome in the goat is acrocentric and the Y-chromosome is much smaller than that of the cattle.

49) Pink carnations have one red and one white parent. Both parents are homozygous. This is a good example of co-dominance.

  A. True
* B. False

  Codominance is expressed in a heterozygote that has phenotypic characteristics of both genes. Example : If a homozygous red bull and homozygous white cow mate, the calves produced will be roan-colored, with a mix of red (father) and white (mother) hairs because the coat-color gene in this case is co-dominant. <p>Pink carnations are an example of incomplete dominance. Palamino horses are another example of incomplete dominance, the palamino color being an intermediate between chesnut and cremello.

50) Male monozygotic twins are more identical than female monozygotic twins

  A. False
* B. True

  This is because of X-inactivation in females. Female monozygotic twins will, almost always, differ in their X-chromosome deactivation pattern, so could have larger phenotypic variation that male twins who only have a single X-chromosome that cannot be deactivated.

51) A chance mutation is caused by the same gene that is responsible for a trait that defines a breeding standard.

* A. False
  B. True

  Unlike selectional mutations which are pleiotrophic (influence multiple traits), a chance mutation is caused by a gene that is close, in loci, to the breed-standard gene. <p>For example, deafness in dalmations is a selectional mutation (caused by the 'spotting' gene), but arthritis is triggered by a different gene that's close to the 'spotting' gene.

52) Genetic anticipation is a phenomenon whereby the symptoms of a genetic disease reduce in successive generations due to 'anticipation' by tumor suppressor genes.

  A. True
* B. False

  Genetic anticipation is a phenomenon whereby the symptoms of a genetic disorder become apparent at an earlier age as it is passed on to the next generation. In most cases, an increase of severity of symptoms is also noted. It is common in trinucleotide repeat disorders like Huntington's disease, myotonic dystrophy and fragile X syndrome, where triplet repeat mutations in DNA are implicated. Rather strangely, all of these diseases produce neurological symptoms. <p>Tumor suppressor genes prevent cancers; they have no role in genetic anticipation.

53) Mammals are known to have about 3 billion genes while birds only have about 1 billion. However, the approximate number of coding genes is the same (about 20,000)

* A. True
  B. False

54) Microchimerism is the presence of a small number of cells, genetically distinct from those of the host individual.

* A. True
  B. False

  Microchimerism is the presence of a small number of cells, genetically distinct from those of the host individual, and an organ. The most common form is fetomaternal microchimerism (or fetal chimerism) whereby cells from a fetus pass through into the mother. Fetal cells have been documented to persist in maternal circulation for as long as 27 years. Microchimerism had also been shown to exist after blood transfusion to severely immunocompromised population of patients who suffered trauma.

55) An oncogene is a normally differentiated proto-oncogene. This differentiation usually commences after a certain age.

* A. False
  B. True

  An oncogene is a mutation of a normal proto-oncogene, usually caused by errors of chromosome replication leading to amplification (high copy number). <p>If a cell that usually does not produce growth factors suddenly starts to do so (because it developed an oncogene), it will thereby induce its own uncontrolled proliferation (autocrine loop), as well as the proliferation of neighboring cells (paracrine), resulting in cancer. <p> Note : Growth factors, or mitogens, are usually secreted by a few specialized cells to induce cell proliferation in paracrine, autocrine, or endocrine manner.

56) Dominant genes are related to 'gain of function'

* A. True
  B. False

  A dominant gene requires a single allele (on either of the chromosomes). This is because the presence of the allele allows coding for the protein that results in the function. Presence of a similar allele on the second chromosome is irrelevant because the first allele already has the coding instruction (and makeup!) to produce adequate quantities of the protein.

57) Calico cats are always female because the characteristic is related to X-inactivation.

  A. True
* B. False

  Calicos are usually female (as it's caused by X-inactivation). However, the following can also result in the calico phenotype - 39XXY males, XX/XY chimera

58) Achondroplasia (dwarfism) usually carries with it problems related to reproduction and the skeletal system

  A. False
* B. True

  Daschunds, who are bred for achondroplasia, are very prone to IVDD (inter-vertebral disc disease) and patellar luxations.

59) A frameshift mutation could cause the same phenotype as a point mutation

  A. False
* B. True

  A frameshift mutation causes alteration of DNA in which an addition or deletion occurs that is not a multiple of three base pairs (a codon). <p>A point mutation changes a single bp. <p>It follows that a frameshift usually causes bigger differences than a point mutation. However, there could be situations (for example, if the mutation occurs near the stop codon) when a frameshift has the same impact as a point mutation.

60) Penetrance describes the extent, in a population, to which the properties controlled by a gene, its phenotype, will be expressed.

  A. False
* B. True

  Penetrance describes the extent to which the properties controlled by a gene, its phenotype, will be expressed. Note that the degree of expression is not at issue (that's expressivity). A highly penetrant gene will express itself almost regardless of the effects of environment. 30% penetrance indicates that only 30% of individuals with the allele are showing the phenotype.

61) A common selectional mutation (breeding disease) associated with the daschund is

  A. Dermatosparaxis
  B. Brachygnathia (small lower mandible)
  C. Spondylosis (degeneration of vertebral articular surfaces)
* D. IVDD (Inter-verterbral disc disease)

  Daschunds, who are bred for achondroplasia, are very prone to IVDD, patellar luxations. <p>Sharpei, bred for dermatosparaxis (skin that sags), have skin prone to tearing, stretchy, loose, fragile skin, impaired wound healing; Ear mites; Entropion. <p>The bulldog is prone to brachygnathia (small lower mandible), spondylosis (degeneration of vertebral articular surfaces), respiratory problems, malocclusion of jaw - eating difficulties; eye problems

62) An individual with a phenotype caused by a recessive gene will always have parents showing the same phenotype.

  A. True
* B. False

  3 main features of a recessive gene Carriers (e.g. Parents) are not necessarily affected (both could be Rr) Individual must be homozygous for the recessive gene (rr) to be impacted Phenotype is not necessarily present in every generation
<
Examples : Arthrogryposis in cattle, Red holsteins.

63) Selectional mutation defects refers to defects caused by a breed-standard gene

  A. False
* B. True

  Selectional mutation defects occur because the specific gene that defines a breed also causes other undesirable, usually mild, traits. Often, the gene is dominant for the breed trait, but recessive for the undesirable trait. <p>For example, Dalmation spotting 'carries' the deafness gene. According to The Dalmation Club of Canada, only 6% of the Dalmatian population is thought to be entirely free of the deafness gene, which causes some variation of deafness when homozygous recessive.

64) A telomere is a region of highly repetitive DNA at the end of a linear chromosome that functions as a disposable buffer

  A. False
* B. True

  Telomeres don't contain useful genetic material but have the important function of maintaining chromosome integrity, much like the plastic thingimajig at the end of shoelaces. Every time a cell divides, it loses a small piece of one of its strands of DNA - the "end replication problem" - which usually just results in a shorter telomere. If it were not for telomeres, this would quickly result in the loss of useful genetic information.

65) Susceptibility is controlled by many genes and is usually autosomal dominant

  A. True
* B. False

  Susceptibility is controlled by one or a few genes and is generally autosomal recessive. This is because susceptibility is usually due to loss of function ... a required protein cannot be created.

66) A somatic mutation will affect the individual as well as its progeny while a germ-line mutation will affect only the progeny.

  A. True
* B. False

  Germ line mutation affects sex cells and, so, can be passed on to offspring. However, they do not affect the individual. <p>Somatic mutations, on the other hand, since they do not affect germ cells will not be passed on to progeny. The individual will be affected.

67) The X chromosome has about twice the number of genes as the Y chromosome.

  A. True
* B. False

  Actually, the X chromosome has about 15 times the number of genes compared to the Y chromosome. <p>X Chromosome - 1200 genes. Functions include
Sex determination (sex determining genes eg SRY), Ovarian development Cell homeostasis (housekeeping genes eg HPRT) Metabolism (eg G6PD) Stress reduction (eg XIAP/BIRC4) Growth (eg transcription factors ZFX, GAB3) Intelligence (are we sure about this?) 10% of known human genetic defects are mapped the the X-chromosome Y chromosome is believed to have less than 80 coding genes

68) DNA Methylation primarily causes mutation, but may also cause translocation

  A. True
* B. False

  DNA methylation affects transcription. It is a type of chemical modification of DNA that can be inherited without changing the DNA sequence. It may itself physically impede the binding of transcriptional proteins to the gene, thus bocking transcription. Also, it could result in change to the chromatin structure which would silence those genes.

69) Approximately how many known genetic disorders exist in dogs?

  A. 1000
* B. 400
  C. 50
  D. 150

  see Lecture 1 >400 known genetic disorders in dogs >70% described in the past 20 years >50% have breed specific aggregations >50% known mode of inheritance About 2/3 of these are single gene disorders inherited as autosomal recessive

70) A "Chain termination" occurs when telomerase (an enzyme that adds specific DNA sequence repeats to the 3' end of DNA strands in the telomere regions) is inactivated.

* A. False
  B. True

  A chain termination is a nonsense point mutation that results in a premature stop codon. <p>A point mutation results in a change to a single base pair (bp) of a gene.

71) Manx cats are examples of a gene that has variable expressivity but low penetrance

  A. True
* B. False

  The Manx is a breed of cat with a naturally occurring mutation of the spine. This mutation have variable expressivity as it can result in a range of tail lengths from close-to-normal to tailless. However, the trait is highly penetrant as most cats with the manx gene show the tail modification. <p>Related problems include Spinal problems and megacolon imbalance. <p>Homozygous dominant is lethal.

72) Polyploidy is a type of aneuploidy

* A. False
  B. True

  Aneuploidy is defined as "a condition of having a number of chromosomes that is not the exact multiple of the normal haploid number". i.e. 2n-1. Polyploidy is "a condition of having a chromosome number that is a multiple greater than 2 of the haploid number" i.e. 3n, or 4n. (i.e. an exact multiple of the haploid number). Thus, aneuploidy and polyploidy cannot refer to the same thing.

73) A recessive lethal can easily be bred out

* A. False
  B. True

  A recessive lethal occurs when a recessive homozygous gene is not compatible with life. It is difficult to breed it out because the heterozygote (which is unaffected, but a carrier) cannot be differentiated from a homozygote dominant (which is unaffected and not a carrier). <p>Example : (1) arthrogryposis in cattle (deformed feet). (2) Hydrocephaly in calves.

74) % of mammalian genome that controls immune responsiveness?

  A. 20%
  B. 1%
* C. 5%
  D. 10%

75) T Gene Locus controls the striping pattern of Tabby cats.

* A. True
  B. False

  There are two major alleles at the T locus - T and tb. TT and Ttb tabbies have the vertical stripes and are called Mackerel tabbies. tbtb cats are blotched tabbies; their stripes make wide, indistinct whorl patterns on their flanks.

76) When a gene is X-linked dominant, an affected male will always pass on the defect to his offspring.

* A. False
  B. True

  A male offspring always gets his X from one of his mother's, so he will be unaffected by his father's affliction <p>A female offspring always gets the father's X chromosome, so she will always be affected.

* A. True
  B. False

  In June 1981, the breed which is true to its name and its place in modern American culture was discovered in the suburban California community of Lakewood on the doorstep of some unsuspecting residents, Joe and Grace Ruga (Curlniques Cattery). Grace, in the throes of being seven months pregnant with their first child, remembers that she was "trying hard not to do anything" on the day that the first American Curls graced the Rugas' path. Joe returned from work that evening and spotted two six-month-old kittens outside his home. He approached Grace inside and remarked, "Did you see those kittens outside?" When Grace replied that she hadn't, Joe continued, "Well, they look skinny; don't feed 'em!" <p>According to Grace, Joe went into the other room to change clothes, and Grace "promptly got the kitties something to eat," noting that they had "ears that curled back from their heads in a funny way." The kittens appeared to be sisters; one was black with long hair and the other was black and white with semi-long

78) Coat color in domestic animals is controlled by how many loci?

* A. 10 to 15
  B. A handful of mimic genes
  C. 5 to 6
  D. 1 or 2
  E. A few genes on the X chromosome

  The coat color of a horse is based on interaction of genes from at least ten loci. Cats' color is controlled by at least 8 genes. All said and done, though, the correct answer remains unclear.

79) A chance mutation is an example of "genetic hitch-hiking"

* A. True
  B. False

  Genetic hitch-hiking is the process by which an evolutionarily neutral or in some cases deleterious allele or mutation may spread through the gene pool by virtue of being "linked" to a beneficial mutation. That is, the gene causing the chance mutation is close, in loci, to the breed-standard gene. <p>For example, deafness in dalmations is a <u>selectional</u> mutation (caused by the 'spotting' gene), but arthritis is triggered by a different gene, a <u>chance mutation</u>, that's close to the 'spotting' gene.

80) Double muscling in cattle is due to a nonfunctional myostatin gene.

* A. True
  B. False

  Double muscling results in 20% more muscle mass, higher meat yield, increase in muscle fibers and decreased subcutical fat. <p>Associated problems include Dystocia (difficult birth) and limb problems. The trait is autosomal recessive (mh) but "not completely recessive" (?)

81) Cancer is usually a result of a mutation. Mutations are very common. Why doesn't cancer occur more frequently than it does?

  A. Tumor suppressor genes prevent it
  B. When something is deemed wrong with the cells, apoptosis occurs
  C. Mutations may affect DNA that does not matter (introns)
* D. All of the above

82) Hemangiosarcoma is a rapidly growing, highly invasive, blood-fed variety of cancer.

  A. False
* B. True

  Hemangiosarcoma, as the name suggests, is a blood-fed sarcoma. Blood vessels grow directly into the tumor, which is typically filled with blood. A frequent cause of death is the rupturing of this tumor, causing the victim to rapidly bleed to death.

83) Southern blot is a technique used for protein identification.

* A. False
  B. True

  Southern blot - DNA identification (through electrophoresis) <p>Western blot - Protein identification (through electrophoresis)

84) A fibrosarcoma, like a fibroma, is a benign growth of fibrous cells and tissue that is often the result of trauma

* A. False
  B. True

  A sarcoma is a cancer of the connective or supportive tissue (bone, cartilage, fat, muscle, blood vessels). A fibrosarcoma is malignant. <p>A fibroma is a benign growth of fibrous cells and tissue.

85) A dominant lethal is easy to breed out because the heterozygote usually is different from the homozygous recessive

  A. False
* B. True

  Homozygous dominant die while heterozygotes often show milder form of the defect. This is easy to breed out (unlike recessive lethals) because the phenotype of a homozygous recessive differs substantially from the heterozygote. e.g. Manx in cats

86) An XO mare will usually lead a normal life as it has one X chromosome (just like its male sibling)

* A. False
  B. True

  XO is the most common chromosomal abnormality found in horses. An XO mare will be smaller and will often show sexual abnormalities like a blind-ended uterus. It will usually be anestrus. <p>They may be excellent performance horses with no apparent problems until they are taken to the breeding shed. These mares generally have tiny, inactive ovaries and show no signs of estrus and are infertile. <p>The XO is caused a nondisjunction event or anaphase lag that leaves the gamete, either oocyte or spermatocyte with neither X nor Y chromosome. When this gamete combines with a gamete from the other parent (with a normal X chromosome), the embryo lacks the normal two chromosomes. <p>Is this an X inactivation problem ???

87) The p-arm of a chromosome is always equal in size or shorter than the q-arm

* A. True
  B. False

  Each chromosome has two arms, the shorter one called p arm (from the French petit, small) and the longer one q arm (q follows p in the Latin alphabet).

88) Nuclear transfer is primarily aimed at producing a transgenic animal

* A. False
  B. True

  Nuclear transfer essentially produces a clone. It is a two-part process: first, scientists remove the nucleus from an egg, and second, they replace it with the nucleus of an older donor cell. A new clone - a genetic copy of the donor - forms when the egg starts to divide. Despite the seemingly simple nature of this technique, successful nuclear transfer thwarted scientists for many years after it was first proposed in 1938. However, thanks to the patient efforts of two scientists, Robert Briggs and Thomas King, nuclear transfer was finally accomplished with the frog species Rana pipiens. Their findings were published in a 1952 PNAS paper, irreversibly expanding the fields of genetics and development and setting the stage for current cloning efforts. <p> Note : if the nucleus being transferred had previously been genetically modified to include genes from multiple species, a transgenic is created.

89) Epistasis takes place when the action of one gene is modified by one or more others

  A. False
* B. True

  Epistasis takes place when the action of one gene is modified by one or more others that assort independently. The gene whose phenotype is expressed is said to be epistatic, while the one whose phenotype is altered or suppressed is said to be hypostatic. <p>Example : Grey gene in Lipizzaners is epistatic to other gene. Similarly, coat color in Labradors. <p>Explanation : Two enzymes in a biochemical pathway. One enzyme makes the product; one enzyme allows it to be used.

90) When a female affected by a X-linked recessive mates with an unaffected male, their male offspring will always be affected

* A. True
  B. False

  Male offspring always get their X chromosome from their mother, so they will be affected. <p>Female offspring will be carriers

91) An intersex always has gonads of both sexes

  A. True
* B. False

  An intersex is one who is born with genitalia and/or secondary sex characteristics determined as neither exclusively male nor female, or which combine features of the male and female sexes ... ambiguous genitalia. They are categorized into Pseudohermaphrodites which can be Male : More common. Gonads are testes. Could be XX, XY, XXY or combination of these (Veterinary Genetics - Basrur) Female : Less common.
True hermaphrodites : Have both gonads (testes and ovaries)

92) Pleiotropy occurs when a single gene influences multiple phenotypic traits.

* A. True
  B. False

  Pleiotropy occurs when a single gene influences multiple phenotypic traits. PKU, for example, causes mental retardation, and reduced hair and skin pigmentation all because of no or reduced conversion of phenylalanine to tyrosine. <p>Similarly, Dalmations' spotted coat is caused by a gene that is also associated with deafness, eczema and cataracts.

93) How can one distinguish the pig's karyotype from that of the cat?

* A. The ideogram of the pig has 5 pairs in the first row while the ideogram of the cat has only 3 pairs.
* B. The ideogram of the pig has 4 rows while the ideogram of the cat has 6 rows
  C. The pig has 38 chromosome, but the cat has 54
  D. The X chromosome of the pig is acrocentric while that of the cat is metacentric
* E. All the cats chromosomes are metacentric, while some of the pigs are acrocentric

  <img src="PigCatKaryotype.jpg"><p>Both the pig and the cat have 38 chromosomes. The key differences in their karyotype are indicated above. <p>An ideogram is an international standard use to depict a pictorial representation of a karyotype. They are set up according to internationally recognized numbering methods. The numbering method is largely based on an ordering according to size and/or the place of the centromere. <p>Swine have 6 pairs of acrocentric chromosomes and 12 pairs of metacentric autosomes. The X-chromosomes are also metacentric. The cat has all metacentric chromosomes.

94) A Robertsonian translocation is a type of reciprocal translocation

* A. False
  B. True

  <img src="RobertsonianTranslocation.gif"><p>A Robertsonian translocation is a type of non-reciprocal translocation in which two non-homologous acrocentric (usually!) chromosomes break at their centromeres, following which the long arms become attached to a single centromere. The short arms also join to form the reciprocal product, which typically contains nonessential genes and usually is lost within a few cell divisions, resulting in karyotypes like 59 1/29 XY. <p>Animals with such karyotype produce fewer offspring due to problems during meiosis

95) Rexoid cats (also called 'Rex') are usally cited when referring to genes that are

  A. 100% expressive
  B. Co-dominant
  C. Incompletely penetrant
* D. Mimic

  Mimic genes exist at 2 or more separate loci producing similar phenotypes independently. <p>Example : Rexoid (wavy-haired) cats produced by genes at 3 different loci (Cornish, Devon, Oregon) <p>When the mimic gene is recessive (e.g. Rexoid), parents showing similar phenotype but affected by genes at different loci (e.g. Cornish x Devon) will have unaffected offspring as they will be heterozygous for both genes

96) The pedigree symbold for a carrier of an X-linked trait is

  A. Clear square with a large dot in it
  B. Clear rhombus (diamond shaped)
  C. Clear circle with the symbol "X" it it
* D. Clear circle with a large dot in it

