# PART VIII HEALTH AND DISEASE

Chapter 18

1. “Genome lag, “Out of Eden, “Evolutionary discordance” are all terms referring to which set of similar ideas concerning health and evolution?
2. Ill health can partly be attributed to the move out of Africa (“Eden”) some 75,000 years ago when we moved to new environments to which we were not adapted.
3. These terms refers to the presence of troublesome vestigial organs and traits that are evolutionary left overs but currently cause problems.
4. That modern life has led us to evolve in new directions contrary to many of the ancestral genes we now possess.
5. That, primarily as a consequence, of the Neolithic Revolution, we now live in very different conditions and eat very different food to which we were once adapted in the EEA; so in a way we are imperfectly adapted to modern life.
6. That the occurrence of the Neolithic Revolution in Africa about 75,000 years ago caused population pressures that led to an exodus of some populations which are now not well adapted to modern life.
7. What is best description of antagonistic pleiotropy?
8. Where harmful genetic mutations are recent and have not yet been selected out by natural selection
9. Where genes that were laid down in the EEA are now out of step with modern life
10. Where genes for a good immune system (MHC ) give rise to odours that can be detected
11. Where genes have more than one effect and may be deleterious in some ways but increase fitness in others.
12. Where there are variety of forms in the population, a state sometimes called pleiotropic polymorphism
13. The following statements concern heterozygotic advantage in relation to health and disease. Which set of statements is most accurate?
14. Heterozygotic advantage is also sometimes called “over dominance” since Aa genotypes have higher fitness that aa or AA genotypes
15. Heterozygotic advantage results from organisms that breed according to the standard Mendelian ratios of 3:1 and 9:3:3:3:1
16. Heterozygotic advantage has been used to explain sickle cell anaemia and cystic fibrosis
17. Heterozygotic advantage is the term used to explain the advantages of not breeding with a close relative.
18. (i) and (ii)
19. (i) and (iii)
20. (ii) and (iii)
21. (iii) and (iv)
22. (ii), (iii), (iv)
23. Which of the following statement best describes how the theory of sexual selection (considered alongside natural selection) can explain causes of ill health?
24. Selecting a sexual partner runs the risk of disease transmission through sexual contact
25. Natural selection throws up conflict between the sexes (e.g. access to food) and this conflict can result in ill health
26. Sexual selection can give rise to features and behaviour that increase reproductive success even though such features may not be optimal for the health and wellbeing of an individual.
27. Sexual selection results in sex specific imprinting of genes leading to malfunctions at the genomic level.
28. Sexual selection is associated with a high mutation load and this can lead to problems at the phenotypic level.
29. Which statement best describes the “smoke detector principle” as advanced by Nesse?
30. That phobias are irrational and prone to go off randomly without warning
31. That the human genome now finds itself in a society very different from the EEA
32. That a little bit of anxiety firing even when there is a false alarm is useful in the long run if it correctly predicts a true hazard
33. That small amounts of stress can be detected which in some patients causes an outburst that is manifest and can be detected by everyone
34. That early diagnosis of mental disorders can often prevent them from escalating out of control
35. Several studies have shown that virulence is higher for pathogens carried by vectors than for pathogens transmitted by direct contact. Which statement best explains this phenomenon?
36. In the case of direct transmission it is in the interests of the pathogen to thoroughly debilitate the host in order to secure its transmission to the next victim
37. Vectors tend to higher shorter generation time than hosts and so can evolve defence systems that reduce the virulence whilst it is inside the vector
38. Transmission by vectors means that the generation time of the pathogen is reduced (since it reproduces anew more quickly) and this means it can evolve high virulence.
39. High virulence in pathogens will reduce the mobility of hosts and so reduce their transmission by direct contact; hence this strategy will not be favoured by natural selection
40. Vectors have simpler immune systems than hosts and so cannot stop the pathogen evolving to high virulence as they carry it.
41. Walther and Ewald (2004) suggested that high virulence in pathogens that are transmitted by host to host contact (such as smallpox and tuberculosis) can be explained by high durability and the “sit and wait” strategy. Which statement best explains the logic of this hypothesis?
42. In such cases the host is so immobilised for such a long period of time that eventually another host will enter the vicinity and pick up a new infection.
43. In such cases the vectors carrying the pathogen sit and wait until a pathogen infects them and then they are manipulated into attacking a new host
44. These pathogens hardly exist outside of the host and so instead remain in a dormant state until a new host makes contact will the current host.
45. High durability means they are resistant to most immune systems and so easily pass form host to host.
46. Although such pathogens kill their hosts they have high durability meaning they can wait in the environment until the next infection opportunity arises.
47. Gluckman, Hanson and Beedle (2007) have been at the forefront of the “developmental origins of health and disease paradigm”. Which statement best explains this set of ideas?
48. The developing foetus picks up information about the environment from intrauterine cues and uses this to match its future development to anticipated later environments. If the predictions turn out to be incorrect the organism is sub-optimally adapted.
49. Over a long period of time humans become genetically adapted to localised conditions and the genome and environment match fairly well. But rapid cultural change or geographical mobility can leave some genomes poorly matched to their adult environment.
50. Social and economic development since the Neolithic revolution have left many humans ill matched to contemporary environments. This can lead to ill health and disease.
51. The mother and foetus are not in perfect genetic accord. Genetic imprinting will mean that the mother will switch some genes off in the understanding that they will be supplied by the father. If however the father’s genes are faulty ill heath can result.
52. Many Western disease are called the diseases of civilization since they are probably a response to modern living conditions. This pattern of ill health is very different to that found in developing countries where disease is often the result of underdevelopment.
53. Compared to other great apes, childbirth for humans is painful and risky. Which set of statements best explains the “obstetrical dilemma hypothesis” as a means of explaining this?
54. The mother supplies resources to the growing foetus. The dilemma is whether to continue to supply resources and face a difficult childbirth or to deliver the baby and supply resources outside the uterus.
55. There is a conflict between bipedal locomotion (requiring a narrow pelvis) and giving birth to large –brained babies (requiring are large pelvic opening). The dilemma is solved by delivering babies effectively prematurely (in relation to brain size in the primate taxon) and with a head size that will only just pass through the pelvic canal.
56. Humans have such large and energetically expensive brains that they have to be nourished in utero for far longer than other primates and this means that the head size is then a tight fit to the pelvic canal.
57. The dilemma results from the Neolithic revolution which moved human diets towards ones higher in cereals and carbohydrates of high glycaemic index. This has promoted brain growth in human embryos meaning that childbirth is now much more risky than it was in the Palaeolithic period.
58. The growing embryo picks up information about anticipated future environments form the mother’s body. Modern future environments are relative rich in foodstuff and so the embryo grows accordingly to dimensions that make childbirth difficult.
59. Researchers such as Williams and Nesse have suggested that some signs of ill health may be exercise of the body’s natural defence mechanisms. Which set of statements best accords with the evidence of morning sickness and food cravings and aversions in relation to this idea?
    1. Mothers with morning sickness often have babies with a higher rate of complications
    2. Mothers that experience vomiting tend to vomit after meals high in animal protein
    3. Mothers often experience food craving for foods that are highly nutritious but also have a risk of pathogens such as animal protein
    4. Nausea and vomiting during pregnancy are surprisingly associated with a lower rate of miscarriages
    5. Mothers often experience aversion to foods likely to contain pathogens such as meat products
60. (i) only
61. (i) , (ii) and (iii)
62. (ii) and (v)
63. (iii) and (iv)
64. (iv) and (v)

Chapter 19

* + 1. The Neolithic revolution first occurred independently in several area of the world in around the same time period (within a few thousand years). Which statement is most accurate about these areas and periods? (BP = before present)

1. East Africa; the Middle east, south east Asia (70,000 – 56,000 years BP)
2. Meso America, India, South East Asia (7,000 – 11,000 years BP)
3. Middle East; South East Asia; Meso America (7,000 – 11,000 years BP)
4. East Africa; Sothern Europe, Middle East (8,000 – 14,000 years BP)
5. South East Asia; Middle East; meso America (56,000 – 35,000 years BP)
   * 1. In the West it is sometimes argued there is an epidemic of hyperinsulinaemia that may be related to modern diets. Which set of statements best describes the logic of this argument?
6. Modern diets high in carbohydrate cause a massive lowering of insulin in the blood stream resulting in insulin deficiency and hence the beginnings of type I diabetes.
7. Modern diets high in carbohydrate cause rises in insulin so frequently that the body loses sensitivity and so produces more, leading to permanently elevated levels of insulin in the blood stream.
8. Modern foods with a low glycaemic index do not raise insulin levels to amounts necessary to control blood sugar and this is one of the first signs of diabetes type II
9. Modern good with high glycaemic indices (GI) cause insulin levels to drop so sharply that the body produces more insulin in response and eventually levels become dangerously high – a classic symptom of type II diabetes.
10. Modern diets high in sugars and refined carbohydrates seem to be responsible for the epidemic if diabetes type I sweeping Westernised countries. One of the early signs of this condition is hyperinsulinemia.
    * 1. Dietary fat has been implicated in raised cholesterol levels, raised blood pressure and cardiovascular disease (CVD). Yet these medical problems are fairly rare in hunter-gathering cultures. Which set of statements best accords with the evidence on why this may be so?
11. Hunter –gatherers eat relatively little animal protein and animal fat.
12. Hunter –gatherers eat meat but wild animals have lower levels of unsaturated fats compared to farmed animals and it is unsaturated fats which are possibly the cause of CVD
13. Hunter –gatherers eat meat but wild animals have higher levels of unsaturated fats, it is the level of saturated fats high in farmed animals compared to wild animals that are possibly the cause of CVD
14. Hunter gatherers eat food with low glycaemic fat indices (GFI) and it is high GFI foods that are implicated in CVDs
15. We have to distinguish between saturated fats, polyunsaturated fats, monounsaturated fats and polysaturated fats; the first two are high in hunter gathering diets but low in Western diets. The latter two are high in Western diets and this may lead to elevated serum levels of cholesterol and CVDs.
    * 1. Mental disorders pose something of a paradox since they have high heritability and yet considerably reduce Darwinian fitness. Which statement best explains what this means?
16. Since they reduce Darwinian fitness this is a problem since high heritability conditions always increase Darwinian fitness.
17. High heritability means that the environment has a considerable effect on shaping the outcome of the disease and yet the outcomes tend to be lower fitness rather than higher fitness.
18. Disorders may reduce Darwinian fitness but they increase inclusive fitness and yet inclusive fitness is associated with low heritability of traits
19. They reduce the Darwinian fitness of the sufferer but reproductive fitness is still high and this is a problem since we would expect heritability to be low in such cases.
20. High heritability points to alleles influencing the condition and yet such alleles can be expected to be weeded out by reduced fitness.
    * 1. The Table below shows concordance rates for schizophrenia compiled from various studies.

|  |  |
| --- | --- |
| Relationship | Concordance rates (i.e. probability of individual developing schizophrenia if relative (shown left) is afflicted |
| Monozygotic Twins | 0.48 |
| Dyzygotic Twins | 0.17 |
| Sibling | 0.09 |
| Both parents | 0.45 |
| One parent | 0.15 |
| Random individual (background rate) | 0.01 |

Here are some statements about schizophrenia in relation to the table.

1. If your non-identical brother or sister has schizophrenia then you have about a 9 % to a 17% chance of contracting the disorder
2. The fact that if both your parents have schizophrenia and if an identical twin has schizophrenia the concordances add up to nearly 1 (0.45 + 0.48 = 0.93) shows that schizophrenia is 93 % genetic
3. About 1 in 100 people in the world will suffer from some sort of schizophrenia
4. The fact that if identical twin has schizophrenia gives you a probability of about 1 in 2 that you will have the disease shows that there must also be non- genetic factors at work

Which of the statements above are valid interpretations of the data?

1. All of them
2. (iv) only
3. (ii) only
4. (ii), (iii), and (iv)
5. (i), (iii) and (iv)
   * 1. Which statement offer the best explanation of what is meant by mutation- selection balance in describing the effect of new mutations?
6. Mental disorders can either be explained by selection or mutation – the term balance is to express that fact that we must make sure we use the correct term to explain the appropriate disorder.
7. Mutation selection balance is applied to the understanding of heterozygotic advantage where the frequency of heterozygotes and homozygotes in the population can be explained by this concept.
8. It is akin to the smoke detector principle at the genetic level where small mutations are favoured if they occasionally produce worthwhile results.
9. Mutations will always arise and many will be selected against depending on their properties – hence there is a dynamic balance achieved between the rate of accumulation of mutations and the rate of their elimination by natural selection.
10. Some mutations will be advantageous and some will lower fitness; the relative ratio of these two types can be explained by mutation – selection balance ideas.
    * 1. There have been studies on the occurrence of schizophrenia in children in families in relation to the age of the mother and the father. Which set of statements best describes this work and the conclusions that have been drawn?
11. Schizophrenia rates rise with the age of the mother more rapidly than with the age of the father, suggesting that like, Down’s syndrome, chromosomal abnormalities underlying schizophrenia are primarily inherited from the mother.
12. Schizophrenia rates rise more rapidly with the age of the mother compared to the father suggesting that mutations in mitochondrial genes are responsible since these are only inherited form the mother
13. Schizophrenia rates rise more rapidly with the age of the father than the mother and this is in line with the rising rate of mutations from fathers – suggesting schizophrenia may be partly explained by mutation load
14. Schizophrenia rates rise equally with the ages of mothers and fathers suggesting that both equally contribute mutations to the cause of this disease
15. The rate of schizophrenia rises with the age of both biological and step fathers suggesting that aging father somehow contribute to the incidence of schizophrenia through rearing practices.