1. What type of protein can participate in transmitting signals among the cells?
   a) enzyme  
   b) anti-body  
   c) receptor  
   d) structural

2. A protein that can initiate or repress gene activity is called...
   a) enzyme  
   b) hormone  
   c) transcription factor  
   d) receptor

3. Which of the following proteins is an enzyme?
   a) hemoglobin  
   b) collagen  
   c) topoisomerase  
   d) myoglobin

4. Which of the diagrams below shows the correct structure of a nucleic acid?
   a)  
   b)  
   c)  
   d)  

Proteins have complex shapes!

1. Primary structure – sequence of amino acids (polypeptide)
2. Secondary structure – helical or folded
3. Tertiary structure – complex/functional
4. Quaternary structure – several polypeptides together

DNA code

A A T C A C C G G G G G C A T A C A C T
T T A A G T G G C C C C C G T A T G T G A
codon/ triplet – 3 bases that map one amino acid

RNA – ribonucleic acid

P  S  A
S  P  G
S  P  G
S  P  G
S  P  G
S  P  G

S  G  A
S  A  G
S  G  A
S  A  G
S  G  A
S  A  G

Adenine  Uracil  Guanine  Cytosine

RNA
mRNA – messenger RNA
tRNA – transfer RNA
rRNA – ribosomal RNA

transcription – RNA assembly on a DNA template
Following transcription an RNA molecule has coding and non-coding areas

exon

intron

splicing

postprocessing – removes introns

mRNA

TRANSLATION – protein assembly on mRNA template

mRNA

AUG

UAG

UAC

CCG

GGG

Karyotype

DNA + proteins (histones)

chromosome =

body cells

diploid

somatic

2 sets of DNA

2 sets of every gene

2 sets of chromosomes

haploid

gametes (sperm and oocytes)

2 sets of DNA

1 set of every gene

1 set of chromosomes

MUTATIONS – changes in the DNA sequence

AATTCA CCGGGG GCATACACT

TTAAGTGA ACCCCG TATGTA

Alleles – different versions of the same gene

A diploid cell can be:

Homozygous – having 2 identical alleles AA bb S1 S1

Heterozygous – having 2 different alleles for the same gene: Aa NM S1 S1

Where do different cells come from?

diploid cells

result of mitosis

or result of fertilization

mitosis

meiosis

gametes

result of meiosis

mitosis

meiosis

replication
**Mitosis (increases the number of somatic cells)**

1. **Prophase**
   - Chromatids

2. **Metaphase**
3. **Anaphase**
4. **Telophase**

**Meiosis (makes gametes), 1st division**

1. **Prophase I**
2. **Metaphase I**
   - Homologous chromosomes conjugate and undergo crossing over
3. **Anaphase I**
4. **Telophase I**

**Meiosis, 2nd division**

1. **Prophase II**
2. **Metaphase II**
3. **Anaphase II**
4. **Telophase II**
   - Gametes – haploid

**Meiosis, 1st division**

1. **Prophase I**
2. **Metaphase I**
3. **Anaphase I**
4. **Telophase I**