**Solution key - 7.012 Recitation 20 - 2010**

## Question

1. HIV can lie dormant in a person's body for many years without causing any noticeable symptoms. Explain how an unrelated infection that activates the humoral response pathway may lead to the development of a full – blown HIV infection.
*The HIV targets the cells that express CD4 on their surface. Accordingly the cell targeted are the T-Helper cells which are required directly for the humoral immune response and indirectly participate also in the cytotoxic T cell mediated response. The HIV virus may remain dormant in these cells for a long time period. However, an unrelated infection may trigger the rapid proliferation with the objective to trigger an immune response to combat the infection. As these HIV infected T-helper cells proliferate, more and more virus is made resulting in a full blown HIV and the collapse of the immune system.*

2. The polymerase that copies the genome of the HIV virus is very error-prone. Why does this make it difficult for the body to mount an immune response against HIV?
*The reverse transcriptase enzyme of HIV has no proofreading activity, which makes its genome error prone and allows new strains of the HIV to emerge against which there are no treatments available.*

3. For each of the following medicines/treatments, answer these three questions:

i. Which disease/condition does this treatment work for?
ii. What is the target of this treatment?
iii. Why does this treatment work?

- Herceptin (an antibody directed against the Her2 growth factor receptor expressed in breast cells):

*Often 25-30% of the breast cancers are associated with an amplification of the Her 2 gene. The amplification of the Her2 gene correlates with the increased expression of receptor on cell surface, which increases the proliferation signal that is critical for tumor development. Herceptin is a monoclonal antibody that works on both the extracellular and the intracellular domains of the HER2 receptor. It does so by binding to the Her2 receptors that are expressed on the surface of cancerous cells thereby flagging these cells for destruction by the immune system. At the same time herceptin blocks the downstream signaling by the Her2 receptors thereby preventing tumor proliferation. Some less aggressive forms of breast cancer are not associated with an over-expression of the Her2 gene, so they are not sensitive to Herceptin.*

- Prozac:

*This is often used an anti-depressant since it inhibits the re-uptake of serotonin that may act as an excitatory neurotransmitter. It allows the serotonin released from any pre-synaptic neuron to remain in the synaptic cleft for a longer time, increases the binding of serotonin to its receptor, and increase the chance that the post-synaptic cell to fire an action potential.*

- Gleevec:

*Gleevac, targets the tyrosine kinase activity of the BCR-ABL fusion protein that is formed by reciprocal translocation in patients suffering from chronic myeloid leukemia (CML). It binds to the kinase domain of the BCR-ABL protein and disables it by preventing ATP from binding to its active site.*