CHAPTER 8

1) Look up glossary then ask questions of transient versus terminal; think about markers and function.
2) (Most) house-keeping genes are common to most cell types. The important thing in the experiment is to overlap the profiles and look at the two classes of genes. In the comparison, be careful with quantitative differences.
3) The main issue here is that, with regard to transcription, cells have in common all the basal machinery i.e. they can respond. They also have all the *cis* acting regulatory elements. So if we inject a protein that is a transcription factor (or a gene encoding it), the cell has the basic elements to respond. If it does it is because it also has all the other elements that combine with the injected protein (or gene) to produce a response. If it does not, it is lacking these. The same principle applies if the injected protein is a signal or a transducer because cells, in general, share all the basic elements of signal transduction and organization.
4) On the 'peptide based' one can have: Wnt, Shh, Delta, TGF-ß, FGF, EGF; in the lipid soluble one can have vitamins and steroids. The peptide based need a cell surface receptor to act that will trigger a series of events that lead to a transcriptional response through a protein which does not interact with the signal. Whereas the lipid soluble signal can penetrate the membrane, diffuse through the cytosol and reach the nucleus where they can affect transcription through a direct interaction with transcription factors.
5) There is much to be learnt about this but, at the moment, the memory appears to lie in the strand specific methylation patterns or/and strand specific segregation of modified histones.
6) Go to Figure 8.14 and use this as a template.
7) The stem cell niche is the physical environment in which stem cells reside. It is usually composed of extracellular matrix and contains signalling molecules. There are many examples, choose one.
8) Draw the elements and link them with positive and negative links. You will be writing down a network.
9) Go to Figures 8.16 and 8.18 and synthesize.
10) Each globin is adapted to the needs of the developmental stage. The switches are mediated by exchanges between enhancers of gene expression acting on common promoter elements.
11) The intestinal stem cell population, like other stem cell populations, is under the control of a balance of self-renewal and differentiation which keeps the differentiated cells in a steady state. Wnt signalling maintains the stem cell population.
12) The answer to this question lies in the figure and has to do with 'redundancy', the ability of functionally related transcription factors to stand in functionally for each other.
13) (1) Cells differentiate when they leave the cell cycle; (2) p21 blocks cell cycle progression, hence its activation will block differentiation; (3) Rb prevents cell cycle progression.
14) The information to consider is in Box8C.
15) For the process of cloning, go to Figure 8.31. It does it because the DNA of the clone is the same as that of the donor differentiated cell, so the reason why it is different is because of the complement of genes it expresses and thereby of its transcriptional activity. The difficulty does say that it is not only the transcription factors that influence the success of the process but their accessibility which is related to the epigenetics.
16) The ES cells are obtained from an embryo, the iPS cells result from the genetic reprogramming of differentiated cells to an ES-like state.
17) The main advantage is that they are donor derived. The main disadvantage is that the process of reprogramming might have generated some epigenetic or genetic defect that will preclude a proper differentiation of the iPS cells and improper physiological activity of the resulting differentiated cells.
18) The information to consider is in Box8G.