**Handout 1; A brief summary**

In the first handout, we tried to focus a little bit on setting the foundations for biochemistry and for the module that lies ahead. We started out very broadly, looking at the term of ‘biochemistry’ and how it influences and is involved in a whole array of branches of science from enzymology to metabolism, structural biochemistry, cell biology and so many more. I showed you some examples of biochemistry in everyday life, for example with diagnostics, and how we might look at blood tests or pregnancy tests or the presence or absence of antigens in our systems all very protein based and diagnostic focused. We then started looking at how cells respond to things, as well as talking about a good example such as how we regulate our blood sugar levels and how we can turn on a specific gene for the expression of a particular protein in certain scenarios and then in other scenarios we can activate something else. So I wanted you to get that idea that we switch on particular genes to make a particular proteins when the need is there. We talked about proteins being such versatile components within the cell and how they carry out a job or a task, but it's so wide-ranging as to what they do. When we looked at the module, we talked through the idea of we would start with Carbon initially, and start building from there. So we treat everything as starting from a flat platform at the early stages with something simple, and we would start to build and grow from there and that's something you'll see throughout the module. But I really wanted to focus on a key few things as we went through the idea, a few principles with one of those to do with proteins actually, and that was that their shape is vital, with one of you saying to me that structure and function are connected and that's a real principle that we really have to emphasise and remember as we go through biochemistry, that the structure function relationship is absolutely critical. If a protein has a particular function job or task or role, its shape will be linked to that and if we change its shape well then it won't be able to carry out its role. So then, I brought it back a little bit when I kind of zoomed out a bit from looking at proteins within cells, and we said well let's talk about cells for a minute to remind ourselves of cells and what you were already aware of from first year. We looked at an animal and a plant cell, and we talked about how we all originated from one cell and all the instructions were inside in one cell for us to survive and grow into an adult and then we focused on the cell cycle and this was something we spent a bit of time on and this idea going from G1 to S to G2 and then to mitosis before again G1 to S to G2 to mitosis and so on. This was something we really focused on because we talked a lot about aspects of the cell cycle that maybe you weren't aware of, such as how many times a cell will go around the cell cycle how long it takes, what happens at each stage. We talked about the importance of checkpoints and how we regulate growth of cells and unfortunately we talked about some situations where this regulation gets disrupted and how this can lead to the progression of diseases. We talked about an amazing entity at the end of our chromosomes called telomeres so we went right back through the history of telomeres and some of the work I had done at the time on telomeres (in a review article) and some of the people that were involved in their discovery and what's the big thing about telomeres. So we spent a lot of time on those aspects so you could get an idea of how a cell grows and how things happen and change, and how our bodies are working as multicellular organisms to make sure that life continues. Once we had those kind of aspects in place we came back to biochemistry again and the different types of molecules we're going to be talking about such as metabolites or nucleic acids or proteins. With regard to the principles kind of ideas, again we were back to structure function, we talked about laws of thermodynamics but another buzzword we talked about was conservation, that if something was conserved it was conserved through evolution and we looked at an example of a protein called TATA binding protein from three different species, but its shape looks the same, the structure looks the same, and again that's back to function. Hence, we began to say well right, OK, if we go right back to the elements and we break it right down and zoom all the way back in now so get your various proteins or whatever molecules and zoom all the way in we'll find carbon often in the center and we stick things to carbon. A lot of you told me and reminded me that Yes you can stick four things, you all knew about the four bonds that you could have and if it was four single bonds onto the carbon and then you can have different bond structures with carbon bonding which gives it some more versatility so we know that C and hydrocarbons, with H, are involved in a lot of these molecules. But I was broadening your eyes to those functional groups again and you were aware of some of them and how functional groups can be attached to these carbon entities and sometimes more than one functional group. This is something that's kind of priming you for the discussions that we're going to have as we progress with proteins we then began to think about the history of biochemistry so we went right back a little bit to look at how X-ray crystallography and nuclear magnetic resonance were used for determining the 3D structure. We talked a little bit about the elements being discovered, we've talked about the in vitro production of ethanol by Hans Buchner, of these enzyme reactions and how he ultimately kind of discovered enzymes because of yeast cell free extracts catalysing reactions in vitro or in glass, and we talked a little bit about water and the importance of water as a ‘molecule’ in our cells and how water is ultimately the, I would just say provides the solvent for all these reactions to occur. Once we built all these molecules that we are talked about then there was one other molecule in the nucleus called DNA, and we're all familiar with DNA but I hope I opened your eyes to some of the history of its discovery and some of the importance of that and the information that we have in DNA, how many genes we have for example, what percentage of our genome is coding for proteins. We began to look at how base pair rule can influence different things and how the information, as you said, for life for the instructions is encoded in the DNA and how do we get that information to become a reality, or a product such as a protein. When we looked a bit more at GCs and ATs we looked at the hydrogen bonds between those so we spent some time on hydrogen bonding and what the importance of it here. We began to read the sequences so that we learned a lot about five prime to three prime reading of DNA and how DNA strands are antiparallel, so if we read one strand in a particular direction five prime to three prime, you should be able to determine the five prime to three prime strand of the complement, or the other strand which we refer to that as the complement. Then we began to think about the idea of sequencing our genomes and how it's become an awful lot more viable these days for the general public as the cost has come dramatically down from along the lines of 100 million, you know down to like 1000 euros and we talked a little bit about companies that are using sequences that they are obtaining from provided samples to try and build personalised medicine, gain insights or build profiles to help treat people overtime or treat particular diseases. Here, we talked about the complications of that, and the ethics of that, and we talked about the potential of that, so there was a lot of elements in that discussion for us to reflect on and really really consider. Overall we set a strong foundation for where we're going to go in our second hand out and hopefully be able to build on this as we start our journey now with proteins. We've started with carbon, we sort of stuck things onto that carbon we talked about functional groups we're going to stick onto them and now we're going to kind of join them together in a way a bit more to make a functional protein. But we've set the foundation on the cells and how they function, the cell's life and how it works, and even the cells death we talked about apoptosis as well in certain situations in order to save kind of the multicellular organism. So quite an array of topics in the first handout and quite a lot I'm sure in your notes around the slides too that you have taken from the things that we discussed in class, because that's going to be key throughout the years that you're keeping some sort of helpful notes for yourself as you go, and next we're going to move as I said into the composition of proteins in the next handout. I hope this helps.