TBP01x - 2.7 - banana 1

Welcome today, and the subject of this unit is bananas. Bananas is a term I have given to stupidities students do with interpretation of their experimental results, by not following proper procedures. The first banana I'm going to talk about is that F_{in} is not equal to F_{out}, but that students do not take that into account. The consequences of such errors I am going to show to you by giving you an example. Suppose that an organism make a compound that is called 6APA and the organism also receive a compound from the outside, called phenyl acetic acid, and this whole molecule is called penicillin. So we are talking about penicillin production by an organism. PAA is supplied from the outside in the nutrient, and PAA is a very expensive molecule, so the important question always is how many moles PAA are consumed per mole of penicilling produced? The student does an experiment, so we have here a steady state chemostat with an inflow. And the inflow is 0.10 m^3/h and it contains 10 mol PAA / m^3 of inflow. The outflow contains the non-consumed PAA, which is 6.3 mol PAA/m^3. The outflow has an $F_{out}$of 0.12 m^3/h, and you see that there is a difference of 0.2 m^3/h which is due to titrant flow for pH control of 0.02 m^3/h. And of course there is penicillin produced, 2.0 mol Pen/m^3. Now the student looks at his data and he comes to the conclusion and he comes to the following reasoning. How much mol of PAA do I consume? I start with 10 mol PAA/m^3 and I end with 6.3 mol PAA/ m^3 so mol PAA/mol Pen equals 10 minus 6.3 divided by 2, because there is no Penicillin present here, and this equals 1.85. The student comes to the conclusion that the organism consumes much more PAA than it builds in into penicillin, so he comes to the conclusion: this organism does very undesirable things with PAA, spending it somewhere else, which is a costly business. So he comes to the conclusion we need to improve the organism using genetic engineering or what else. Now, my claim is completely wrong. Calculation wrong, conclusions wrong, so what is the reality? What we should do is that we come to the conclusion that mol PAA/mol Pen is only defined by the rate of PAA divided by the rate of penicillin production in mol/h. And of course we need to calculate the rate of PAA consumption from the PAA balance in steady state, and when we do that we see that there's an inflow of PAA, which is 0.1 m^3/h, multiplied by 10 moles of PAA/ m^3, so this is 1 mol PAA coming in. How much PAA is coming out? This is 0.12 multiplied by 6.3, so this is the mole PAA leaving, and of course the difference equals the consumption rate of PAA, and we divide it by the rate of penicillin production, which now comes from the penicillin balance. There is no penicillin inflow, there is just penicillin outflow with a rate of 0.12 m^3/h multiplied by 2 mol pen / m^3 . So this is the moles penicillin per hour, this is the moles PAA per hour, and if you make the calculation you come to the conclusion that this equals 1.00. So the end of the story is, if we do the correct approach, we come to the conclusion that our organism is perfect, because it basically only consumes the PAA to couple it to 6APA to make penicillin. So the cell does not do undesirable things with PAA, so from that perspective we don't need to change the organism. So this was banana number 1, so never assume that F_{in} equals F_{out}, because this is usually not the case and you make tremendous errors. Thank you very much.