7.1 A Salty Solution

Hal and Sal discuss the need for salt in our bodies and the origin of salt in the oceans.

HAL: Have you ever tried this sports drink?

SAL: No, I usually prefer water. Those sports drinks always taste too salty to me.

HAL: I am not really a fan either. I wonder why they put so much salt in them. I saw this show last night about two guys that got lost at sea and drifted for weeks in a rubber raft. One of them got so thirsty that he drank the water out of the ocean. He ended up dead and they said it was because he drank the salty water. Hey, I am not going to die if I drink this am I? *(suddenly looking frightened and gazing suspiciously at the drink)*

SAL: Your body needs some salt. You are actually about as salty inside as sea water is—at least the sea water that was in the seas 500 million years ago. When people sweat a lot they lose some salts and those drinks are meant to replace that. They really are not for couch potatoes like you to just sit and drink.

HAL: Hey! *(looking indignant)* I will have you know that I did not sit on the couch once yet today. If we are so salty inside, then why is it harmful to drink seawater?

SAL: For one thing, your kidneys regulate the amount of salt in your body. For the system to work your urine has to be less salty than ocean water. If the water that you drink has a higher salt concentration than that, then your kidneys actually pull water out of your body to dilute the urine. This causes you to dehydrate. That is bad. Eventually your kidneys will shut down and that is not good either.

HAL: It sure would be handy if the oceans would be full of fresh water instead of salty water.

SAL: That would help with our shortage of fresh water on the planet. There are ways of removing salt from ocean water, but it is expensive…and it wouldn't help those folks that get lost at sea.

HAL: Why are the oceans so salty anyway? All of the water that goes into them is fresh. Rivers carry fresh water and rain is fresh water. How did the oceans get so salty?

SAL: First we have to define "fresh water."

HAL: To me it means that there is nothing in the water but H_2O. Nothing else in there. Totally pure.

SAL: That certainly does not describe what is running in rivers or even what comes down as rain. Different elements such as sodium and chloride, which come together to make the compound we use as table salt, and magnesium and other things are dissolved out of rocks and soils as river water runs over them. Even rain can pick things up from the molecules in the air as it falls. So, even the water that we think of as "fresh" has a bit of salt in it.

HAL: But it doesn't taste salty. I have gotten plenty of lake and river water in my mouth when I go swimming. It doesn't taste salty at all.

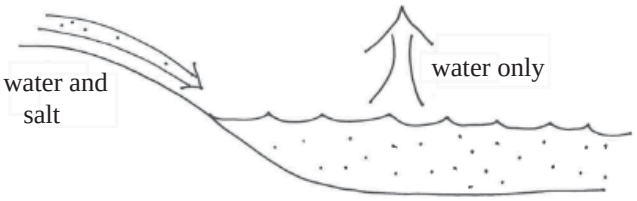
SAL: You could do a little experiment with that. Take some fresh water from your tap and put just a few grains of salt in it. Give it a taste. Do you think you could taste that?

HAL: Probably not, but I might give it a try at home tonight.

SAL: You can keep adding salt a tiny bit at a time and see when you can first taste it. It would be better if someone else gave you the water. Sometimes salty and sometimes fresh so you are not expecting any specific taste. That would be a better experiment. What you would find is that if the concentration of salt is small enough you won't taste it…but it is still there. As it turns out a cubic foot of ocean water contains about 2.2 pounds of salt and a cubic foot of Lake Michigan water contains about 0.01 pounds of salt.

HAL: So rivers and rain carry tiny amounts of salt to the oceans. But there is a BIG difference between 0.01 pounds and 2.2 pounds of salt per cubic foot. I still don't get how the oceans get so salty.

SAL: That mostly has to do with evaporation. Water that evaporates is pretty much just hydrogen and oxygen combined as the water molecule. That "pure" water you talked about. So water that is a little salty goes in and only pure water goes out. Take a look at this sketch I made for you.



HAL: So over time, the oceans got saltier and saltier. Are they still getting saltier?

SAL: As you can imagine, the salinity of the oceans depends on more than just how much salt is going in. It also depends on the amount of water that is coming in. If there is more rainfall, and if more glaciers melt, then there is more fresh water in the oceans to dilute the salt. A warming planet will melt more glaciers which will decrease salinity, but a warmer ocean will also have a higher rate of evaporation which would tend to increase the salinity.

HAL: This is getting complicated. It sounds like the salinity can go up and down depending on climate. I would guess that the salinity of sea water is not the same everywhere either. If melting glaciers add fresh water then the oceans at the poles might be less salty.

SAL: Good thinking! That is indeed generally true. And seas that are warmer and near the equator, especially if they do not have good circulation with the open ocean, tend to concentrate dissolved solids and thus have a higher salinity.

HAL: Once again, systems in nature are more complex, and interesting, that I ever thought.

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