**Hydration and Purification**

This is being written as a supplement to the chapter checklist for 172 and 321 for spring 2020, due to class meeting being limited by the Corona virus. It is approximately what we would have discussed in class and is designed to help your thought process and identify questions to ask. You will still have to add your own knowledge, experience, thinking, and research to complete the chapter assignment. Good luck and embrace geeking out on an important topic.

1. **How does hydration affect physical and mental functioning?** Humans might deal better than other mammals with dehydration, and can be better at ignoring it. One theory is that it helped us when we used to run down prey for our dinner, having to go back to the river for a drink regularly probably didn’t help much with that. Our drive to drink may be lower and less accurate. One study showed that a significant part of the population mistakes thirst (the body telling you it’s is dehydrated) for hunger and eat instead of drink. However, a few % loss of body fluids/dehydration has a much bigger % effect in reducing physical and mental capacity. We don’t need to be 100% all the time but sometimes we do (especially in adventure sports) and we need to realize that our abilities might be reduced. If we get too dehydrated, we die, this can happen pretty quickly. Although people have survived for longer in extreme situations it’s usually quoted as 3 days. This is obviously (hopefully) very dependent on lots of factors such as individual physiology, environment, activity level.
2. **What are the signs and symptoms of dehydration?** 
   * Feelings/sensations (thirst, headache, light headed, cramps, etc.)
   * skin/appearance (this will change depending on the level of heat stress, it might appear cold and clammy which is kinda misleading)
   * pee and poop
   * heart rate/pulse
   * loss of weight
   * sweating stops.
3. **Staying hydrated. How much? How often?**
   * Humans can lose more liquid (sweat, pee, poop, diarrhea, etc.) per hour (hint – Google “maximum lost through sweat”) than we can replace in an hour (hint – Google “max water absorption per hour”)
   * We generally wake up at least a little dehydrated
   * We can deal with being in fluid debt for a while but once dehydrated it can take 24hrs or more to rehydrate
   * If we are active and especially in certain environments, we need more water than the standard recommendation
   * The standard recommendation is often based around the ratio of 1ml water per calorie and the standard 2500cal per day recommendation, if we are working hard we probably need more calories so we probably need more water, even before sweating and all that stuff. Meaning, if we are taking a lot of calories in our drink (energy drinks, Gatorade, etc.) we probable aren’t getting as much hydration as we think.

We need to take all of these factors into account with our hydration plan. Start drinking as soon as you wake up, drinking/hydrating is a JOB. You should obviously drink enough but there is little point in drinking too much, it takes our body time to absorb fluids you’ll just pee it out rather than rehydrating yourself. A little too much to make sure is probably ok but you can die from drinking too much (see hypo natremia below). Make it easy to drink. Make the drink taste good. Set an alarm to remind yourself. Measure what you drink. Get to know your body, weigh yourself before and after a work out how much did you sweat off, how do you feel when you are dehydrated?

1. **Why electrolytes?** Essential to keep electrical signals movingbetween brain and body (reminding you to breath etc.) as well as other important functions. Sodium is the most common one but there are others and they are all important. In normal life we can replace electrolytes through eating a well-balanced diet. When we are losing electrolytes through sweating etc., drinking a lot of water, and or not eating well we might need to replace electrolyte in some other way. While we are talking about salt, we all know drinking seawater is not good as it has too much salt, however adding salt to diet/liquids (in the right amount) helps you retain water/avoid dehydration for longer, lots of athletic drinks utilize this, lots of cool sciency stuff about cells and osmosis, etc. Salt (table salt etc.) also contains chlorine, hence its chemical name - sodium chloride. Amongst other things is aids or is essential for: transporting oxygen/carbon dioxide/nutrients, maintaining fluid and acid balance, nerve impulses, breathing, heartbeat, muscle contractions, digestion, senses (taste, smell, touch). We are generally encouraged to reduce the salt in our diet as the average western diet has too much salt (and other stuff) for the average western lifestyle. However, if we are not eating an average western diet and or not leading an average western lifestyle we may need to reconsider this advice. Too much salt is bad but so is too little.
2. **Metabolize calories.** There seems to be plenty of places talking/writing about needing 1 ml of water to metabolize 1 calorie but I couldn’t find any peer reviewed papers talking about it. Also, there is Metabolic Water which appears by magic inside of us when we metabolize food, there are quite a few papers about that. I’m confused, can anyone explain?
3. **Choosing sources of water?** Visual, moving or not, temperature, where is it from, surface or deeper down (UV, algae, etc.)?
4. **What are the advantages or limits of different treatments?** Weight (think about it, don’t just repeat the book/website that says filters are light and quick and boiling isn’t)**.** Time. Temperature. How much do you need? Cost. Convenience. **What treats what?** What is there to treat, living organisms, chemicals, minerals. **Pre-filtering** why is this important? Its different for different methods e.g. filters clog, bad stuff hides from chemicals or UV, etc. **, chemical** iodine is not recommended or banned in a lot of the world, long term health impact has been known for a while but evidence of short term use issues as well. Chlorine and Chlorine Dioxide (CD) are not the same. CD is not slower than Iodine (even if a lot of sources say it is.), it will treat what iodine does in around the same time and treats stuff iodine does not if you give it longer. CD does not taste bad, another example of a source confusing iodine with chlorine. Drops are generally cheaper than tablets but tablets have some advantages (correct dosage etc.). A student a while ago refused to use CD, they had worked in a swimming pool and knew that it could produce a very dangerous gas, they were correct but had maybe forgotten to take into account the dosage and delivery method being used for backcountry water treatment. Also, the fact that there are plenty of other dangerous substances that we use that are safe if we use them properly.**, filters** might not be as fast, light or convenient as the sources say, might need to plan how to use especially f part of a group **, pore size** how small a thing will it filter out, and how small are the things we want filtered out? are they all the same size?**, UV** doesn’t kill, organisms can re-activate**, forward/reverse osmosis** maybe the only one listed here that can deal with salt/sea water, can deal with really nasty water and a lot of other stuff that filters/boiling/chemicals don’t. It is available in a backpack friendly format (see link to HTI on Useful Stuff)**, flocculation** can deal with really nasty water and a lot of other stuff that filters/boiling/chemicals don’t. It is available in a backpack friendly format (see link to Day One on Useful Stuff)**, boiling** Does it really need to boil for five minutes? Effect of altitude? If you are going to say it is time consuming and heavy because it uses fuel you need to justify/compare to other methods (you should be doing that in general anyway)**.**

**With all of these you need to identify how to use them correctly. Avoiding cross contamination (dirty stuff touching clean stuff) and not cleaning all of it (water bottle threads, nasties hiding in bits, etc.). Time. Effect of cold or freezing.**

**Maybe identify which would be more appropriate for different environments/needs.**