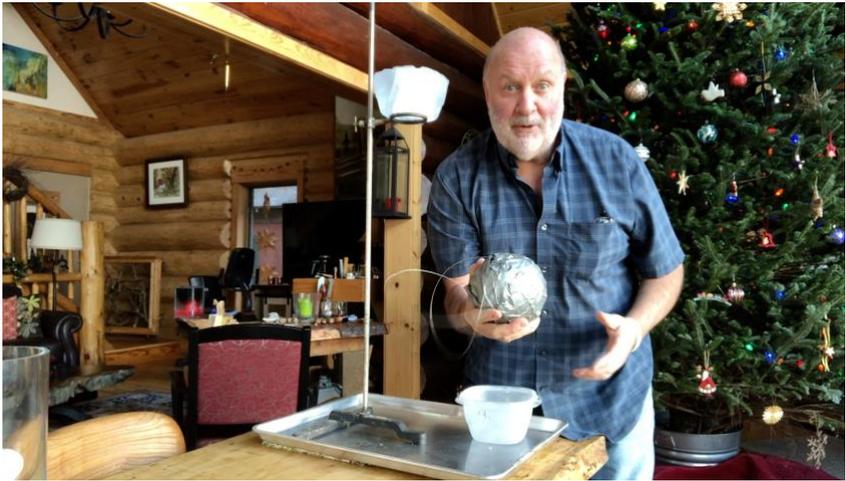


# Science Lesson #19

## *Wonderful Water!*

### (Your Scientific Lens)

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### [Introduction to Fables and Science](#)

#### **Today's Lesson**

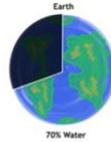
The language of hard science constantly bumps into the language of wonder and beauty as if you were speaking-in-fables (see [\[Fable #133\]](#)) It is like learning another language, or like looking through a different lens (see [\[Fable #138\]](#)). Here's the point: a scientist should keep her objectivity, but not make that her objective. A scientist's objective is good OBSERVATION - and she aims for this with an unbiased pursuit of the truth.

## A Few of Water's Amazements

- **The Earth and the Human are mostly water.**

### Water

Earth's Body ... Human Body



- **The water on the planet recycles but stays here to be shared forever.**

SCIENCE PRESENTATION/SIMULATION  
 LEIB ESTIMATES THE AMOUNT OF  
 WATER IN A SINGLE GLASS, THAT  
 WAS CAI CE DRUNK BY

**ADVANCED SCIENCE SEMINAR**  
MAY 2

**QUESTIONS** (on a single glass?)

- AMOUNT OF WATER DRUNK BY
- AVERAGE LIFE = 70 YRS
- HUMAN DRINKS ~ 6 GLASSES/DAY
- GLASS IS ~ 8 OUNCES
- 1 OUNCE ~ 30 mL
- 1000 mL WEIGHS 1g (OF WATER)
- 1 MOLE WATER WEIGHS 18g
- $6 \times 10^{23}$  MOLECULES = 1 MOLE
- AVERAGE AMOUNT OF WATER ON EARTH = A BILLION CM<sup>3</sup>
- 1 YR = 365 DAYS
- 1 CM<sup>3</sup> = 1 mL
- 100 CM = 1 m
- 1000 m = 1 km

**ESTIMATE:** # OF MOLECULES OF WATER IN A SINGLE GLASS DRUNK BY

QUESTION: DO THESE ALL IN #S OF MOLECULES

$$\frac{5 \times 10^{23} \text{ MOLECULES}}{8 \times 10^8 \text{ MOLECULES}} \times \frac{4 \times 10^8 \text{ MOLECULES}}{1 \text{ GLASS}} = \frac{4 \times 10^8 \text{ MOLECULES}}{1 \text{ GLASS}}$$

This means 400 million molecules of the next glass of water you drink will be shared by (PERSON).

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①  $\frac{10 \text{ YRS} \times 365 \text{ DAYS} \times 6 \text{ GLASSES} \times 8 \text{ OUNCES} \times 30 \text{ mL} \times 1 \text{ g} \times 1 \text{ mole}}{1 \text{ LIFE}} \times \frac{1 \text{ mole}}{18 \text{ g}} = \frac{6.2 \times 10^{23} \text{ MOLECULES}}{1 \text{ LIFE}}$

②  $\frac{3 \times 10^8 \text{ MOLECULES}}{1 \text{ EARTH}} \times \frac{10^8 \text{ L} \times 10^3 \text{ CM}^3 \times 1 \text{ mL} \times 1 \text{ g}}{1 \text{ L}} \times \frac{1 \text{ mole}}{18 \text{ g}} = \frac{1.5 \times 10^{20} \text{ MOLECULES}}{1 \text{ EARTH}}$

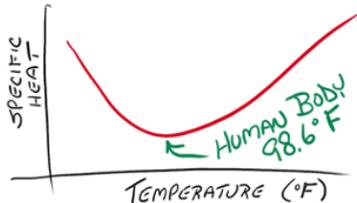
③  $\frac{8 \text{ GLASSES}}{1 \text{ GLASS}} \times \frac{30 \text{ mL}}{1 \text{ OUNCE}} \times \frac{1 \text{ g}}{1 \text{ mL}} \times \frac{1 \text{ mole}}{18 \text{ g}} = \frac{8 \times 10^8 \text{ MOLECULES}}{1 \text{ GLASS}}$

John Deeken, Inc.

Memoranda

- Specific Heat of Water:** The sensitivity of water to heat, in other words, the amount of energy that it takes for water to change its temperature varies according to whether the water is hot or cold. It is at its most sensitive spot (lowest specific heat capacity) at the human body temperature of 98.6° F or 37° C.

## Specific Heat



- **Regelation** (found by Michael Faraday)
  - many other materials contract under pressure, but ice melts
  - recent study by Zhang and associate scientists in 2015 says that this is related to **water's specific density**, expanding from 4 degrees Celsius down to ice, and also related to **water's specific gravity** - "Regelation, i.e., ice melts under compression and freezes again when the pressure is relieved, remains puzzling since its discovery in 1850's by Faraday. Here we show that hydrogen bond (O:H-O) cooperativity and its extraordinary recoverability resolve this anomaly. The H-O bond and the O:H nonbond possesses each a specific heat  $\eta x(T/\Theta D x)$  whose Debye temperature  $\Theta D x$  is proportional to its characteristic phonon frequency  $\omega x$  according to Einstein's relationship." In concluding their paper on this study, they use words to describe water

that almost sound to me like they were talking about a living being. “The O:H-O always tends to recover from its higher-energy state to initially lower state. Coulomb repulsion between electron pairs on adjacent oxygen ions and the O:H-O bond segmental disparity form the soul dictating its **adaptivity, cooperativity, sensitivity, memory and recoverability** when subject to stimulus.

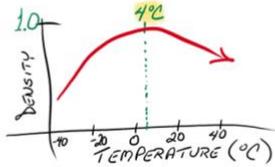
Observations may extend to damage recovery of living cells of which O:H-O bond dominates.”

(Zhang et al., 2015)

- *thus glaciers can move on a layer of water*
- *water from glaciers can flow to other areas that are in freezing temperatures*
- ***Heat of Fusion of Water:*** The night a pond freezes, the water gives up 1 calorie for every gram that drops 1 degree Celsius. But it gives up 79.7 calories - nearly 80 times as much - when it turns into the lattice formation we call ice. This is called the *Heat of Fusion* for water. What this means that the night the pond formed an ice layer on top, it gave a great amount of heat to the surrounding animals and plants, just at the time they needed it.
- ***Specific Density of Water:*** One affect is to Frozen Ponds in Winter ...

Water that is under ice is very interesting. Water does a trick that is very different from most of the rest of nature. Water begins to expand as its temperature goes from 4° down to 0° Celsius. This

## Specific Density

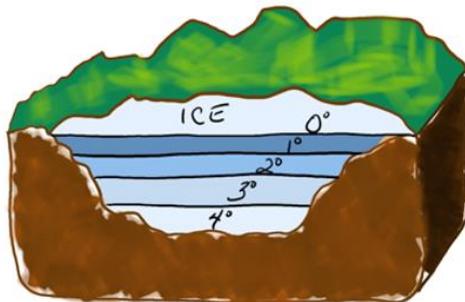


is why ice cubes float.

Therefore, as a pond drops its temperature below 5°, the densest, heaviest water is 4°, so that sinks to the bottom of the pond. The next

layer up is 3°, then 2°, then 1°. The ice, at 0° is on top, which expands so much that it leaves a layer of air. The ice and air layers on top insulate the water below so that any pond or lake that does not completely freeze can experience ambient air temperatures above that are below zero and stay relatively warm below the ice.

## The Frozen Pond



[\[Play video here to see live demonstration.\]](#)

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## **Here's a provocative thought...**

I have two questions here. Did the inhabitants of the Earth and the Water and the Air and the Sun - you know, the elements and plants and animals and humans evolve to take advantage of this incredibly intricate and numerous set of factors that help each other, or did a spiritual world see to it that this occurred? And my second question is ... is it this wonderful in other parts of the solar system, the galaxy and beyond?

Here are some fables that deal with this whole idea: [[Fable #20](#)] [[Fable #27](#)] [[Fable #44](#)] [[Fable #88](#)] [[Fable #90](#)] [[Fable #92](#)] [[Fable #120](#)] [[Fable #133](#)] [[Fable #138](#)] [[Fable #139](#)] (Bickart, 2020a, Volume 1; 2020b, Volume 2; 2020c, Volume 3).



## #138 *The Lens*



*There once lived an entire family in a tiny house at the base of a lighthouse. In the lighthouse was a great, bright light.*

*Surrounding the light was a wonderful set of glasses, called LENSES - as big as windows and as thick as your arm. Each glass had the special property of being able to focus the lighthouse light and send it out into the ocean very far as a beam. Ships could see this beam and know that they were near land, so that they should take care not to crash into the rocks at the edge of the land.*

*There was a boy named Henry who lived with the family in the lighthouse. One day, Henry invited his friend, Jack, to come and stay for the week. Henry was quite excited because he and his family lived alone at the edge of the land and sea and he loved to have friends over. Jack was excited to visit a real lighthouse and to see the mighty light and the magical lenses. When Jack arrived, Henry ran out to greet him, and of course you know what they did first. Henry got permission from his parents, then took*

*Jack right to the top of the lighthouse. Up 69 steps and there it was! The light was bigger than Jack, himself! When he saw the lenses, he said they looked like great windows. The boys played in the lighthouse, then they played in the yard, then they went into the house to play a bit more before dinner.*

*After dinner, Henry's father and mother introduced Jack to a very different game they loved to play. They pretended to put glasses on. They pretended the glasses had a magical LENS like the ones in the lighthouse. Then, they would look around and try to shine some light on something new and wonderful. Henry's mother took the first turn. "Ok, I'll look at the water that is all round us. An ordinary way to view water is to say that we see it every day and drink it and wash with it and swim in it. But to look through the LENS, I observe that water MEANDERS! That's right, it winds back and forth as it runs. It goes in twisting, curving paths." Henry's mother jumped up and poured water down a tilted plate. It meandered left and right. His mother continued, "Rain twists. Rivers and streams and waterfalls meander. And if you observe water carefully, you can see that the meandering and twisting are always the beginnings of circles." Now she jumped up and ran to the window, "Come and look at the sea with your magic lens! Look at the circles! The ocean waves are coming into the shore with a curling motion that is always starting a circle, then crashing on the rocks!"*

*Next, it was Henry's turn. He thought for a few moments, then jumped into the game saying, "I've got one. Although water is soft, it can crash on the rocks outside and make them smooth!" That's a good one!" said Henry's mother. "And, I'll add that if water gets in the cracks of rocks and freezes, it is strong enough to break them apart," joined in father. All this time, Jack was listening. Now, he spoke up, "I think I have a way to see water through the magic lens that my mother told me once. She said that I was born after she carried me in water in her womb when she was pregnant. She said it was like magic that it was water*

*that kept me warm, protected my body, and carried all the food and drink I needed.” Henry and his father and especially his mother sat back in appreciation. “Jack,” Henry’s mother said in a soft voice, “even though you just learned our lens game, you have touched our hearts, tonight.”*

**WHAT LENS ARE YOU LOOKING THROUGH?**

# *The Lens*

## Why Use Fables to Teach Science?

### Conversation Starters

- Do you have a favorite family or friend that you like to visit?
- Do you have someone you talk to about important things - interesting things - exciting things - troublesome things?
- Does this friend or family you can talk to cause you to see things in a new way that you did not see on your own?
- Is there any part of nature that you have taken for granted because you are so used to it that you don't really give it much attention?

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### References

- Bickart, J. (2020a). *Bickart's Just-in-Time Fables (Volume 1)* (Vol. 1). Asheville, NC: Red Shirt Interactive Group.
- Bickart, J. (2020b). *Bickart's Just-in-Time Fables (Volume 2)* (Vol. 2). Asheville, NC: Red Shirt Interactive Group.
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