Thoughts Out of Season
Occasional Reviews and Notes
Of Mutual Interest
Compiled by Tim Froward

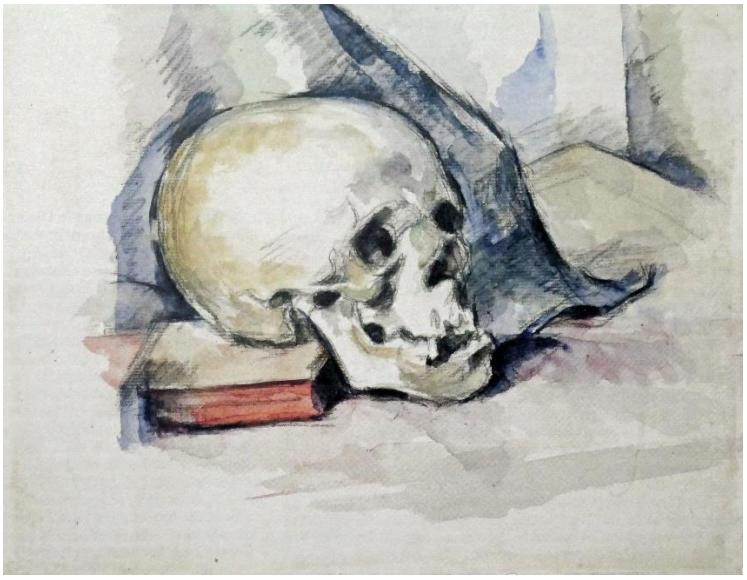

Fig. 1[1]

Headbone connected to the . . . jawbone . . .

An experiment revealed that chomping on slightly tougher material requires markedly more energy. Spending less time on mastication may go hand in hand with human evolution.

Humans spend about 35 minutes every day chewing. That adds up to more than a full week out of every year. But that's nothing compared to the time spent masticating by our cousins: Chimps chew for 4.5 hours a day, and orangutans clock 6.6 hours.

The differences between our chewing habits and those of our closest relatives offer insights into human evolution. A study published Wednesday in the journal Science Advances explores how much energy people use while chewing, and how that may have guided — or been guided by — our gradual transformation into modern humans.

Chewing, in addition to keeping us from choking, makes the energy and nutrients in food accessible to the digestive system. But the very act of chewing requires us to

[1] Jodi Hauptman and Smantha Friedman (Editors). *Cézanne Drawing* (New York: The Museum of Modern Art. 2021) 79. Scull and Book by Paul Cézanne. c. 1885. Pencil and watercolor on laid paper, 9 x 12" (21 x27.2 cm)

expend energy. Adaptations to teeth, jaws and muscles all play a part in how efficiently humans chew.

Adam van Casteren, an author of the new study and a research associate at the University of Manchester in England, says that scientists haven't delved too deeply into the energetic costs of chewing partly because compared with other things we do, such as walking or running, it's a thin slice of the energy-use pie. But even comparatively small advantages can play a big role in evolution, and he wanted to find out if that might be the case with chewing.

To measure the energy that goes into chewing, Dr. van Casteren and his colleagues outfitted study participants in the Netherlands with plastic hoods that look like "an astronaut's helmet," he said. The hoods were connected to tubes to measure oxygen and carbon dioxide from breathing. Because metabolic processes are fueled by oxygen and produce carbon dioxide, gas exchange can be a useful measure for how much energy something takes. The researchers then gave the subjects gum.

The participants didn't get the sugary kind, though; the gum bases they chewed were flavorless and odorless. Digestive systems respond to flavors and scents, so the researchers wanted to make sure they were only measuring the energy associated with chewing and not the energy of a stomach gearing up for a tasty meal.

The test subjects chewed two pieces of gum, one hard and one soft, for 15 minutes each. The results surprised researchers. The softer gum raised the participants' metabolic rates about 10 percent higher than when they were resting; the harder gum caused a 15 percent increase.

"I thought there wasn't going to be as big a difference," Dr. van Casteren said. "Very small changes in the material properties of the item you're chewing can cause quite substantial increases in energy expenditure, and that opens up a whole universe of questions."

Because chewing tougher food — or in this case, tougher gum — takes significantly more energy, these findings suggest that the metabolic costs of chewing may have played an important role in our evolution. Making food easier to process through cooking, mashing food with tools and growing crops optimized for eating might have dialed down the evolutionary pressure for us to be super-chewers. Our evolving chewing needs may have even shaped what our faces look like.

"One thing that we haven't really been able to figure out is why the human skull is so funny-looking," said Justin Ledogar, a biological anthropologist at East Tennessee State University, who was not involved with the study. Compared to our closest relatives, our facial skeletons are delicately built with jaws, teeth and chewing muscles that are all relatively small. "All this reflects a reduced reliance on forceful chewing," he explained. (See Fig 1.)

But he added that our flatter faces and shorter jaws let us bite more efficiently. “It makes the whole process of feeding just metabolically less costly,” Dr. Ledogar said. Humans developed ways to chew smarter, not harder. Dr. van Casteren, who hopes to continue his research using actual foods, says he’s excited by the prospect of learning more about how humans evolved.

“To know about the environmental and societal and dietary causes that led us to get here, it’s just infinitely interesting to me,” he said, because it enables humankind to “try and work out the foggy road ahead.”[2]

[2] Golembiewski, Kate. (2033, August 28). *How Chewing Shaped Evolution*. New York Times Daily Edition for Kindle Edition, Science Times.