Is Cold Brew *Really* Different from Iced Coffee?

By Wynne Parry

Maybe you start your morning with a hot cup of coffee, or maybe you grab one later in the day to get through afternoon classes or a late study session. If so, you are in good company: More than half of adults and 37% of teens drink this energy-boosting beverage every day, according to recent surveys.

And perhaps you have also tried cold brew—a type of coffee that has gained popularity in recent years.

"I'm blown away by how much of it we sell," says Brian Niles, the roaster and owner at House Cup Coffee Roasters in Havertown, Pennsylvania.

He offers cold brew in half-gallon and gallon jars, or mixes it with nitrogen gas to create a frothy drink called a nitro. Options like these are now common at coffee shops, and it's easy to pick up a bottle at a grocery store or find a brew-it-yourself recipe online.

Not just cold coffee

Although it's chilled, don't mistake cold brew for regular coffee served over ice. The latter is called iced coffee and is made by brewing hot coffee—bringing ground coffee beans into contact with hot water—and then adding ice.

"It's a very different process than cold brew," Niles says. Cold brew uses cooler water and takes much longer to make, producing coffee often described as smoother, sweeter, and less acidic than its hot-brewed counterpart.

"A lot of people come in here and say, 'can I have an iced coffee?' and I usually try to talk them out of it," he says.

Anyone who's consumed much hot-brewed coffee knows that it's best when freshly made. However, to make iced coffee, it has to cool, and, in the process, its flavor can change, sometimes in unappealing ways. One reason for this is that the volatile organic compounds, which carry aromas into your nose, evaporate as the coffee sits. Cold brew's flavor remains stable for much longer.

Connoisseurs have taken notice. In 2016, the National Coffee Association (NCA) began asking people about their cold brew drinking habits in its annual survey. That year, 8% reported drinking cold brew in the past day. In 2019, that number increased to 13%.

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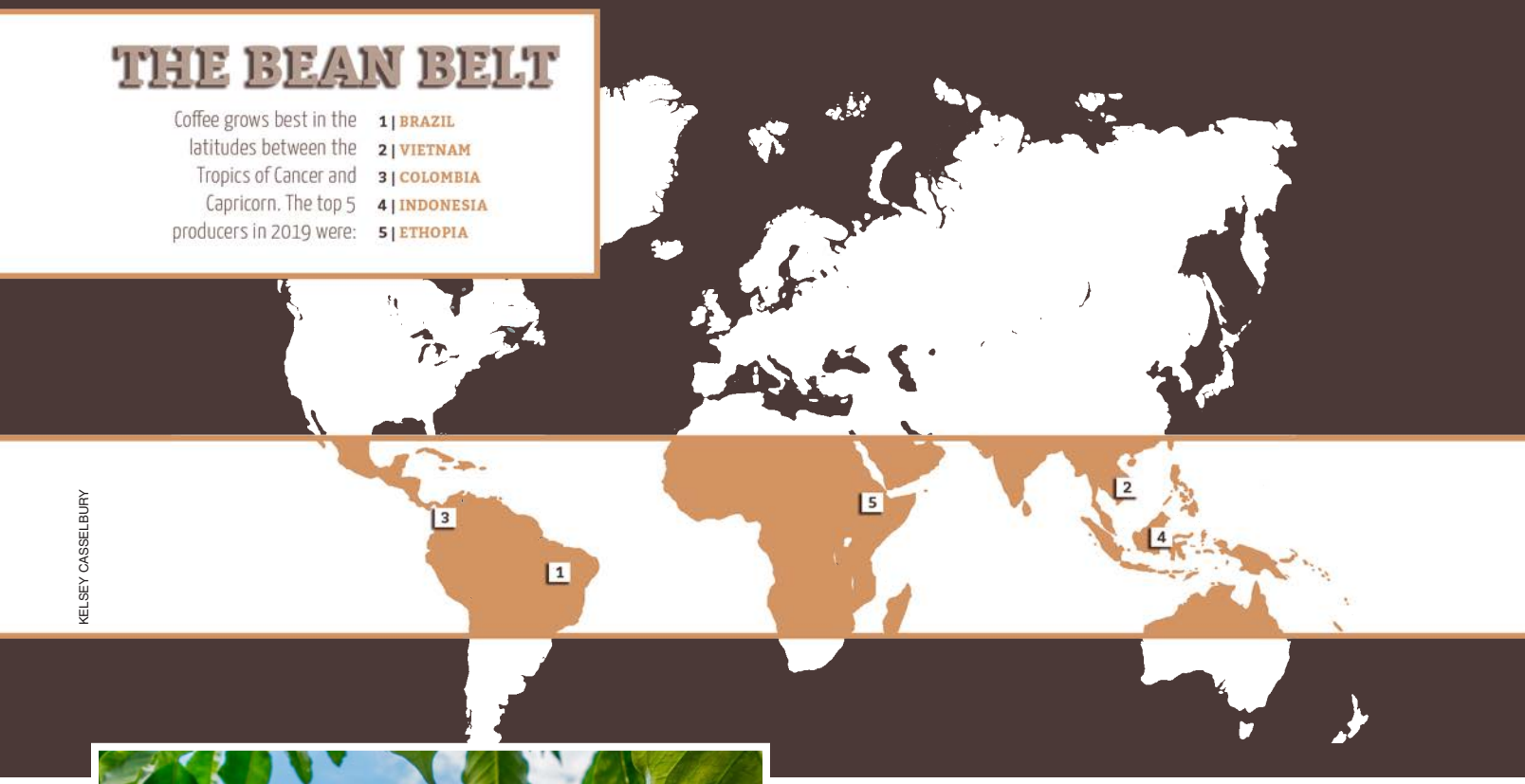

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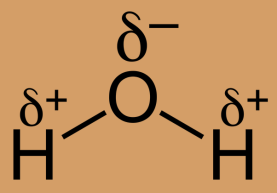
DEPOSIT PHOTOS

The dark brown coffee beans you're probably familiar are actually seeds from coffee cherries, which start out green and turn red when ripe.

How polarity makes for good coffee

Water is the solvent in coffee. Because water molecules are polar—they have a partial positive charge on one side and a partial negative charge on the other side—they attract other polar molecules, including those residing in coffee grounds. The coffee molecules that diffuse out of the grounds and dissolve in water are responsible for the taste and aromas of coffee. Grinding the beans increases their surface area, aiding in the transfer of molecules with particular flavors or aromas to your mug.



Cold brew has caught on with scientists, too. As its popularity has risen, studies have begun exploring the processes that occur during brewing and the characteristics that result. But to understand cold brew, and coffee in general, you have to start at the source.

From seed to bean

Coffee beans are seeds produced by species of waxy-leaved trees that grow between the Tropics of Capricorn and Cancer. The two most economically important varieties of coffee are: *Coffea arabica*, which produces the more expensive, mild, lower caffeine Arabica coffee, and *Coffea canephora*, the source of harsher-tasting, higher caffeine robusta coffee.

The trees produce fruit called cherries, each of which typically contain two seeds—the coffee beans. The variety of the plant, the soil, weather, altitude, and how the beans are processed, all influence the character of the coffee you drink, according to the NCA.

But first, these greenish beans must be cooked, or roasted. Roasting drives an enormous number of reactions within the beans, breaking down some compounds and creating new ones.

During roasting, the beans darken and become puffier. At first their acidity rises, then, after reaching a light roast, it declines. Chlorogenic acids make up one of the main groups of acids in green coffee beans. These acids break down during the roasting process, lowering the acidity. Also, the faint grassy odor of the green beans gives way to other aromas as volatile compounds within the beans degrade, and new ones form. If roasting progresses long enough, a nutty burnt smell dominates. While caffeine content generally stays constant during roasting, a small amount may be lost.

Extracting coffee from beans

Niles makes batches of cold brew in a 10-gallon container by immersing 5 pounds of a special house roast in cold water. He arrived

at this method through trial and error, the same way he formulated the roast, a mix of Brazilian, Nicaraguan, and Colombian beans.

"What I love about coffee is that it is an art and a science," he says.

While the art of coffee may involve tinkering and tweaking, science defines brewing, both cold and hot, as an extraction.

Comparing brews & roasts

After trying cold brew for the first time, Niny Rao, an associate professor of chemistry at Thomas Jefferson University in Pennsylvania, tried making some herself. "It didn't taste as good as I remembered," Rao says. "I was like, 'What can I do to make this coffee better?'"

This kitchen experiment led her to study cold brew in her lab. In research published in the journal *Foods*, Rao and her colleagues explored how hot coffee extractions differ from cold ones, using lightly roasted beans, as well as medium and heavily, or darkly, roasted ones.

With so many variables to account for, the researchers needed to keep other aspects of brewing the same. This meant using the same ratio of grounds to water for the six types of coffee they made.

However, cold brew is typically made with more grounds, generating more concentrated coffee that is often diluted with milk or water. In these experiments, the researchers made hot brew using cold brew proportions, rendering their hot coffee undrinkable. Beyond the big differences in flavor, Rao found that compared to hot brewed coffee, cold brew was less acidic, and had lower levels of antioxidants and other compounds.

The differences they uncovered show that cold brew is more than just a much slower version of hot brew.

"During the roasting process, you are creating compounds that are selectively soluble," Rao says. "If something's not soluble in cold water, no matter how long you let it sit, it's just not going to come out."

If these results don't make you want to change your coffee habits, Rao understands. "In terms of drinking, I always tell people 'drink what you enjoy,'" she says. Rao is still tinkering with her own home-brew recipe.

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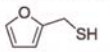
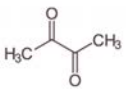
WHAT HAPPENS DURING ROASTING?

PROCESS	WHAT IS IT?	WHEN IT OCCURS	THE RESULTS
Maillard reaction	Carbonyl groups from sugars and amino groups in proteins react to form aroma and flavor compounds.	150 to 200°C (302 to 392°F)	Coffee flavor compounds form, including 2-furfurylthiol (roasted flavor):  2-FURFURYLTHIOL
Caramelization	Sucrose browns and releases caramel-smelling compounds	170 to 200°C (338 to 292°F)	Caramelized compounds form, including diacetyl (butterscotch flavor):  DIACETYL
First crack	Water inside the bean vaporizes, causing the bean to expand and crack. You can even hear it!	205°C (401°F)	Light roasts finish around this point.
Pyrolysis	Chemical reactions release CO_2 and other compounds.	220°C (428°F)	In addition to CO_2, acetaldehyde forms (green apple aroma):  ACETALDEHYDE
Second crack	Cellulose in the bean's cell walls break apart, resulting in the second crack and the release of aromatic compounds.	225 to 230°C (473 to 446°F)	Dark roasts stop around here.

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The time versus temperature trade off

Hot brewing happens quickly because warmth typically—but not always—increases the solubility of solid solutes, meaning more of a substance will dissolve in a given amount of solvent.

That's because the dissolved substances require energy to break up the interactions among water molecules. The dissolved substances can then slide in between water molecules. Warmth also increases the rate at which these compounds diffuse from a high concentration within the grounds to a low concentration within the water.

	Hot Brew	Cold Brew
Temperature	91 to 96°C (195 to 205°F)	25°C (77°F) or colder
Time	20 seconds to 5 minutes	8 to 24 hours