ENTANGLED CULTURES

How Humans and Microbes Co-create through Fermentation

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GLOSSARY

Maxwell Museum of Anthropology

THE UNIVERSITY OF NEW MEXICO

FERMENTATION GLOSSARY

A

ADH4
Also known as the alcohol dehydrogenase gene, ADH4 is an enzyme found in human livers that helps metabolize ethanol. Paleogenetic research argues that the ADH4 gene demonstrates that Hominids adapted to metabolize ethanol circa 10 million years ago, long before human-directed fermentation.

A'qa
A Quechua term for alcoholic beverages, mostly made from fermented corn, but also other fermented grains, tubers, fruits, and herbs. Now commonly referred to as "chicha" in Spanish, A'qa was one of several types of intoxicating beverages ritually consumed by the elite class in pre-Inca Peruvian cultures such as the Wari.

Acocote
Adapted from the Nahuatl words for throat and swallow, an acocote is a siphon made from an elongated bottle gourd (*Lagenaria siceraria*) that has been used for over 2,000 years in central and southern Mexico to extract nectar from agave plants before it is fermented into pulque.

Adjuvant
A substance that enhances the fermentation process and the texture, appearance, and aromas of its products. For example, by promoting microbial growth, adjuvants can speed up fermentation and increase the output of carbon dioxide, which helps bread rise, or they can increase alcohol content and modify flavors in beers and wines.

Airlock
A device that releases carbon dioxide during fermentation while keeping out undesirable microbes that cause spoilage or illness.

Amphora (Amphorae [plural])
Unglazed ceramic storage vessels that are commonly long and narrow with pointed bottoms, small openings, and two handles, used by ancient Roman societies throughout the eastern Mediterranean to store and transport ferments such as wine, olive oil, and garum.

Amylase
An enzyme that breaks down complex carbohydrates like starch, into simple sugars.

Amylolysis
The process of breaking down complex carbohydrates into simple sugars, usually by the amylase enzyme; crucial to microbial fermentation of grains and for human digestion.

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A

Anaerobic
Means, without oxygen. Restricting oxygen is one of the most important environmental factors that people seek to control in the fermentation process because it encourages the growth of desirable microbes like lactic acid bacteria, while keeping out undesirable microbes that cause spoilage like acetic acid bacteria.

Aquilla
A ritual vessel made of metal used by the elite class for drinking fermented corn beer throughout the Andes in ancient Peru, Bolivia, and northern Chile; a metal kero.

Autochthonous
Originating from the place where found; indigenous.

Autolysis
The breakdown of all or part of a cell or tissue by self-produced enzymes.

B

Backslopping
A technique used to start a new fermentation by keeping a small portion of a previous fermentation to inoculate fresh substrate; a starter culture.

Biomolecular Archaeology
The molecular study of ancient organic remains including DNA, lipids (fats), carbohydrates (starches and sugars), and other residues collected from archaeological sites and vessels. Used to reconstruct paleoenvironments and provide insights into human biological and cultural evolution, such as the domestication of plants and animals, ancient diets, and past culinary practices.

Bioreactors
Specialized vessels that provide a controlled environment for the growth and cultivation of microorganisms—particularly fermenting bacteria—as well as plant and animal cells, or tissues that are used for a variety of purposes such as the production of pharmaceuticals, vaccines, biofuels, and food products, or to break down waste, like sewage or compost.

Biotechnology
The industrialized combination of natural sciences and engineering to solve large scale problems and manufacture helpful products using living organisms and biological processes.

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B

Brine
Water that is saturated with salt. Salinity is one of the most important environmental factors that people seek to control in the fermentation process because it encourages the growth of desirable microbes like lactic acid bacteria, while keeping out undesirable microbes that cause spoilage or illness.

C

Chicha
A Spanish term that refers to the many types of fermented corn drinks made throughout the Andes, mostly in Peru, but also Bolivia, and northern Chile.

Commensal Microbes
Microorganisms, most commonly bacteria and yeasts, that naturally live on the surfaces of plants, animals, and people, and which obtain food and other benefits from their hosts without harming them; symbionts.

E

Endophyte
A microorganism, such as a bacterium or fungus, that lives inside of a plant.

Endosymbiont
A form of symbiosis in which one symbiont lives within the body of its symbiotic partner.

Entanglement
The condition of being inextricably involved; a complex relationship.

Ethanol
A colorless, flammable, and intoxicating liquid produced by microbial fermentation of sugars; alcohol.

Enzyme
Protein molecules that act as biological catalysts for cellular metabolism, and which regulate chemical reactions in organisms, including the digestion of food and production of energy.

Ethnomicrobiology
An interdisciplinary field of research that studies the relationships between microbes and human cultures and the interplay between micro and macro worlds.

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E

Eukaryote
An organism composed of one or more cells that each contain true nuclei (meaning, they house the organism's genetic material in the form of DNA) and membrane-enclosed organelles specialized in energy transformation. All animals (including humans), plants, fungi, and most algae are eukaryotic.

Ewer
A vase-shaped pitcher used for serving wine.

G

Garum
Derived from "garos," the Greek name for a small but now unknown species of fish, garum is a salty, savory, ad highly aromatic fermented sauce beloved by ancient Greeks, Romans, and other cultures throughout the Mediterranean.

Glycolysis
The enzymatic breakdown of a carbohydrate; one of the methods cells use to produce energy.

H

HCA3
This gene helps humans digest fermented milk products like cheese and yogurt.

Heterofermentive
A fermentation process wherein one type of microbe creates a variety of end products from a common substrate. For example, when lactic acid bacteria breakdown wheat flour to produce lactic acid, acetic acid, carbon dioxide, mannitol, and ethanol.

Holobiont
This concept argues that eukaryotic organisms are not autonomous individuals. Rather, the development, growth, and health of a host and the full assemblage of their commensal microbes that live in, on, and around it, together form an ecological unit.

Homofermentive
A fermentation process wherein one type of microbe creates a single end product from a given substrate. For example, when lactic acid bacteria breakdown raw milk and only produce lactic acid.

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H

Hong Qu
Also known as "Red Yeast Rice," Hong Qu is a traditional Chinese fermentation starter made with the bright purplish red *Monascus purpureus* mold. Hong Qu is commonly used to make a popular type of fermented rice wine.

Hydrolyze
A chemical process that breaks down molecular bonds through exposure to water.

I

Inoculation
The process of adding a starter culture / live microbes, for example, active yeast, to a substrate, like flour, to begin fermentation.

J

Jicara
A bowl-like vessel made from the gourds of the higüera tree (*Cresentia cujete*) for drinking pulque.

Jiuqu
Also known simply as "Qu," this traditional Chinese fermentation starter contains several species of *Aspergillus* and *Rhizopus* filamentous fungi, and *Bacillus* bacteria. Jiuqu is most commonly dried into cakes or balls that are used to make rice wine.

K

Kefiran
Also called "Kefir Grains," Kefiran is a polysaccharide and protein matrix created and inhabited by symbiotic microbial cultures, including lactic acid bacteria, acetic acid bacteria, and yeasts. Kefiran is a starter culture traditionally used to ferment milk.

Kero
Derived from "q'ero" in Quechua; refers to a type of ceramic or wood drinking vessel used for the ceremonial consumption of fermented corn beer, now commonly called "chicha."

FERMENTATION GLOSSARY

K

Kimchi
A popular traditional Korean lacto-ferment made with a variety of substrates, most commonly cabbage, radish, garlic, chili and shrimp, with countless variations.

Koji
A traditional Japanese fermentation starter predominantly made from *Aspergillus oryzae* mold typically grown on grains of rice or barley. Because of koji's ability to enhance flavors and nutritional qualities of all kinds of popular foods, koji has been declared the national mold of Japan.

Kombucha
Sweetened black tea fermented by a SCOBY typically comprised of acetic acid bacteria (usually *Gluconobacter xylinus*) and osmophilic yeast (usually *Saccharomyces cerevisiae*), originating from China and now widely adopted as a refreshing carbonated beverage.

K'usa
Aymaran term for fermented corn beer, commonly referred to in Spanish as "chicha."

Kylix (Kylikes [plural])
A two-handled shallow bowl-type cup made from black glazed terracotta widely used to drink wine in Ancient Greece. Archaeologists have defined many subtypes of kylikes based on stylistic, regional, and chronological variations.

L

Leavened
Bread made with yeast, which produce carbon dioxide during the fermentation process, thus causing the dough to rise before baking.

M

Malting
A process of steeping, germinating and drying (sometimes followed by grinding) of grains that activates enzymes within them that break down complex carbohydrates into simple sugars that are fermentable by yeasts. Often the first step in making beer.

Mastication
The process of chewing/grinding food with the teeth. Traditionally used as an alternative to malting in the production of chicha and other fermented beverages.

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M

Mbwoongntey
Elaborately carved wooden cups made in the Democratic Republic of Congo for drinking nsámbá, wine made from fermented palm sap at communal feasts.

Meju
A traditional Korean starter culture comprised of air-dried cakes or bricks of cooked and mashed soybeans inoculated with a variety of microbes, mostly *Aspergillus oryzae* mold and *Bacillus subtilis* bacteria. Meju is used to make doenjang (fermented soybean paste) and gochujang (fermented red chili paste.

Mesophillic
Refers to microorganisms, particularly bacteria, that thrive at moderate temperatures (between 68°F and 113°F).

Metabolite
Any substance that is produced as a result of a metabolic process such as digestion.

Microbiome
The diverse community of harmless and/or beneficial microorganisms such as bacteria, fungi, and viruses that naturally live on and inside of people.

Miso
A traditional Japanese condiment/seasoning paste made from salt and soybeans (and occasionally rice, barley, or seaweed) fermented with koji (*Aspergillus oryzae* mold).

Mixed Fermented Beverage
Early alcoholic beverages were often made from a mix of fermented base materials including honey, grapes or other fruits, and grains, which are now commonly subdivided into single ferments we call mead, wine, and beer, respectively.

Mold
A type of microscopic fungal structure comprised of skinny strands called hyphae, which appears as a fuzzy coating on the material its growing on. Also referred to as filamentous fungi.

Mother
A common name given to kombucha SCOBY's, the biofilm comprised of a symbiotic community of fermenting bacteria and yeast. Also often erroneously called a "mushroom," but it is not, in fact, a fungus.

Must
The raw, unfermented material for making wine from crushed grapes that contains juice, skins, seeds, and stems.

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N

Nsámbá
A milky white wine made from palm sap spontaneously fermented by wild yeasts in the Democratic Republic of Congo, Africa.

Nuruk
A traditional Korean fermentation starter made from coarsely ground grain (usually wheat, rice, or barley) that is soaked in water, pounded underfoot, formed into cakes, and spontaneously inoculated by wild microbes (usually *Aspergillus oryzae*, *Saccharomyces cerevisiae*, *Rhizopsus oryzae*, and *Lactobacilli*) as it airdries.

O

Oinochoe
Ancient Greek terracotta wine pitcher characterized by a curved handle extending from the lip to the shoulder of the vessel.

Onngi
Onggi means jar and is a general term for traditional Korean ceramic vessels of different sizes for fermenting and storing a wide variety of foods and beverages. The porous nature of onggi slowly releases carbon dioxide, salt, and water, creating optimal conditions for lactic acid bacteria like *Leuconostoc mesenteroides* to proliferate.

Organoleptic
Refers to the sensory properties of foods and beverages, for example, taste, color, odor, texture, mouthfeel.

Oxidation
The chemical process wherein compounds are exposed to, combined with, and thus changed by oxygen. For example, when iron is oxidized, it forms rust.

P

Pellicle
Refers to the sometimes slimy, often fuzzy, bubbly, or ropey looking layer that forms on top of a ferment at the liquid-air interface; created by certain types of yeasts and bacteria when they interact with oxygen.

Prebiotic
A food ingredient, usually a plant-based fiber, that is nondigestible to humans but is digestible by (aka "feeds") beneficial microorganisms living in the human gut.

FERMENTATION GLOSSARY

P

Probiotic
A food, beverage, or dietary supplement that contains living microorganisms which, when administered in adequate amounts, are beneficial to human digestion, and/or immunity, and/or overall health.

Prokaryote
A unicellular organism that lacks a nucleus and other organelles.

Proofing
When bread dough is left to ferment, rise, and expand in volume through the metabolic actions of yeasts, after it has been shaped and before it is baked.

Ptyalin
An amylase enzyme found in human saliva used by people across the world to breakdown complex carbohydrates into simple sugars and initiate the fermentation process by chewing starchy substrates like corn and cassava.

Pulque
A viscous, milky white, tangy alcoholic beverage made throughout Mexico from agave nectar fermented by *Leuconostoc mesenteroides* acetic acid bacteria.

Q

Q'ero
Quechua for "kero," a type of ceramic or wood drinking vessel used for the ceremonial consumption of fermented corn beer, now commonly called "chicha."

Qocha
A wooden bowl-like cup made by Aymara peoples for drinking k'usa, a traditional fermented corn beer also commonly called "chicha" in Spanish.

R

Raspador
Sickle-shaped scraper, made from obsidian by ancient Aztecs, used by tlachiqueros to remove developing flower buds from agave plants in order to collect their sap and ferment it into pulque.

FERMENTATION GLOSSARY

R

Rennet
An enzyme first discovered in the stomachs of young ruminant animals like goats, sheep, and cows, that causes milk to curdle. Plant and microbe derived rennet are now also available. Used in the cheesemaking process to separate curds from whey.

S

Saccharification
The process whereby complex carbohydrates, like starches, are broken down into simple sugars, like glucose, that are fermentable by yeasts. The first step in producing fermented alcoholic beverages from grains.

SCOBY
Symbiotic Culture of Yeasts and Bacteria; a starter culture in the form a layered gelatinous biofilm made from active yeasts, lactic acid bacteria, and acetic acid bacteria. Most commonly used to make kombucha and increasingly cultured as an alternative material to animal-based leathers.

Skyphos
A two-handled, deep, black-glazed terracotta cup used throughout Ancient Greece for drinking wine.

Starter Culture
A preparation of living microbes deliberately used to initiate fermentation. Starter cultures take several forms and are comprised of many kinds of microbes and different substrates.

Substrate
The raw material to be fermented, for example, wheat flour, corn kernels, rice, grapes, honey, agave nectar, milk, cabbage, anchovies, etc.

Succession
A biological term for the progressive change in communities of organisms over time. Often in fermentation, the process will be initiated by one type of microbe, and as both the substrate and the environmental conditions of the ferment change, different microbes will join in the process.

Symbiosis
The intimate relationship between one or more different organisms that live closely together in the same physical space (sometimes body) and environmental conditions. The relationship can be mutualistic, commensal, or parasitic.

FERMENTATION GLOSSARY

T

Tesgüino
The common name for a type of fermented corn beer made with wild yeasts and lactic acid bacteria by several Indigenous groups living on either side of the present-day border between the United States and Mexico.

Thermophillic
Refers to microorganisms, particularly bacteria and archaea, that thrive at higher temperatures (between 106°F and 252°F).

Tiswin
A traditional fermented corn beer made in the American Southwest by Ndee (Apache) peoples.

Tlachiquero
Derived from the Nahuatl word tlacametl, meaning lord of agave; refers to the person who harvests agave nectar in order to ferment it into pulque.

U

Umami
A pleasantly savory taste derived from amino acids such as glutamate, ionosinate, and guanylate, characteristic of soy, mushrooms, cooked meat, and some cheeses.

Umqombothi
A traditional fermented grain beer made from malted sorghum and maize by Zulu peoples of South Africa.

W

Wort
A liquid solution extracted from malted grains that provides sugars fermentable by yeasts, and which is transformed into beer.

Z

Zymology
The scientific study of fermentation.