

The hungry, striving, sociable, parasitized, and slightly buzzed monkey

Humans are voracious consumers of psychoactive substances. Globally, we produce over 10 million tons of coffee every year, and over 6 million tons each of tea and tobacco (Food and Agriculture Organization, 2019). In addition to one or more of those substances, the average adult consumes the equivalent of about a liter of wine per week. Given that all these substances are toxic, the evolutionary question is why are they so popular? Focusing on ethanol, the 13 contributions to *Alcohol and humans: A long and social affair* tackle this question from a variety of biological, archeological, social, and cultural perspectives. As the volume's editors Hockings and Dunbar make clear, any evolutionary benefits to ethanol consumption must outweigh its toxic costs.

The volume leads off its biological section with a chapter by Robert Dudley, one of the first scholars to seriously grapple with the puzzle of ethanol consumption from an evolutionary perspective. Dudley (whose day job is studying animal flight) persuasively argues that a low concentration of ethanol in fermenting fruit was part of hominoid diets, including those of human ancestors, for millions of years. Because ethanol yields 7 kcal/g, compared to 4 kcal/g for carbohydrates, it was probably a source of energy. Indeed, Hockings et al. present an intriguing case of habituated chimpanzees regularly consuming palm wine. Dudley also reprises his argument that, similar to fruit flies, frugivorous primates evolved to use ethanol plumes as an olfactory cue to the location of ripe fruit, at least partly explaining its attraction to humans. The studies needed to test this hypothesis, sadly, have never been done.

To extract energy from ethanol and protect against its toxic effects, humans and other mammals have a class of enzyme-coding genes (alcohol dehydrogenases-[ADH]) that metabolize ethanol to highly toxic acetaldehyde, and another class (aldehyde dehydrogenases-[ALDH]) that metabolize acetaldehyde to acetic acid, which enters the Krebs cycle where its caloric energy is extracted. Carrigan reviews his previous work and presents new results on the evolution of these genes. A mutation in ADH4 in the common ancestor of African great apes dramatically increased its efficiency in metabolizing ethanol compared to more complex plant alcohols. The timing of this shift suggests an adaptation to increased ethanol in the diet due to the transition to a semi-terrestrial lifestyle and increased consumption of fruit fermenting on the ground (but ADH1 in the liver is responsible for most ethanol metabolism).

The volume then turns to the archeological evidence for alcohol consumption and its role in feasting at the dawn of agriculture. Guerra-Doce and McGovern, in separate chapters, provide an overview of the evidence from the Neolithic through the Iron Age. The

earliest evidence, from the early Neolithic in China c. 7000–6600 BC, is a large jar with traces of a complex fermented beverage consisting of wild grapes, hawthorn fruit, rice, and honey. Evidence of viticulture appears in Neolithic sites in Georgia a few centuries later, after which large-scale winemaking in southern Europe and the Middle East increases rapidly in concert with the emergence of urban centers, social stratification, and elites. In contrast to fermenting grapes, which are rich in sugar, fermenting cereals into beer is a more involved process because the starches must first be converted into sugar in a temperature-sensitive process. Beer production therefore likely remained low until much later, with consumption of this prestige item limited to feasts and other special occasions. Dietrich and Dietrich make the case that the early Neolithic site of Göbekli Tepe in Turkey, with its monumental buildings, limestone vats, drinking vessels, and cereal processing tools, might have served as a central site for such rituals and feasts, perhaps accompanied by alcoholic beverages. Dietler provides a broad overview of the political economy of alcohol, from prehistoric feasting to ancient Mediterranean trade to its central role in the slave trade of the colonial era.

The final chapters focus on alcohol use in contemporary populations. Daly provides a detailed ethnographic case study in an Amazonian Guyana group of a unique fermentation technology that involves the use of a fungus to instigate the breakdown of starches into sugars, which are then fermented with ambient yeast. He goes on to document the social and ritual significance of alcoholic beverages in this population. Rosinger and Bethancourt present a longitudinal study among a Bolivian horticultural population, the Tsimane, of the consumption of *chicha*, made primarily by women who chew a starchy vegetable like manioc and spit it into a pot to ferment. Despite increasing market integration and access to commercial alcohol products, *chicha* consumption was remarkably constant over many years. This underscores its importance in Tsimane culture, where it is served to visitors and might also have historically been a critical source of safe drinking water. Dunbar makes a pitch for the role of alcohol and social meals in social bonding, and McShane dives into the drinking practices in early modern England (1600–1700), arguing that these reveal the significance of the ritual practices that created and reinforced social, political, and religious bonds. The volume wraps up with a summary chapter by the editors, Hockings and Dunbar, where they link increased ethanol consumption by African apes to Miocene climate changes that forced an increased reliance on fermenting fruit. Noting that alcohol has played an important role in human social rituals since at least the Neolithic, they speculate that alcohol enhances social

bonding, and bemoan the medical and public health literature that overemphasizes the harms of alcohol while ignoring the social and other benefits. Finally, they raise several themes for future research.

Readers interested in a broad overview of the prehistory of alcohol use will benefit most from the chapters by Dudley (primates), Carrigan (genetics), Guerra-Doce (Neolithic archaeology), and perhaps Dietler (political economy). Specialists in different disciplines might be interested in particular case studies, such as chimpanzee use of palm wine (Hockings et al.), the deep dive into the archaeology of early Neolithic Göbekli Tepe (Dietrich and Dietrich), the ethnography of an Amazonian fermentation complex (Daly) and *chicha* use (Rosinger and Bethancourt), and the praxis of drinking in early modern England (McShane).

The volume succeeds in highlighting the long importance of alcohol in our social lives but fails to persuasively explain why this is so. I'm unconvinced by Dunbar's social bonding hypothesis. It's hard to avoid the impression that for Dunbar, the ultimate-level evolutionary explanation for behaviors like laughing, singing, dancing, and drinking is that they trigger the endorphin system, a proximate-level mechanism implicated in social relationships, and that these behaviors are positively selected *for that reason*. If a triggered endorphin system was so beneficial due to its social effects, why would not selection have simply acted to upregulate endorphins directly? Instead, regardless of the underlying proximate mechanism(s), Dunbar must show how drinking is an efficient solution to one or more problems inherent in sociality, such as free-riding, conflicts of interest, and private information, or what role it plays in existing evolved social strategies, such as reciprocity, and this he fails to do.

Dietler, despite his disavowal of evolutionary explanations of human behavior, probably provides the best evolutionary explanation for the key role of alcohol in human sociality. Dietler sees alcohol "as a special class of food with psychoactive properties" (p. 118). Indeed, in most of the volume's examples of feasts and other social activities,

there is not much difference between the role of food and that of alcohol, except that alcohol is more valued. Sharing food, a valuable resource, is at the core of many evolutionary accounts of human sociality. Sharing alcohol, an even more valued food with an additional valued property, is easily accommodated by these accounts.

It is worth considering, though, why psychoactivity, a cue of toxicity, is valued. As several authors briefly note, ethanol is a toxin with potent antimicrobial effects, a property it shares with spices, which are also highly valued substances consumed with food. Many spices, moreover, have mild psychoactive effects. It is possible that toxic, psychoactive substances, which have driven so much of human history, from the Neolithic feasts that might have set the stage for the emergence of the earliest city states, to the spices, tobacco, and rum that powered European colonialism, to the legal and illegal cash crops and drug wars of today, are valued because they kill pathogens, our most ancient and formidable enemies.

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