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### Evolutionary Eating: A Critical Evaluation of the Paleo Diet

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DEPAUW UNIVERSITY

Greencastle, Indiana

EVOLUTIONARY EATING: A CRITICAL EVALUATION OF THE  
PALEO DIET

A thesis submitted in partial fulfillment of the requirements  
for the

HONOR SCHOLAR PROGRAM

by

Ben Roess

April 10, 2014

Supervisory Committee:

Dr. Darrell Lalone  
Dr. Kevin Kinney  
Dr. Barbara Whitehead

For my sister Claire, who exemplifies  
the fact that food is love.

Without the slightest bit of irony, I was introduced to a caveman over the Internet in the year 2014. Thirty-year old Grok, as I came to understand, was not only an archetypal figure; he was the pinnacle of physiological vigor. In addition to being tall, lean, and agile, Grok led a life full of consistent rhythm, adequate sleep, and little stress. From all initial indications, the only thing this Grok fellow lacked was a surname. I will freely admit that I had never envied any club-wielders prior to our chance encounter, but Grok sure was impressive. He was also quite different from any caveman I had envisioned before; middle school textbooks and *New Yorker* cartoons portrayed short, brutish lives largely void of any leisure or self-reflection. Had I been under the wrong impression this whole time?

Grok is an “official primal prototype,” the poster-persona creation of author and blogger Mark Sisson.<sup>1</sup> Sisson’s website, *Mark’s Daily Apple*, joins thousands of other examples promoting what he calls “primal living in the modern world.” The common thread among those in support of this idea is the Paleo Diet, a nutritional plan originating sometime in the mid-20<sup>th</sup> century that seeks in some way or another to attain Grok-like health and wellness through the foods we eat in the modern day. That sounds vague because it is; precise consensus is not at the movement’s forefront. The same goes for its reception: the first time I heard the term “Paleo Diet,” my immediate mental image of an oversized poultry drumstick was quickly replaced by a flood of questions. Combined with my lifelong love of food and intrigue of the human body, those questions began the yearlong project that produced this study, my DePauw University Honor Scholar Program senior thesis.

Prior to articulating my goals for this paper, I would like to express my gratitude toward the committee of faculty who supervised its inception and ensuing direction; the aid of

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<sup>1</sup> Mark Sisson, “Who is Grok?,” *Mark’s Daily Apple*, accessed January 3, 2014,

Professors Lalone, Kinney, and Whitehead was an invaluable aspect of this project that produced not only interesting discourse but also welcome acquaintance in the very spirit of the liberal arts.



This study's specific academic ambitions are sixfold, all of which are encompassed within my overall desire to understand the Paleo Diet in a logical, supported manner.

Throughout the pages that follow, I strive to:

- Provide the historical origins of the Paleo Diet movement
- Offer a definition of the Paleo by compiling the various practices and opinions within the Paleo Diet community
- Evaluate the Paleo Diet's proposed connections to evolutionary science and address the existing criticisms to these proposals
- Examine the health effects and nutritional outcomes of the Paleo Diet
- Address the sociopolitical forces that shape diet in both evolutionary and modern terms
- Conclude by discussing the factors that complicate and/or restrict the Paleo Diet's widespread appeal and acceptance

## A Brief History of the Paleo Diet

The concept of a nutritional plan purposely based on the presumed diets of Paleolithic ancestors is relatively recent; its popularity spans less than fifty years. To fully understand the idea's broader origins, however, we must travel in time to the turn of the 20<sup>th</sup> century.

Environmental historian Roderick Nash suggests that this era ushered the rise of a “wilderness cult,” in which certain environmentally minded members of the public embraced a return to primitivism amidst an increasingly modern existence.<sup>2</sup> Environmental organizations such as the Sierra Club, founded by John Muir in 1892, pledged to “explore, enjoy, and protect the wild places of the earth.”<sup>3</sup> The Boy Scouts of America, founded in 1910, echoed these conservationist goals and urged America’s urban youth to experience nature in its most pristine form. Perhaps the most recognizable supporter of the movement was 26<sup>th</sup> President Theodore “Teddy” Roosevelt, who, in addition to founding the hunting-conservationist Boone and Crocket Club in 1887, fiercely advocated for the creation and expansion of the National Park Service. Roosevelt’s dedication to wilderness preserves echoed his argument that embracing the “strenuous life” would lead to ultimate triumph for nature-toughened Americans as the new century dawned.<sup>4</sup>

Perhaps no one in the early 1900s held Teddy Roosevelt’s so-called “strenuous life” in as high regard as Joseph Knowles. A 44-year-old professional illustrator from Maine, Knowles set off into the New England wilderness on August 10, 1913 to conduct a self-described

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<sup>2</sup> Roderick Frazier Nash, *Wilderness and the American Mind*, 4<sup>th</sup> Edition (New Haven: Yale University Press, 2001), 22.

<sup>3</sup> “Sierra Club Mission Statement.” *Sierra Club Online*, accessed January 8, 2014, <http://www.sierraclub.org/policy/>.

<sup>4</sup> Theodore Roosevelt, “The Strenuous Life” (speech, Chicago, April 10, 1899), Bartleby, <http://www.bartleby.com/58/1.html>.

“experiment.” Naked and entirely without supplies, Knowles hoped not only to survive for two months without human contact, but also to share his journey with the public through periodic tree-bark correspondences to the *Boston Post*. Donned the “Primitive Man” by the newspaper, Knowles’ wilderness diet consisted of berries, trout, and various small game; he even claimed to have killed a bear with only a crude club in the experiment’s second week. For clothing, Knowles donned animal hides and fashioned sandals from strips of moist bark.<sup>5</sup> When he emerged from the forest on October 4<sup>th</sup>, the tan and thickly bearded voyager received a hero’s welcome from the citizens of Boston. His subsequent memoir, *Alone in the Wilderness*, sold some 30,000 copies, and the “primitive man” became a household name for a brief period following the book’s publication. Despite questions of the experiment’s validity (a rival newspaper claimed that Knowles purchased his famous bearskin pelt and spent much of his journey drinking beer in a friend’s cabin), Knowles swore that the wilderness journey substantially improved his overall health: among his claims were that he lost weight but gained muscle, his complexion improved, his digestion became “perfect,” and he acquired the ability to lift “over a thousand pounds” with his legs alone.<sup>6</sup> Flaws aside, Knowles’ journey established him as one of the first Americans to openly (albeit temporarily) reject modernity in favor of a primitive lifestyle.

As the twentieth century progressed, Joseph Knowles’ visions of a healthy nation living like cavemen gained little popularity. Industrialism and scientific advances led to mass-produced, readily available food, and many Americans found themselves living increasingly sedentary lifestyles. Strength training for athletes was uncommon through the 1950s (many

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<sup>5</sup> Bill Donahue, “Naked Joe,” *Boston Magazine*, April 2013, accessed January 9, 2014, <http://www.bostonmagazine.com/news/article/2013/03/26/naked-joe-knowles-nature-man-woods/>.

<sup>6</sup> Joseph Knowles, *Alone in the Wilderness* (Boston: Small, Maynard & Co., 1913), 232.

feared that lifting weights or other anaerobic exercise made participants “muscle bound”), and like dietary science, kinesiology was a virtually nonexistent academic field.<sup>7</sup> Born in 1937, Dr. Arthur De Vany was a product of this era. De Vany received his Ph.D. from UCLA in 1970 and became a motion-picture economist, but his true passion was for exercise science. He often spent his workdays observing the exercise routines of Hollywood stunt doubles, many of whom lifted heavy weights and scheduled their meals around grueling film shoots. De Vany used these observations to create his “evolutionary fitness regimen,” designed to simulate the physical and dietary habits of human hunter-gatherer ancestors. The program called for periods of intermittent fasting followed by high-intensity cardiovascular exercise and regular compound weightlifting. De Vany’s routine follows the generalized reasoning that hunter-gatherers lived meal-to-meal and often had to chase down prey before dragging or carrying it back to the place of consumption. While the plan initially failed to make much of an impact in both scientific and fitness circles, Arthur De Vany stands as a pioneer of applying evolutionary thinking to fitness and diet. In 2010, his book *The New Evolution Diet: What Our Paleolithic Ancestors Can Teach Us about Weight Loss, Fitness and Aging* updated his proposed evolutionary fitness plan to include nutritional information published in the last two decades.

Despite only brushing the surface of Paleolithic nutrition, Joseph Knowles and Arthur De Vany framed the public relationship between evolutionary history and modern science. The explicit suggestion that a diet mimicking the Paleolithic era could lead to health benefits, however, was first popularized in 1975 by gastroenterologist Walter Voegtlin. Dr. Voegtlin’s self-published book *The Stone Age Diet: Based On In-Depth Studies of Human Ecology and the Diet of Man* remains a polarizing advancement. On one hand, it represents the first time that a

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<sup>7</sup> Chance Morgan, “The History of Strength Training,” *The Sport Digest*, Winter 2007, accessed January 10, 2014, <http://thesportdigest.com/archive/article/history-strength-training>.



medical doctor publicly advocated an ancestral diet based on scientific evidence. Voegtlin's radical suggestion that humans are chiefly carnivorous, however, was met with skepticism from both the public and fellow physicians. Despite longstanding evidence of plant food consumption in sources like archaeological digs and cave art, Voegtlin claimed that human ancestors were "exclusively flesh-eaters."<sup>8</sup> Furthermore, he advocated replacing sugar with the artificial sweetener Sucaryl, a product that was invented in 1937 and banned by the U.S. Food & Drug Administration in 1969 after it was linked to a myriad of health problems, chiefly bladder cancer.<sup>9</sup> *The Stone Age Diet* was fatally flawed, but it was a revolutionary work that, if nothing else, exposed the clear lack of popular and scientific understanding of human ancestral diets.

The commercial and scientific failure of Walter Voegtlin's *Stone Age Diet* was quickly overshadowed by another monumental dietary product of the 1970s: *Dietary Guidelines for Americans*. This joint publication by the Department of Health and Human Services (HHS) and Department of Agriculture (USDA) was first published in 1980, but it started as the 1977 brainchild of the Senate Select Committee on Nutrition and Human Needs.<sup>10</sup> Led by Senator George McGovern, the committee used extensive data from both scientists and industry groups to propose five core dietary recommendations for Americans:

- Increase carbohydrate intake to 55 to 60 percent of calories
- Decrease dietary fat intake to no more than 30 percent of calories, with a reduction in intake of saturated fat, and recommended approximately equivalent distributions among saturated, polyunsaturated, and monounsaturated fats to meet the 30 percent target

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<sup>8</sup> Walter L. Voegtlin, *The Stone Age Diet: Based On In-Depth Studies of Human Ecology and the Diet of Man* (New York: self-published through Vantage Press, 1975), 13.

<sup>9</sup> Voegtlin, *The Stone Age Diet*, 64.

<sup>10</sup> U.S. Department of Health and Human Services, "History of the *Dietary Guidelines for Americans*," accessed January 13, 2014, [http://www.health.gov/dietaryguidelines/dga2005/report/HTML/G5\\_History.htm](http://www.health.gov/dietaryguidelines/dga2005/report/HTML/G5_History.htm).

- Decrease cholesterol intake to 300 mg per day
- Decrease sugar intake to 15 percent of calories
- Decrease salt intake to 3 g per day<sup>11</sup>

Despite widespread media publicity, the Senate recommendations were met with considerable debate and controversy from industry groups (particularly cattle, dairy, egg, and sugar producers) and select members of the scientific community, who questioned the specificity of the recommended numbers and accused the committee of catering to profitable lobby organizations. The Senate responded by establishing a scientific review committee, but the first published edition of *Dietary Guidelines for Americans* in 1980 contained few changes from the 1977 Senate report. In 1990, Congress authorized the HHS and USDA to produce an updated version of *Dietary Guidelines* every five years; the most recent report from 2010 is far more detailed than its predecessors, but the recommended macronutrient proportions remain consistent with the levels introduced in 1977.<sup>12</sup>

One of the scientists who took a critical look at both *Dietary Guidelines for Americans* and *The Stone Age Diet* is Melvin Konner, a medical doctor and professor of Anthropology, Neuroscience, and Behavioral Biology at Emory University in Atlanta. In 1985, he and fellow physician Stanley Boyd Eaton attracted significant scientific and medical attention to the concept of Paleolithic nutrition through their article publication in *The New England Journal of Medicine*. Entitled “Paleolithic Nutrition: A Consideration of Its Nature and Current

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<sup>11</sup> Senate Select Committee on Nutrition and Human Needs, *Dietary Goals for the United States* (Washington, D.C.: U.S. Government Printing Office, 1977), accessed January 13, 2014, [http://zerodisease.com/archive/Dietary\\_Goals\\_For\\_The\\_United\\_States.pdf](http://zerodisease.com/archive/Dietary_Goals_For_The_United_States.pdf).

<sup>12</sup> U.S. Department of Agriculture and U.S. Department of Health and Human Services, *Dietary Guidelines for Americans, 7<sup>th</sup> Edition* (Washington, D.C.: U.S. Government Printing Office, 2010), 15. Accessed January 13, 2014, <http://www.health.gov/dietaryguidelines/dga2010/DietaryGuidelines2010.pdf>.

Implications,” Eaton and Konner’s article suggests that differences between ancestral diets and those in modern industrialized countries have “important implications for health,” including a possible connection to the modern rise in illnesses like coronary heart disease, hypertension, diabetes, and certain types of cancer.<sup>13</sup> Furthermore, they contend that the development of agriculture has apparently had a “minimal influence” on our genes.<sup>14</sup> Eaton and Konner used a dietary sample of 58 current hunter-gatherer groups, varied not only by their geographic locations but also by the amount of daily calories they obtained from animal foods. None of the sample populations utilized agriculture. Because these groups acquired their food in a way that resembled Paleolithic humans, Eaton and Konner consequently argued that their diets provide an estimate on what human beings are “genetically programmed to eat, digest, and metabolize.”<sup>15</sup>

Melvin Konner and Stanley Boyd Eaton’s research findings differed considerably from the nutritional recommendations in *Dietary Guidelines for Americans*. Instead of meat and fish, vegetables and fruit, milk and other dairy products, and breads and cereals (the “four basic food groups” listed by *Dietary Guidelines* as “foods choices that should be emphasized”)<sup>16</sup>, Konner and Eaton found that pre-agricultural hunter-gatherers derived all of their nutrients from the first two groups alone. “They apparently consumed cereal grains rarely, if at all,” the scientists concluded, “and they had no dairy foods whatsoever.”<sup>17</sup> While the sample groups that Konner and Eaton studied varied widely in their ratios of animal to vegetable food consumption (some groups ate as much as 90% animal foods, and others as little as 15%), the authors used the

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<sup>13</sup> S. Boyd Eaton and Melvin Konner, “Paleolithic Nutrition: A Consideration of Its Nature and Current Implications,” *The New England Journal of Medicine* 312 (1985): 283.

<sup>14</sup> Eaton and Konner, “Paleolithic Nutrition,” 283.

<sup>15</sup> Eaton and Konner, “Paleolithic Nutrition,” 285.

<sup>16</sup> USDA and HHS, *Dietary Guidelines*, 33.

<sup>17</sup> Eaton and Konner, “Paleolithic Nutrition,” 287.

average ratio of 35% animal foods and 65% plant foods to estimate nutritional characteristics. From this, they concluded that approximately 45% of a “typical” late Paleolithic diet was comprised of carbohydrates, 34% of protein, and 21% of fat, a large difference from the modern Senate recommendations of 58, 12, and 30 percent respectively.<sup>18</sup>

The authors of “Paleolithic Nutrition” noted that estimating ancestral diets was “intellectually satisfying and a heuristically valuable reference standard,” but beyond their musings on “modern” health problems, their work was devoid of any explicit advocacy towards eating like a hunter-gatherer.<sup>19</sup> The article did create a stir within the medical community, however, and several of Eaton and Konner’s colleagues urged the pair to introduce their findings to the general public. They obliged, and in 1988 the two men (along with Konner’s wife Marjorie Shostak, an anthropologist specializing in hunter-gatherer women) published *The Paleolithic Prescription: A Program of Diet & Exercise and a Design for Living*. Instead of simply implying a connection between modern diets and “modern” diseases, *The Paleolithic Prescription* urged readers to improve their health by adopting the same nutrient proportions as were present in average Paleolithic diets. Interestingly enough, the book did not exclude foods that were absent prior to agriculture; as long as the 45/34/21 macronutrient ratio was approximately met, followers of the program could still consume foods like whole grain bread, rice, potatoes, and milk.<sup>20</sup>

Modern understanding of Paleolithic nutrition drastically increased in the 1970s and 1980s, but the movement still lacked widespread recognition and tangible evidence of health

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<sup>18</sup> Eaton and Konner, “Paleolithic Nutrition,” 288.

<sup>19</sup> Eaton and Konner, “Paleolithic Nutrition,” 288.

<sup>20</sup> S. Boyd Eaton, Marjorie Shostak, and Melvin Konner, *The Paleolithic Prescription: A Program of Diet & Exercise and a Design for Living* (New York: Harper & Row, 1988), 47-48.

benefits. These shortcomings were significantly reduced in the last decade of the 20<sup>th</sup> century, largely due to the Kitava Study. Named for a small Pacific island in the Trobriand archipelago (officially part of Papua New Guinea), the Kitava Study comprised a series of scientific surveys started in 1989 by Swedish medical doctor and Lund University professor Staffan Lindeberg. In the Study's first survey, Lindeberg and his colleagues interviewed 213 adult members of the island's indigenous population about their dietary habits and health concerns, in addition to recording their heart activity using an electrocardiogram (ECG). They found that the islanders maintained an active, subsistence-based lifestyle uninfluenced by western dietary habits; their diets consisted almost exclusively of fish, tubers, fruit, vegetables, and coconut.<sup>21</sup> Furthermore, the survey revealed no reported cases of stroke, sudden death unrelated to accidents or homicide, or angina pectoris (heart-related chest pain). In other words, the Kitava natives appeared to live in a society absent of stroke and coronary heart disease.<sup>22</sup>

Subsequent surveys contributing to the Kitava Study in the mid-1990s revealed more about the diet consumption and health outcomes of native islanders. Despite deriving less than 0.2% of their caloric intake from typical "modern" foods (including but not limited to bread, cereal grains, dairy, processed sugar, and alcohol), Kitava researchers encountered no cases of malnutrition or famine; most natives even consumed more vitamins, minerals, and soluble fiber than the scientists had observed in a typical Swedish diet.<sup>23</sup> Both salt and fat were consumed in relatively low quantities (the latter made up approximately 20% of total caloric intake) on the

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<sup>21</sup> Staffan Lindeberg and B. Lundh, "Apparent absence of stroke and ischaemic heart disease in a traditional Melanesian island: a clinical study in Kitava," *Journal of Internal Medicine* 233 (1993): 269.

<sup>22</sup> Lindeberg and Lundh, "Apparent absence," 274.

<sup>23</sup> Staffan Lindeberg and B. Vessby, "Fatty acid composition of cholesterol esters and serum tocopherols in Melanesians apparently free from cardiovascular disease – the Kitava study," *Nutrition, Metabolism and Cardiovascular Diseases* 5 (1995): 45.

island. Saturated fat, however, made up a higher percentage of total fat intake in Kitava than in Sweden, a statistic explained by the islanders' high levels of coconut consumption.<sup>24</sup> The scientists noted that like stroke and heart disease, obesity and hypertension were virtually nonexistent in Kitava, as were any signs of dementia or memory loss among the island's 138 residents between the ages of 60-95.<sup>25</sup> Perhaps the most puzzling aspect of the early Kitava research was the average lifespan on the island: just 45 years. Why were the islanders, who seemed to be extraordinary healthy, dying at such a low age? The answer was twofold. Firstly, the leading causes of death were completely unrelated to diet and ironically are considered "primitive" or preventable in many Western societies: infections (primarily malaria), pregnancy complications and accidents topped the list.<sup>26</sup> Secondly, Kitava's disproportionately high rate of infant mortality significantly dragged down the average figure; Lindeberg estimated that the post-adulthood rate much more closely resembled his native Sweden's.

Following the groundbreaking results of the Kitava Study in the 1990s, both academic and commercial interest in Paleolithic nutrition has dramatically increased. As scientists continued to research the health effects and evolutionary connections of the human diet, the early 2000s saw a dramatic surge in commercial book and Internet advocacy of hunter-gather nutrition. It was also in the 2000s that the first widespread usage of the term "Paleo Diet" emerged. The name's ownership is a subject of great debate, but most credit Dr. Loren Cordain for its introduction into the public vocabulary. Currently a Professor of Health and Exercise Science at Colorado State University, Cordain received his Ph.D. in Health from the University

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<sup>24</sup> Lindeberg and Vessby, "Fatty acid composition," 48.

<sup>25</sup> Staffan Lindeberg, "The Kitava Study," accessed January 17, 2014, <http://www.staffanlindeberg.com/TheKitavaStudy.html>.

<sup>26</sup> Lindeberg, "The Kitava Study."

of Utah in 1981. His website, ThePaleoDiet.com, proclaims him “the world’s leading expert on Paleolithic Diets and founder of the Paleo movement.”<sup>27</sup> Beyond the obvious bias in that statement, Cordain’s resumé checks out: he has authored or co-authored more than 100 peer-reviewed articles appearing in publications like the *American Journal of Clinical Nutrition* and the *World Review of Nutrition and Dietetics*, including several collaborations with Stanley Boyd Eaton and Staffan Lindeberg. Two of Cordain’s books, *The Paleo Diet*, published in 2001, and *The Paleo Diet for Athletes*, published in 2012, have reached the New York Times’ bestseller list and bridged much of the gap between academic and popular interest in Paleolithic eating.

Unlike Konner and Eaton’s groundbreaking attempt to identify a “typical” Paleolithic diet, Loren Cordain’s research primarily focuses on forming and analyzing a contemporary experimental diet (hereby referred to as “Cordain’s Paleo Diet”) based upon what he calls “Paleolithic food groups.”<sup>28</sup> Commonly available modern foods are the diet’s focus elements, while processed foods, cereal grains, and dairy products are entirely excluded. Using a similar analysis of hunter-gatherer societies as his predecessors, Cordain estimated a higher percentage of animal foods (55%) than Konner and Eaton’s 35%. As a result, his macronutrient proportions differed as well; Cordain’s Paleo Diet calls for just 23% carbohydrates, 38% protein, and a full 39% fat.<sup>29</sup> Despite these incongruities, Cordain supports that his diet is rich in many areas where a contemporary Western diet is deficient, including vitamin, antioxidant and dietary fiber intake. Cordain argues that increased animal-food and fat-consumption percentages in Cordain’s Paleo Diet would not lead to unfavorable increases in blood lipid profiles (an indicator of both weight

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<sup>27</sup> “Dr. Loren Cordain,” *The Paleo Diet*, accessed January 17, 2014, <http://thepaleodiet.com/dr-loren-cordain/>.

<sup>28</sup> Loren Cordain, “The Nutritional Characteristics of a Contemporary Diet Based Upon Paleolithic Food Groups,” *Journal of the American Nutraceutical Association* 5 (2002): 15.

<sup>29</sup> Cordain, “The Nutritional Characteristics,” 17.

gain and cardiac distress) due to the hypolipidemic effect of increased dietary protein and relatively low carbohydrate and saturated fat levels.<sup>30</sup>

It would be a nearly impossible task to credit all the major players in the modern Paleo Diet movement, largely because new ones are constantly emerging. In 2013, the term “Paleo Diet” was the most-searched dietary topic on Google, and some estimates even put the number of American Paleo adherents between one and three million, or around 1% of the country’s population.<sup>31</sup> Beyond the scholarly interest and output between the 1970s and the present, thousands of commercial Paleo-focused avenues (from websites, blogs and message boards to cookbooks and magazines to simple word-of-mouth discussions and personal dietary experiments) have made an undeniable impact on the identity (or many identities, as I will argue) and direction of the Paleo Diet. It is because of them that at this point I find it necessary to briefly discuss my own research and use of source material.

### **Source Discussion and Academic Considerations**

At this point in human history there is no diet considered universally ideal, and while generalization occurs for the sake of majorities and averages, individual digestive systems remain incredibly variable from person to person. Furthermore, the Paleo Diet’s large departures

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<sup>30</sup> Cordain, “The Nutritional Characteristics,” 21.

<sup>31</sup> Eliza Barclay, “Was 2013 Really The Year Of The Paleo Diet?,” *The Salt – NPR*, December 30, 2013, accessed January 22, 2014, <http://www.npr.org/blogs/thesalt/2013/12/27/257669972/was-2013-really-the-year-of-the-paleo-diet>.



from the longstanding American government and medical guidelines put it in a controversial space; it is often considered a “fad” diet with conspiratorial and non-scientific characteristics.<sup>32</sup> It is my firm opinion as an historian and academic researcher that neither the arguments of majority status quo (“the way most people do it now”) nor established tradition (“the way most people have done things for so long”) are wholly valid in and of themselves. Anthropology, biology, history and nutritional science drive my research, and there are obvious benefits that peer-reviewed and scientifically tested studies and sources have over their non-academic counterparts. Academic “legitimacy” is one of my many goals for this paper, but in the discussion of the Paleo Diet I absolutely cannot ignore testimony of normal people and even the claims of trendsetters like “primitive” Joseph Knowles; they will be used and evaluated for flaw and bias just as a government document or scientific article will be. Simply put, the realm of diet is too universal yet also too personal to be confined to academia alone; anyone who eats potentially has something to offer, and the research is there to serve as an important second “commentary” step.

Throughout my own research, I found some aspects of the Paleo Diet to be more concrete than others. For example, I considered the anthropological and evolutionary components of this study to be much less subjective than discussions of health and wellness. Scholarly findings on human origins and evolution rightfully remain at the forefront because there is relatively less room for individual interpretation or experimentation, the empirical past remains unchanged by actions in the present, and as a result, there are valid conclusions to be made. In regards to

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<sup>32</sup> “Fad diets like “Paleo” plan can work, but experts find no magic slimming bullet,” *Fox News Online*, January 10, 2014, accessed January 12, 2014, <http://www.foxnews.com/health/2014/01/10/fad-diets-like-paleo-plan-can-work-but-experts-find-no-magic-slimming-bullet/>.

health, however, this is unquestionably not the study for readers who are deciding the Paleo Diet's final fate based only on either the volume or content of any external voice, whether it be academic, governmental, commercial, or even my own. I find it a massive disservice (yes, academic, but also based simply on intellectual effort) for readers to make any health conclusions about the Paleo Diet without trying it themselves. In the wildly individualistic world of diet, the words of others (and the motivations and biases behind them) can inform, suggest and contextualize, but they cannot predict final outcomes with the guaranteed accuracy that experimentation can. In this paper, I will do my best to present the biological responses others have predicted or experienced following modern and Paleolithic-based diets as well as what scientists have identified as the necessary nutritional components of human eating, and I will insert my own opinions no more than when I think it beneficial. I cannot, however, conclude overall whether the Paleo Diet is somehow better or worse for anyone health-wise than any other mode of eating. Therefore, the best definitive *health conclusion* that this paper can offer on the Paleo Diet comes in the form of advice, which I humbly offer here and here alone:

1. Destroy preconceptions of diet. The best diet is now the diet that works the best in accordance to individual goals.
2. Define these dietary goals. At the very base, they should involve taking in enough calories to happily survive while simultaneously fulfilling the body's various nutritional requirements, but beyond that, goals are subjective. Make sure, however, to acknowledge the mental side of things; body and mind are deeply connected via a two-way street, and eating should be enjoyable.
3. Schedule a doctor's appointment and get weighed, measured, and a blood panel taken.

4. Follow the Paleo Diet for 30 days - enough time that the digestive system can completely transition from its prior state. Keeping a food journal makes it much easier to track progress and stay on task.
5. After 30 days, repeat step 3.
6. Compare results from before and after, take bodily and mental feelings into consideration, and make conclusions.

### **Defining The Paleo Diet**

At its very core, the Paleo Diet aims to mimic what humans were eating prior to the advent of agriculture some 10,000 years ago. The evolutionary and anthropological assumptions behind Paleo are the subject of widespread academic debate; later on I will compare various evolutionary claims in an attempt to evaluate the diet's genetic "accuracy." Before that, however, it would help to establish a working definition of the Paleo Diet, and that name itself is a great starting point. It goes without saying that the abbreviated word "Paleo" is not a literal term; humans in the 21<sup>st</sup> century simply do not eat food that is thousands of years old. Therefore, mimicry an essential element. To the authors of *The Paleolithic Prescription*, mimicry extended no further than nutritional levels; people could eat whatever they wanted as long as numerical ratios were balanced. Today, however, most advocates of the Paleo Diet attempt to not only mimic the nutrients but also the foods that contain them. Under this mindset, "modern" or post-agricultural foods are excluded; a Paleolithic diet means consuming the very foods that might

have been available to cavemen themselves. Like humans, these foods are also living organisms and therefore also subject to evolution, a fact that I will again save until after our definition is set.

The second half of the Paleo Diet's name is unfortunately no less ambiguous than the first. For modern humans lucky enough to be unaffected by food scarcity, the word "diet" has taken on an interesting double meaning. On one hand, diet is simply *what is eaten*: the sum of food consumed by a person, no matter what it is or when it is taken in. On the other hand, diet can also be understood in the context of *going on a diet*: eating either less food or different food altogether. Weight loss seems to be the most commonly desired outcome, but anything from religious or ethical beliefs to medical problems prompt people to go on diets of the second meaning. Each one differs from the next in just about every comparable way (including legitimacy among doctors and dieticians, prompting the term "fad diet") but whether it is the Atkins Diet or the grapefruit diet, it is absolutely a modern idea. Before food scarcity was eliminated in many parts of the world, diet was not a choice but rather the outcome itself. The never-ending quest for enough calories to survive generally meant that people would eat anything they could get their hands on, and the only weight loss connected to diet came in the form of starvation. Therefore, the Paleo Diet falls somewhere in the middle. Assuming evolutionary accuracy for now, it fits the first definition because it is both what Paleolithic humans ate and modern humans mimicking them eat today. This mimicry is a choice with anticipated outcomes, however, so the Paleo Diet also fits the second definition of diet. Such ambiguity has prompted people like Loren Cordain to adopt the term "program of eating" to

describe the Paleo Diet; like many other vocal adherents, Cordain argues for its place as a long-term lifestyle and not a quick-fix, on-and-off solution.<sup>33</sup>

A third and final aspect of the Paleo Diet's name is extremely relevant to defining its underlying content: the singular form. The world's massive variety of geographic, climatic, and historic conditions ensures that most people from China, for instance, do not eat the same foods (and therefore nutritional ratios) as citizens of Europe or North America. And as the 58 native groups observed by Konner and Eaton displayed in the 1980s, there is not one single current hunter-gatherer diet, either. University of Arkansas anthropologist Peter Ungar suggests that this ambiguity is not exclusive to modern times: "There is probably no single diet to which our ancestors were adapted. Recent foragers have varied in their diet from marine mammals (the Inuit) to diets composed mostly of a few plant species in the outback."<sup>34</sup> In other words, the fact that we refer to a "Paleo Diet" and not the "Paleo Diets" is flawed in and of itself. Beyond obvious detriments to effective research (which region, foods, or nutritional ratio should we study?), however, I do not consider the singular name to be Paleo's fatal flaw. In fact, I see it reinforcing the fact that the Paleo Diet takes an umbrella approach over *all* the past diet combinations and varieties, rendering it more inclusive and freeing it from rather nitpicky criticism. Nonetheless, the singularity remains misleading; even excluding geographic specificity there is not one universally accepted Paleo Diet among academic and commercial advocates. Therefore, my following section will cover the foods most *commonly* considered

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<sup>33</sup> "The Paleo Diet FAQ," *The Paleo Diet*, accessed February 12, 2014, <http://thepaleodiet.com/paleo-diet-faq/>.

<sup>34</sup> Anne Stein, "Caveman diet draws grunts from nutritionists," *The Chicago Tribune*, April 21, 2011, accessed February 7, 2014, <http://www.chicagotribune.com/health/sc-health-0420-palos-diet-20110420,0,7758445.story>.

“Paleo” by vocal adherents of the community, and any notable exceptions or points of debate will be addressed.

## **Components of the Paleo Diet**

### 1. Preservative and additive-free foods

One overarching, foundational principle of the Paleo Diet applies to each and every food group contained within it: *eat real food*. In other words, natural or “whole” foods free of preservatives, artificial ingredients and chemical additives are always preferable to those containing them; they more closely resemble the foods hunted and gathered by Paleolithic humans. Non-perishable food is entirely a product of modernity; even using iceboxes for makeshift commercial refrigeration did not emerge in America until the 1830s.<sup>35</sup> In the last two centuries largely alone, science has created the ability to alter food’s taste, appearance, shelf life, and nutritional content. The United States Food and Drug Administration (FDA) currently lists 3,968 additives approved for food use in America, but only a miniscule percentage of these substances can be considered natural, let alone be traced back to the Paleolithic. For example, item number 0545, or natural Fruit Juice, is preceded by chemicals Formaldehyde (0542), Formic Acid (0543), and a substance listed only as 2-Formyl-6,6-dimethylbicyclo(3.1.1)hept-2-

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<sup>35</sup> Oscar E. Anderson, *Refrigeration in America: A History of a New Technology and Its Impact* (Princeton, New Jersey: Princeton University Press, 1953), 11-12.

ene (0544).<sup>36</sup> Using sales data from American supermarkets and restaurants, culinary journalist Eric Schlosser estimates that the average consumer in the United States spends approximately 90% of his or her food budget on processed foods.<sup>37</sup> Thanks to FDA-mandated ingredient lists, however, these foods can be identified and avoided as per the Paleo Diet's highest ideal. It is important to note, however, that not all additives or preservatives are created equal; foods like dried fruits, spices, and natural dyes (beet juice, for example) are technically processed but still commonly accepted as Paleo. Others, like table salt and refined cane sugar, can be argued as being natural but are nonetheless discouraged for nutritional reasons. There is no definitive rule, but whole foods and simple preparation provide an essential Paleo Diet starting point.

## 2. Vegetables

No matter what ratio of plant-to-animal foods a follower of the Paleo Diet is attempting to fulfill, vegetables are an absolute core component. Organic and locally grown vegetables (remember the *eat real food* mantra) are preferable to those grown with chemicals or additives. Beyond this suggestion, vegetables typically face fewer restrictions in terms of both type and quantity than any other Paleo food group. "As long as [vegetables] are not deep fried, eat as many as you want," suggests Steve Kamb, author of "The Beginner's Guide to the Paleo Diet."<sup>38</sup> On a diet that is seemingly so restrictive, why are vegetables so openly embraced? For starters, they provide fullness at a low caloric cost. It takes over a pound and a quarter of broccoli (about

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<sup>36</sup> U.S. Food and Drug Administration, "Everything Added to Food in the United States (EAFUS)," November 2011. Accessed February 17, 2014, <http://www.accessdata.fda.gov/scripts/fcn/fcnNavigation.cfm?rpt=eafusListing>.

<sup>37</sup> Eric Schlosser, *Fast Food Nation: The Dark Side of the All-American Meal* (New York: Houghton-Mifflin, 2002), 7.

<sup>38</sup> Steve Kamb, "The Beginner's Guide to the Paleo Diet," *Nerd Fitness*, October 4, 2010, accessed July 10, 2013, <http://www.nerdfitness.com/blog/2010/10/04/the-beginners-guide-to-the-paleo-diet/>.

three full heads or 20.74 ounces, to be exact) to equal 200 calories, whereas just 1.45 ounces (or about half) of a Snickers® chocolate bar contains the same amount.<sup>39</sup> Fresh vegetables are also incredibly rich in a wide variety of vitamins and minerals, including beneficial phytonutrients (phyto- meaning *plant*) that cannot be obtained through other food groups. Because many vegetables contain high amounts of soluble fiber, their net carbohydrate level (total carbohydrates minus fiber) is low. According to the popular Glycemic Index (GI) measure, blood glucose content (i.e., blood sugar) is raised less from fibrous foods with low net carbohydrates, meaning that vegetables have less of a GI impact than typical carbohydrate-rich Western foods like bread and white potatoes.<sup>40</sup> There are certainly other complicating factors at play, but recent animal research has connected high-glycemic index carbohydrates with obesity, diabetes, and coronary heart disease.<sup>41</sup>

In addition to being filling and nutrient-dense at a low caloric and glycemic expense, vegetables are incredibly adaptable foods. Beyond being eaten raw, vegetables can be grilled, sautéed, baked and boiled; they can also be reduced to broth or added as ingredients in soup. Hundreds of unique tastes and textures exist within the vegetable group, making it difficult to become bored with just one or two central choices. Whether they come in the form of leafy greens (like spinach, lettuce, kale, chard, and broccoli), root vegetables (like carrots, turnips, parsnips, onions, and beets), or “culinary vegetables” (fruited plants like tomatoes, cucumber, peppers, eggplant, and avocado), vegetables are consumed in abundance as part of the Paleo Diet.

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<sup>39</sup> L.S. Wynn, “What Does 200 Calories Look Like?” *WiseGEEK Online*, accessed February 20, 2014, <http://www.wisegeek.com/what-does-200-calories-look-like.htm>.

<sup>40</sup> Staffan Lindeberg, L. Cordain, and S.B. Eaton, “Biological and Clinical Potential of a Paleolithic Diet,” *Journal of Nutritional & Environmental Medicine* 13 (2003): 150.

<sup>41</sup> Dorota Pawlak, J. Kushner, and D. Ludwig, “Effects of dietary glycaemic index on adiposity, glucose homeostasis, and plasma lipids in animals,” *Lancet* 364 (2004): 783.



### 3. Fruits

Fleshy fruits (again, preferably organic) are commonly encouraged as a central component of the Paleo Diet. Like vegetables, they are nutrient-dense sources of vitamins, minerals, and phytochemicals; certain fruits such as prunes, bananas, and the skin of apples and pears are also excellent sources of fiber.<sup>42</sup> Despite these similarities, fruits generally contain higher levels of natural fruit sugar (fructose) than vegetables. This relative abundance of fructose causes sweeter fruits to be higher in calories and carbohydrates, leading many Paleo advocates to suggest moderating fruit intake for people trying to lose weight.<sup>43</sup> Loren Cordain suggests that fruit has undergone particularly dramatic evolutionary change, noting that domesticated fruits are “almost always” larger, sweeter, and less fibrous than their wild counterparts.<sup>44</sup> Additionally, modern shipping and agricultural methods have eliminated geographic barriers that were salient to fruit in the past; high-fructose fruits like oranges, bananas, and pineapple (all grown in relatively small tropical regions) are now delivered to temperate areas that once only featured lower-sugar fruits like berries and melons, if any at all.

Fruits by nature lend themselves to fewer cooking techniques than vegetables, but the Paleo Diet further restricts the manner in which many are eaten. Fruit juice, for instance, is generally excluded from the Paleo Diet because it can contain as much sugar as several servings of whole fruit but with none of the fiber; juice is therefore extremely high in calories and net carbohydrates compared to the feeling of fullness it provides. Dried fruit faces the same fate as juice in the Paleo Diet, although to an arguably lesser degree and for a slightly different reason.

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<sup>42</sup> Lindeberg, Cordain, and Eaton, “Biological and Clinical Potential,” 150.

<sup>43</sup> Kamb, “The Beginner’s Guide to the Paleo Diet.”

<sup>44</sup> “Fruits and Sugars,” *The Paleo Diet*, accessed February 10, 2014, <http://thepaleodiet.com/fruits-and-sugars/>.

Air-drying retains some of the nutrients and fiber found in fresh fruit, but none of the calories or fructose are eliminated with the water (and overall size) that drying takes away. For example, upward of 75 raisins fit in a box marketed for “single serving,” which contains 25 grams of sugar and nearly 130 calories despite weighing a meager 1.5 ounces.<sup>45</sup> 75 *fresh* grapes provide the same calories and sugar but weigh over thirteen ounces; I urge my readers to consider the last time they witnessed someone eat 75 fresh grapes in a single sitting.

#### 4. Meat

Meat is the Paleo Diet’s chief source of both protein and fat. Konner and Eaton’s groundbreaking 1985 study proposed that the average hunter-gather diet was comprised of 35% animal foods and 65% plant foods, but subsequent research has consistently shifted the numbers in favor of the former. In a study published in 2000, S. Boyd Eaton (who worked alongside a team of researchers that included Loren Cordain) amended his original estimates. The study found a new ratio range employed by a majority (73%) of its hunter-gatherer test populations: 56-65% animal foods to 35-44% plant foods.<sup>46</sup> Because this newer ratio closely resembles Cordain’s 55:45 estimate and thus moves further toward academic consensus, many commercial (non-academic) Paleo sources also suggest it as a rough guideline. Increased consumption of animal foods means more protein at the expense of carbohydrates, which is precisely where meat enters the picture.

Because modern humans typically do not hunt wild game for food as Paleolithic ancestors did, Paleo Diet mimicry is rather complex when it comes to meat. Modern

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<sup>45</sup> “Nutrition facts – raisins, seedless,” *SELF Nutrition Data*, accessed February 18, 2014, <http://nutritiondata.self.com/facts/fruits-and-fruit-juices/2050/2>.

<sup>46</sup> Loren Cordain et al., “Plant-animal subsistence ratios and macronutrient energy estimations in worldwide hunter-gatherer diets,” *American Journal of Clinical Nutrition* 71 (2000): 682.

domesticated animals are consistently fatter than their wild counterparts as a result of decreased roaming and steady food supply; Konner and Eaton suggest that this phenomenon holds true when comparing Paleolithic game to modern domesticated livestock as well.<sup>47</sup> Leanness (along with the lack of preservatives, additives and hormones described at the beginning of this section) is therefore a commonly desired attribute of meat in the Paleo Diet. Lean meat provides calories in the form of satiating protein, and several studies have linked its consumption to lowered serum lipids, or fat in the blood linked to health problems like obesity and heart disease.<sup>48</sup>

Because hunting wild-roaming game is out of the question for many modern Americans, ideal “mimicking” meats consumed as part of the Paleo Diet include free-range, omnivorous poultry like chicken, turkey and duck, uncured cuts (again with a general emphasis on leanness) of free-range omnivorous pork, grass-fed and pasture-raised beef and bison, and wild fish and shellfish.<sup>49</sup> Nutrient-rich organ meats like liver, heart, and tongue would not have been wasted in Paleolithic conditions of food scarcity and are therefore also encouraged if properly raised. Lastly, natural meats less often considered food in Western culture (chiefly insects, but also reptiles, amphibians, and other “obscure” game) should also be considered viable Paleo Diet options for the adventurous eater.

At first glance, the list above seems rather specific. Are distinctions like “grass-fed” and “free-range” really that important? Why not simply suggest “poultry” or “fish” and move on? The answers again lie in mimicry. Free-range and pasture-raised livestock have more room to move around than their sheltered counterparts, meaning that they get more exercise and outdoor exposure; in that regard they more closely resemble wild game. Diseases also spread more

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<sup>47</sup> Konner and Eaton, “Paleolithic Nutrition,” 285.

<sup>48</sup> G.F. Watts et al., “Effective lipid lowering diets including lean meat,” *British Medical Journal* 296 (1988): 237.

<sup>49</sup> Kamb, “The Beginner’s Guide to the Paleo Diet.”

quickly in cramped enclosures, and the correlation between decreased roaming and fat gain in domesticated animals suggests the possibility of free-range animals being leaner. In the case of fish, farming has been shown to not only increase fat content and the spread of disease, but also to amplify the concentrations of toxic compounds like mercury and Polychlorinated Biphenyls (PCBs) while simultaneously lowering the content of essential omega-3 fatty acids.<sup>50</sup>

In addition to living conditions, diet plays an important role not only in the health of livestock but also their suitability for the Paleo Diet. Diets closely resembling the eating habits of non-domesticated animals are preferred; any time a farmed animal eats what it might otherwise in the wild its body composition in turn more closely resembles that wild counterpart. Therefore, poultry and pigs fed a balanced diet of both animal and plant foods are preferred to those fed grain-based feedlot diets, many of which deny the animal essential nutrients and lead to accelerated fat gain. The food chain itself also plays an important role; to gain complete Paleo approval, livestock feed should not only be made up of pre-agricultural substances but also be free of the same additives and chemicals that pervade the modern human diet.

Because of these preferences, beef cattle provide the most polarizing example in realm of animal diets. A sharp majority of beef cows in the United States are fed a “conventional” grain-based diet consisting of anything from corn (including corn byproducts like husks and shells) to spent distiller’s grain and post-processing soy ingredients; standards are virtually nonexistent and beyond weight gain, dietary aspects like micronutrient consumption are rarely addressed.<sup>51</sup>

Grass-fed cows, on the other hand, survive on a diet that more closely mimics their wild-foraging

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<sup>50</sup> Ronald A. Hites, et al., “Global Assessment of Organic Contaminants in Farmed Salmon,” *Science* 303 (2004): 226.

<sup>51</sup> Mark Sisson, “The Differences Between Grass-Fed Beef and Grain-Fed Beef,” *Mark’s Daily Apple*, April 7, 2011, accessed February 3, 2014, <http://www.marksdailyapple.com/the-differences-between-grass-fed-beef-and-grain-fed-beef/#axzz2uwgN89Z2>.

ancestors: not only grassland and lawn grasses but also marshy sedges, rushes, clovers and shrubs; basically any leafy green plant within reach.<sup>52</sup> Nutritional research spanning three decades shows the stark differences between grass-fed and grain-fed beef: grass-fed varieties contain more omega-3 fatty acids and less omega-6 fatty acids, which when consumed in excess relative to omega-3s have been linked to arthritis, chronic inflammation, and cancer.<sup>53</sup> Additionally, grass-fed beef contains more precursors for vitamins A and E, more cancer-fighting antioxidants like glutathione and superoxide dismutase, and less total fat than grain-fed beef.<sup>54</sup>

## 5. Nuts and Seeds

Like meat, seeds and tree nuts are calorically dense and rich in protein, fat, and several vitamins and minerals. Their place in the Paleo Diet, however, is a topic of debate for a variety of reasons beyond just evolutionary differences. The biological similarities between Paleolithic and today's varieties are part of a discussion to be addressed later, but there seems to be little doubt that nuts and seeds grew naturally in many parts of the pre-agricultural world. Therefore, many Paleo adherents instead base their decisions on nutritional qualities of seeds and nuts. Like fructose-heavy fruits, nuts and seeds are often recommended in moderation for people trying to lose weight; for relatively small foods, they are high in calories. According to Loren Cordain, tree nuts are also one of the most common allergenic foods; Cordain does not restrict them

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<sup>52</sup> Sisson, "The Differences Between Grass-Fed Beef and Grain-Fed Beef."

<sup>53</sup> Artemis P. Simopoulos, "The importance of the ratio of omega-6/omega-3 essential fatty acids," *Biomedicine and Pharmacotherapy* 56 (2002): 377.

<sup>54</sup> Cynthia A. Daley, et al., "A review of fatty acid profiles and antioxidant content in grass-fed and grain-fed beef," *Nutrition Journal* 9 (2010): Article 10.

altogether but notes that they have been “poorly studied” for antinutrient content and may exacerbate symptoms of dietary autoimmune distress.<sup>55</sup>

But what about people who are neither trying to lose weight nor allergic to nuts and seeds? They should certainly consider these foods a viable part of the Paleo Diet, but there are still a few considerations to keep in mind. Nuts tend to have a higher amount of omega-6 fatty acids than omega-3s (even walnuts, which contain the most omega-3s of all tree nuts, have three times as much omega-6s); eating large quantities of nuts is therefore not logical considering the Paleo Diet’s inherent attempt to normalize the ratio between the two fatty acid varieties. Nuts and seeds are also relatively high in phytic acid and phytate (the former bound to a mineral; essentially it’s salt form), the non-digestible storage unit of phosphorus found within their waxy outer husks. Excessive consumption of phytate has been linked to mineral deficiency and can irritate the lining of the gut by reducing the effectiveness of digestive enzymes like trypsin and pepsin.<sup>56</sup> Preparation techniques like soaking or boiling can break down phytate, but more often than not nuts are simply consumed raw or roasted. These foods should not be excluded from the Paleo Diet altogether, but they also should not be consumed in excess; unsalted almonds (and almond butter), cashews, Brazil nuts, walnuts, pecans, pistachios, hazelnuts, sunflower and pumpkin seeds, and pine nuts are delicious choices for a special-occasion snack or meal addition.

## 6. Fats and Oils

Fats and oils play a variety of different roles within the Paleo Diet. Primarily heated to sauté, fry, or bake other foods, they can also be consumed at room temperature as salad dressing

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<sup>55</sup> “Hidradenitis Suppurativa and the Paleo Diet,” *The Paleo Diet*, accessed February 10, 2014, <http://thepaleodiet.com/part-i-hidradenitis-suppurativa-and-the-paleo-diet/>.

<sup>56</sup> Iosif A. Vaintraub and V.P. Bulmaga, “Effect of Phytate on the in Vitro Activity of Digestive Proteinases,” *Journal of Agricultural and Food Chemistry* 39 (1991): 860-861.

or atop cooked vegetables and meat. The use of natural oils ranging from animal fat to pressed olive oil is widespread throughout history not only as a food source but also to condition hair and skin, fuel oil lamps, and lubricate machinery. In addition to new processing and extraction techniques, the advent of agriculture increased the variety of edible oils to include those made from corn, rice bran, and soybeans. Today, dozens of cooking oils are utilized throughout various cuisines worldwide, but only a select few are Paleo Diet-approved; again, evolutionary and nutritional considerations form the criteria for restriction.

Because the Paleo Diet eschews both grains and grain legumes on the basis of pre-agricultural unavailability, oils derived from these foods are also avoided; corn, soybean, cottonseed, and peanut oils are among the most prominent examples. The remaining oils are therefore evaluated on the basis of processing (a certain amount of which is acquired to obtain any oil, but the minimum is preferred) and nutritional characteristics. In terms of processing, animal fat emerges as a clear choice: the only action required generally involves heating to the point of liquidity for collection. Beyond that, however, virtually zero definitive rules can be created without the entrance of nutritional distinctions. Fat, as it turns out, is much more complicated than previously thought.

All edible fats fall within two broad categories: saturated and unsaturated. Saturated fat consists of carbon-atom fatty acid chains that are fully “saturated” with hydrogen atoms; they contain no double bonds between individual carbon atoms and remain solid at room temperature.<sup>57</sup> These fats are derived chiefly from animal sources like meat, dairy, and eggs, but both coconut and palm oil are examples of plant-based foods high in saturated fat. Unsaturated

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<sup>57</sup> Northwestern University, “Nutrition Fact Sheet: Lipids,” accessed January 21, 2014, <http://web.archive.org/web/20110720014201/nuinfo-proto4.northwestern.edu/nutrition/factsheets/lipids.html>.

fats contain at least one double bond between carbon atoms in the fatty acid chain and are therefore “unsaturated” with hydrogen atoms and remain liquid at room temperature. They can be further broken down into two categories: monounsaturated fats (or MUFA, for MonoUnsaturated Fatty Acids) that contain one double bond, and polyunsaturated fats (PUFA, for PolyUnsaturated Fatty Acids) that contain two or more.<sup>58</sup> MUFA-containing oils include peanut, canola, olive, avocado, and other tree nut oils; corn, safflower, soybean, and sunflower oils are prominent sources of PUFAs. Despite leaning primarily one way or the other, it is important to note that most fat-containing foods (including all of the oils listed above) consist both of saturated and unsaturated fats.<sup>59</sup>

Two unique components further separate polyunsaturated fats from both MUFAs and saturated fats: omega-3 and omega-6 fatty acids. Beyond being PUFAs, omega-3s and omega-6s are considered “essential fatty acids” because the human body requires at least one specific type of each (alpha-linolenic acid and linoleic acid, respectively) for good health; it cannot synthesize them naturally, however, so these fatty acids must be obtained from external food sources.<sup>60</sup> Omega-3s are found in certain plant-based oils (canola, flaxseed, walnut, and soybean oils) and fatty fish and shellfish oils (cod, squid, and krill oils), while omega-6s are found almost exclusively in nuts and liquid vegetable oils like soybean, corn, and safflower oils.<sup>61</sup>

Oils are one of the most debated components of the Paleo Diet, but adherents generally favor those containing primarily saturated fats or MUFAs. Despite including both omega-3s and omega-6s, PUFAs by nature are chemically unstable due to their “incomplete” double bonds and

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<sup>58</sup> “Nutrition Fact Sheet: Lipids.”

<sup>59</sup> “Types of Fats,” WebMD Medical Reference from Healthwise, accessed February 1, 2014, <http://www.webmd.com/food-recipes/tc/types-of-fats-topic-overview>.

<sup>60</sup> “Nutrition Fact Sheets: Lipids.”

<sup>61</sup> “Types of Fats.”



therefore are more prone to turning rancid through oxidation when exposed to heat, air, and sunlight; this rancidity can lead to digestive distress and negate the benefits of essential fatty acids.<sup>62</sup> Additional questions have been raised about PUFAs and their relationship to inflammation as well as the results of an imbalanced omega-3 to omega-6 ratio. The scientific merits of these uncertainties remain largely unclear, but they have nonetheless made a practical impact: animal fat, fish oil, olive oil, coconut oil, palm oil, and avocado oil are the oils of the Paleo Diet.

## 7. Tubers

Latin for “swelling,” tubers are enlarged plant structures designed to store nutrients for survival, regrowth, and asexual reproduction. They fall into two broad categories: stem tubers, which are formed from enlarged, thickened rhizomes and stolons (both essentially root-like stems) and root tubers, which are formed from enlarged lateral roots. As foodstuffs, it is easier to think of tubers as the “family of potato-like vegetables,” but not all of them are created equal. White potatoes are stem tubers; despite being the world’s fourth-largest crop, they are not considered a part of the Paleo Diet.<sup>63</sup> Loren Cordain discourages potatoes due to their high glycemic index (GI) values; even refined sugars such as glucose (GI of 100), sucrose (GI between 60 and 65), and high-fructose corn syrup (GI between 60 and 65) pale in comparison to the blood sugar-raising effects of baked Russet Burbank potatoes, which have a GI value of

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<sup>62</sup> Mark Sisson, “PUFAs,” *Mark’s Daily Apple*, January 25, 2010, accessed February 3, 2014, <http://www.marksdailyapple.com/polyunsaturated-fat/#axzz2vaeQsX48>.

<sup>63</sup> “The Potato,” *Food and Agricultural Organization of the United Nations*, 2009, PDF Document. Accessed February 26, 2014, <ftp://ftp.fao.org/docrep/fao/011/i0500e/i0500e02.pdf>.

111.<sup>64</sup> Additionally, scientists have isolated a group of dietary saponins (a class of foaming, soap-like antinutrients) in potatoes known as glycoalkaloids. Glycoalkaloids serve the important function of protecting the potato's outer layer from microbial and insect attack, but when consumed by humans they can adversely affect the intestinal lining and aggravate symptoms of inflammatory bowel disease.<sup>65</sup> "If the potato were introduced today as a novel food," writes Dr. Bijal Patel and his colleagues from the University of Alberta's Department of Laboratory Medicine, "it is likely that its use would not be approved because of the presence of these toxic compounds."<sup>66</sup>

There are three common varieties of root tubers widely consumed by modern humans: sweet potatoes, yams, and cassava. Despite often being labeled as "yams" in parts of North America (particularly the American South), sweet potatoes are biologically very distinct from true yams, which are native primarily to Africa and parts of Asia. Sweet potatoes are also quite different from white potatoes; the two are distantly related but unlike white potatoes, sweet potatoes are not a member of the nightshade family. The inclusion of sweet potatoes in the Paleo Diet remains contested; some followers restrict them altogether due to their relatively high glycemic index (typically around 70-75) and abundance of complex carbohydrates.<sup>67</sup> Other Paleo devotees, like author Mark Sisson, include sweet potatoes in moderation as part of the Paleo Diet; despite being high in starchy carbohydrates, Sisson notes that sweet potatoes are free

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<sup>64</sup> Loren Cordain, "Are Potatoes Paleo?," *The Paleo Diet*, accessed February 10, 2014, <http://thepaleodiet.com/are-potatoes-paleo/>.

<sup>65</sup> Bijal Patel, et al., "Potato glycoalkaloids adversely affect intestinal permeability and aggravate inflammatory bowel disease," *Inflammatory Bowel Diseases* 8 (2002): 345.

<sup>66</sup> Patel, et al., "Potato glycoalkaloids," 344.

<sup>67</sup> Loren Cordain, "What to eat on the Paleo Diet," *The Paleo Diet*, accessed February 10, 2014, <http://thepaleodiet.com/what-to-eat-on-the-paleo-diet/>.

of saponins and rich in several micronutrients like beta-carotene, vitamin B5, manganese and potassium.<sup>68</sup>

Yams are higher in calories and starchy carbohydrates than sweet potatoes, but conversely have less sugar and a lower glycemic index (typically in the mid-50s).<sup>69</sup> Despite being inedible in raw form, yams are also free of saponins and contain many of the same micronutrients as sweet potatoes. Like sweet potatoes, they are encouraged in moderation by many Paleo devotees, especially for athletes as a post-exercise source of carbohydrate replenishment.<sup>70</sup> Lastly, the prominence of yams in the diets of native islanders in the Kitava Study has led to their endorsement from Steffan Lindeberg and many of his colleagues involved in the academic discourse of the Paleo Diet.<sup>71</sup>

Unlike the previous two root tubers, cassava is generally not considered a part of the Paleo Diet. Also commonly known as manioc, cassava is native to tropical regions in South America and is able to withstand conditions of drought and marginal soil quality. Nutritionally, cassava is a strong carbohydrate source but is low in protein; it contains nearly twice the calories and carbohydrates per serving as both sweet potatoes and yams. However, cassava's essential nutrients density and fiber content is also much lower than the other root tuber varieties. Finally, cassava has several antinutritional (and potentially toxic) factors, most of which are related to its production of hydrocyanic acid (cyanide) when linamarin, a chemical component of cassava, is hydrolyzed. Human consumption of cassava is therefore associated with various health disorders

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<sup>68</sup> Mark Sisson, "A Visual Guide to Yams and Sweet Potatoes (plus How They Fit Into a Primal Eating Plan)," *Mark's Daily Apple*, November 17, 2010, accessed February 9, 2014, <http://www.marksdailyapple.com/difference-yams-sweet-potatoes/#axzz2vmEY6vIy>.

<sup>69</sup> Fiona S. Atkinson, et al., "International tables of glycemic index and glycemic load values: 2008," *Diabetes Care* 31 (2008): 2282.

<sup>70</sup> Sisson, "A Visual Guide to Yams and Sweet Potatoes."

<sup>71</sup> Lindeberg, "The Kitava Study."

ranging from intestinal distress to hyperthyroidism and even death from cyanide poisoning.<sup>72</sup>

For these reasons, cassava stands as the sole root tuber that is completely avoided as part of the Paleo Diet.

## 8. Liquids

Proper hydration is one of the Paleo Diet's foremost objectives. Nearly 75% of Americans fall short of the 10-cup (approximately 80oz) daily water intake recommended by the government, and abundant consumption of caffeinated and sugary liquids like soda and energy drinks only compounds dehydration.<sup>73</sup> Hydration, however, differs from person to person; the government intake recommendations are fairly arbitrary considering they avoid differentiation in terms of body weight or levels of physical exertion. It goes without saying that our Paleolithic ancestors were not carefully measuring their water prior to drinking; they were more likely to simply drink whenever they were thirsty, assuming they were near a water supply. Similar logic can be applied to modern times: the human body provides much better feedback than any numerical target goals. Common signs of dehydration include a feeling of thirst, headache, dry mouth and lips, dark yellow or brownish urine, fatigue and lethargy, and sunken eyes.<sup>74</sup> Conversely, signs of proper hydration include abundant clear or light yellow urine, moist mouth and lips, and a feeling of alertness. Finally, it should be noted that while hyponatremia (over-

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<sup>72</sup> Wanda L.B. White, et al., "Cyanogenesis in Cassava: The Role of Hydroxynitrile Lyase in Root Cyanide Production," *Plant Physiology* 116 (1998): 1224.

<sup>73</sup> John Ericson, "75% of Americans May Suffer From Chronic Dehydration, According to Doctors," *Medical Daily*, July 3, 2013, accessed January 10, 2014, <http://www.medicaldaily.com/75-americans-may-suffer-chronic-dehydration-according-doctors-247393>.

<sup>74</sup> Steve Kamb, "How Much Water Do You Really Need?," *Nerd Fitness*, January 28, 2014, accessed January 28, 2014, <http://www.nerdfitness.com/blog/2014/01/28/everything-you-need-to-know-about-hydration/>.

hydration resulting in a dangerous electrolyte imbalance) is possible, it is uncommon and requires near-constant water consumption for several hours, often several hundred ounces without urinating. Again, attentiveness to the natural feedback that the body provides is more than enough to prevent such a mistake, and fear of too much water is certainly no reason to drink too little.

Food, especially fruits and vegetables, contributes a significant amount of water to the human diet but must be supplemented by additional liquid intake. Within the Paleo Diet, the vast majority of this additional liquid is water. This choice requires little explanation: water is free of chemicals, calories, and (usually) additives and has been consumed by nearly every living organism for millions of years. Beyond water, most Paleo advocates (including Cordain, Eaton, Konner, Sisson, and Lindeberg) include unsweetened tea, black coffee (in moderation, as caffeine is a mild diuretic and can affect adrenal activity), and pure coconut water as appropriate Paleo liquids. In turn, soda (both “diet” and full-sugar varieties), fruit juice, sports drinks, energy drinks, and milk are restricted.<sup>75</sup> Because there is no evidence suggesting that Paleolithic ancestors consumed any form of alcoholic beverages (compounded with the myriad of negative health effects associated with overconsumption), they too are not considered a part of the Paleo Diet.<sup>76</sup>

### **Restrictions of the Paleo Diet**

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<sup>75</sup> Loren Cordain, “The Beverage Dilemma,” *The Paleo Diet*, accessed January 13, 2014, <http://thepaleodiet.com/the-beverage-dilemma/>.

<sup>76</sup> Michael Dietler, “Alcohol: Anthropological/Archaeological Perspectives,” *Annual Review of Anthropology* 35 (2006): 232.

If the components of the Paleo Diet include non-processed and additive-free vegetables, fruits, meats, nuts and seeds, healthy fats and oils, tubers, and liquids, then what foods are restricted? Beyond the ones already listed in the section above, non-Paleo foods generally fit into the following categories.

### 1. Grains

Grains are restricted from the Paleo Diet on the suggested grounds of both history and nutrition. Beginning with Konner and Eaton's groundbreaking assertion in 1985 that Paleolithic ancestors consumed cereal grains "rarely, if at all," advocates of the Paleo Diet have argued that foods like wheat, rice, corn, oats, and barley are virtually exclusive to the post-agricultural diet.<sup>77</sup> Loren Cordain contends that for ancient hunter-gatherers, grains were considered "starvation foods at best" (i.e., only eaten in times of extreme caloric need and not by choice).<sup>78</sup> These statements, much like the Paleo Diet's estimated nutritional ratios, are based primarily upon the observations and subsequent academic applications of modern hunter-gatherer populations like those in Kitava. Despite this reliance on present-day ethnographic data, some Paleo Diet advocates also base their rejections of grain on seemingly more concrete anthropological evidence. One 2009 report co-authored by Loren Cordain credits the appearance of stone grinding tools in the fossil record as a "reliable indication" of when and where grains first emerged in the human diet because wild grains had to be ground in order for humans to digest them.<sup>79</sup> It is worth noting, however, that the report cites no evidence for its suggestion that these

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<sup>77</sup> Konner and Eaton, "Paleolithic Nutrition," 287.

<sup>78</sup> Loren Cordain, *The Paleo Diet: Lose Weight and Get Healthy by Eating the Food You Were Designed to Eat* (New York: John Wiley & Sons, 2002), 10.

<sup>79</sup> Janette B. Miller, Neil Mann, and Loren Cordain, "Paleolithic Nutrition: What Did Our Ancestors Eat?," 35<sup>th</sup> Professor Harry Messel International Science School Genes to Galaxies

grinding tools first appeared between 40,000 and 12,000 years ago, nor does it offer a source for its assertion that wheat was first domesticated approximately 10,000 years ago.<sup>80</sup> For such a large and fundamentally important evolutionary argument, I was consistently surprised by the lack of anthropological support offered not only by Cordain but many other modern Paleo adherents in books, articles, and websites.

Nutritional opposition to consuming grain is not contained to the modern day, nor is it completely separate from the evolutionary claims described above. Konner and Eaton's 1985 article cites a study of fossilized skeletons conducted ten years earlier by British biological anthropologist John Lawrence Angel as evidence of agriculture-based health problems; Angel found that European hunter-gatherer *Homo Sapiens Sapiens* skeletons from 30,000 years ago were an average of six inches taller than their post-agricultural descendants.<sup>81</sup> Konner and Eaton contend that by replacing much of their protein-rich animal foods with grain-based carbohydrates, early agriculturalists suffered from suboptimal nutrition that is still rampant in Western society today.

Many prominent adherents of the Paleo Diet have followed Konner and Eaton's lead, but they also have more to say about grains than just carbohydrates and protein. Loren Cordain refers to cereal grains as "humanity's double-edged sword:" even though they largely contributed to reducing worldwide food scarcity after the agricultural revolution, Cordain considers wheat and other cereals to be poor sources of human nutrition.<sup>82</sup> As of 2005, approximately 85.3% of cereals consumed in the American diet were *refined* grains. Unlike *whole* grains that are either

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Lecture, July 13, 2009. PDF. [www.scienceschool.usyd.edu.au/history/2009/media/lectures/4-brand-miller-chapter.pdf](http://www.scienceschool.usyd.edu.au/history/2009/media/lectures/4-brand-miller-chapter.pdf), 38.

<sup>80</sup> Miller, Mann, and Cordain, "Paleolithic Nutrition: What Did Our Ancestors Eat?," 38.

<sup>81</sup> Konner and Eaton, "Paleolithic Nutrition," 284.

<sup>82</sup> Loren Cordain, "Cereal Grains: Humanity's Double-Edged Sword," *World Review of Nutrition and Dietetics* 84 (1999): 22.

unprocessed (such as corn or whole oats) or processed using crude milling techniques, refined grains are highly processed in steel roller mills that remove the germ and bran. Without germ and bran, the refined flour is not only devoid of fiber but also has a much higher glycemic index than its whole-grain counterpart.<sup>83</sup> Despite being low in fat, cereal grains contain far more carbohydrates (an average of 72 percent per 100 grams; even fruit contains just 13 percent per 100 grams on average) than other food groups, which causes blood sugar to spike more (and more quickly) upon consumption.<sup>84</sup>

Cereal grains are undoubtedly a prominent source of carbohydrate-based calories, but the Paleo community further avoids them due to their general lack of essential nutrients. Cereal grains (even whole ones) contain no vitamin A or (except for yellow corn) its precursor, beta-carotene, no vitamins C or B<sub>12</sub>, only low-bioavailable levels of vitamin B<sub>6</sub>, and little to no calcium or sodium.<sup>85</sup> Refined grains are even worse; examples such as white bread are often artificially “fortified with vitamins and minerals” to offset their natural deficiencies. In fact, not a single essential nutrient is found *only* in grains; despite some grains being the predominant sources, there always exists another source in another food group. In an America where approximately half of the current population fails to meet the recommended daily allowances of vitamin B<sub>6</sub>, vitamin A, magnesium, calcium and zinc, displacement of nutrient-rich fruits, vegetables, and lean meat and seafood by increased grain consumption furthers the problem by lowering the overall micronutrient density of the human diet.<sup>86</sup>

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<sup>83</sup> Cordain, *The Paleo Diet*, 16.

<sup>84</sup> Cordain, *The Paleo Diet*, 45.

<sup>85</sup> Cordain, “Cereal Grains,” 26-30.

<sup>86</sup> Loren Cordain, et al., “Origins and evolution of the Western diet: health implications for the 21<sup>st</sup> century,” *American Journal of Clinical Nutrition* 81 (2005): 348.



Paleo Diet advocates utilize one last major argument against the consumption of grain: they contain several antinutrients and are causative agents for autoimmune disease. Like all plants, cereal grains have naturally gained evolutionary defenses against pathogens and herbivores in the form of antinutritional secondary metabolites; prominent examples in grain include phytates, lectins, protease inhibitors, and alkylresorcinols. Because humans did not consume grains for most of their history, it is suggested that they had little evolutionary experience in developing resistance to these antinutrients; the results therefore range from simply benign to extremely toxic.<sup>87</sup> For scientists within the Paleo community, cases where humans are physiologically unable to overcome grain antinutrients (and therefore suffer negative health consequences on their behalf) further indicate the evolutionary novelty of cereals as food for human beings and thus necessitate their avoidance.<sup>88</sup>

In the early 1950s, it was discovered that the protein gluten, found exclusively in wheat-containing foods, was the causative agent in celiac disease, an autoimmune disorder characterized by intense gastrointestinal distress among those who are intolerant to the protein. At least 3 million Americans have already been diagnosed with celiac disease, and scientists estimate that 1 in 133 healthy people in developed countries are intolerant to gluten.<sup>89</sup> Despite this widespread prevalence of intolerance, gluten is listed as “generally recognized as safe” (GRAS) by the FDA.<sup>90</sup> Official status aside, the prevalence of gluten intolerance coupled with

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<sup>87</sup> Cordain, “Cereal Grains,” 42.

<sup>88</sup> Cordain, “Cereal Grains,” 58.

<sup>89</sup> Nancy Stohs, “Gluten intolerance rising in developed countries,” *The Milwaukee Journal Sentinel*, April 27, 2010, accessed January 3, 2014, <http://www.jsonline.com/features/food/92134239.html>.

<sup>90</sup> U.S. Food and Drug Administration, “Code of Federal Regulations Title 21,” April 1, 2013, accessed March 2, 2014, <http://www.accessdata.fda.gov/scripts/cdrh/cfdocs/cfcfr/CFRSearch.cfm?fr=184.1322>.

the unsettling relationship between cereal grains and autoimmune disease has furthered the Paleo community's opposition to grain consumption.

## 2. Legumes

Legumes are one of the few food groups that are commonly restricted from the Paleo Diet on the nearly sole basis of nutrition; while some varieties (known principally as *grain legumes*) are the products of agriculture, others (like alfalfa and clover, considered *forage legumes*) have in some form grown naturally since the Paleolithic era. In general, it is the grain legumes that are consumed by modern humans; these include beans, peas, lentils, and peanuts. These foods are generally good sources of minerals like potassium and magnesium, and their moderate protein content often makes them a replacement for meat. In reality, however, their protein content (averaging between 4 and 9 grams per half-cup serving) pales in comparison to the 50+ grams obtained from most six-ounce servings of meats, and the same half-cup serving of beans typically contains over 20 grams of carbohydrates to boot.<sup>91</sup> Unlike refined grains, legumes contain soluble fiber and therefore fall lower on the glycemic index, but nearly all of their nutritional benefits can be obtained in equal to greater amounts in other foods that also have lower carbohydrate contents.

Nutritional statistics aside, legumes present a number of obstacles for human digestion; simply put, there is a reason why foods like beans are often at the heart of flatulence jokes and advertisements for anti-gas medications. Some of these obstacles are the result of low bioavailability of minerals like iron and zinc, while others are due to similar antinutrients as those found in potatoes and grains, chiefly saponins, lectins, and protease inhibitors.

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<sup>91</sup> Mark Sisson, "Beans and Legumes," *Mark's Daily Apple*, April 14, 2008, accessed January 6, 2014, <http://www.marksdailyapple.com/beans-legumes-carbs/#axzz2xbB9mntns>.

Furthermore, peanut oil lectins (PNAs), a class of antinutrients found in unsaturated peanut fat, have been linked to artery damage and the underlying causes of heart disease.<sup>92</sup>

Despite the USDA's assertion that legumes are "similar to meats, poultry, and fish" in their contributions of nutrients like iron, zinc, and copper, phytates found in legumes' outer husks (just like those found in the nuts and seeds described earlier, just at higher concentrations) prevent much of these minerals from being absorbed in the body and can cause gut irritation and reduced digestive effectiveness.<sup>93</sup> Like potatoes, legumes contain soap-like saponin antinutrients; lectins and protease inhibitors also are abundant in legumes and contribute to gut irritation, reduced nutrient absorption, and gastrointestinal distress.<sup>94</sup> Soaking or boiling legumes for periods of up to several hours can soften their outer shells and break down antinutrients, but one 1996 study found that even after two hours, soaking removed less than 15% of saponins in chickpeas and lentils.<sup>95</sup> And if they are eaten undercooked or entirely raw, many legumes can be downright toxic: red kidney beans, for example, can cause nausea, vomiting, abdominal pain, diarrhea, muscle weakness, heart inflammation, and even death without proper preparation.<sup>96</sup> For these reasons, legumes are a food group commonly restricted from the Paleo Diet.

### 3. Dairy

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<sup>92</sup> G.L. Sanford and S. Harris-Hooker, "Stimulation of vascular cell proliferation by beta-galactoside specific lectins," *FASEB Journal* 11 (1990): 2917.

<sup>93</sup> U.S. Department of Agriculture, "Beans and Peas Are Unique Foods," accessed December 27, 2013, <http://www.choosemyplate.gov/food-groups/vegetables-beans-peas.html>.

<sup>94</sup> Loren Cordain, "Beans and Legumes: Are They Paleo?," *The Paleo Diet*, February 22, 2014, accessed February 23, 2014, <http://thepaleodiet.com/beans-and-legumes-are-they-paleo/>.

<sup>95</sup> R.G. Ruiz, et al., "Effect of soaking and cooking on saponin content and composition of chickpeas and lentils," *Journal of Agricultural and Food Chemistry* 44 (1996): 1529.

<sup>96</sup> N.D. Noah, et al., "Food poisoning from raw red kidney beans," *British Medical Journal* 281 (1980): 236.

Dairy is perhaps the most unique food group consumed in the modern day; humans are the only species to both routinely consume milk past infancy and consume the milk of another species.<sup>97</sup> The ability to produce dairy products is completely reliant on domesticated dairy cattle, a product of the Neolithic agricultural age (milking wild animals is undoubtedly no easy task), and the Paleo community routinely rejects dairy consumption using this evolutionary argument. Like with grains, advocates of the Paleo Diet further this rejection with nutritional support, in this case falling into three broad categories: lack of nutritional necessity, lactose and casein intolerance, and contamination with external chemicals and other harmful substances.

In its raw form, milk provides an almost equal ratio of saturated fat, protein, and carbohydrates, as well as being rich in calcium and vitamin D. Like grain, however, milk does not contain any exclusive nutrients, and each of its nutritional components can be achieved through the consumption of meat, fruits and vegetables.<sup>98</sup> “You can have a totally healthy diet without dairy,” states Dr. Cheryl Karcher, a dermatologist and former nutritionist; Karcher says that her patients are often surprised to find that foods like spinach, kale, and sardines can provide just as much calcium as the milk products they are used to.<sup>99</sup> Paleo blogger Mark Sisson refers to milk as “baby fuel;” its biological function is to spur infant mammal growth and provide nutritional calories in easily consumable liquid form. Once humans reach childhood and gain the ability to eat solid food, however, dairy foods become relatively less nutrient dense choices than other staple food groups.

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<sup>97</sup> Elizabeth Weise, “Sixty Percent of Adults Can’t Digest Milk,” *ABC News*, accessed March 2, 2014, <http://abcnews.go.com/Health/WellnessNews/story?id=8450036&singlePage=true>.

<sup>98</sup> Cordain, et al., “Origins and evolution,” 348.

<sup>99</sup> Eric Metcalf, “Can Foods Make You Break Out?,” *WebMD*, June 13, 2012, accessed January 13, 2014, <http://www.webmd.com/skin-problems-and-treatments/acne/features/worst-foods-for-your-skin>.

All milk and milk-based products contain lactose, a disaccharide sugar that is digested in the human gut by an enzyme called lactase. Infants naturally produce lactase in order to digest breast milk, but between two and five years after birth this production typically ceases; in fact, less than 40% of the worldwide population retains the ability to produce lactase after infancy, and the other 60-plus percent – a clear majority - is considered lactose intolerant. For those without the enzyme, undigested lactose begins to ferment and produce gas in the colon, which leads to gastrointestinal issues like cramping, nausea, flatulence and diarrhea. Scientists have concluded that post-infancy lactase production is actually a genetic mutation that first appeared approximately 7,500 years ago among dairy farmers in central Europe, which explains why people of European lineage are typically more tolerant to dairy than groups like Native Americans, who maintained a hunter-gatherer lifestyle for centuries longer and have close to a 0% lactose tolerance rate.<sup>100</sup> For many within the Paleo community, this regional disparity and widespread intolerance is evidence of evolution’s slow pace in the realm of diet.

Casein, the primary protein found in dairy, shares many structural similarities to the wheat protein gluten. Many people affected by gluten intolerance are also unable to effectively digest dairy foods, but it currently remains unclear whether casein intolerance is a stand-alone occurrence or if it is a symptomatic product of gluten intolerance.<sup>101</sup> Nonetheless, it is worth noting that Paleo opponents to dairy cite casein intolerance as a possible reason for avoidance.

Despite the subjective nature of lactose and casein intolerance, there is a plethora of scientific evidence that suggests most conventionally available milk (that is, *not* raw, unpasteurized and from free-range cows raised without chemical additives) contains numerous

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<sup>100</sup> Weise, “Sixty Percent of Adults Can’t Digest Milk.”

<sup>101</sup> Mark Sisson, “The Definitive Guide to Dairy,” *Mark’s Daily Apple*, January 28, 2010, accessed March 2, 2014, <http://www.marksdailyapple.com/dairy-intolerance/#axzz2xbB9mtns>.

pharmacologically active substances like antibiotics, hormones, and other potentially dangerous chemicals.<sup>102</sup> Because these artificial substances violate the first pillar of the Paleo Diet (again, “eat real food”), they are continually cited within the Paleo community as yet another reason to avoid consuming dairy products.

#### 4. Added Sugars

Sugar is one of the most talked-about elements of the human diet, and its rejection among Paleo Diet adherents is not only nearly universal but also quite emphatic. Not all sugar is created equal, however, so it is helpful to begin this discussion with a bit of clarification. First, “natural” sugar is both very real and very common; sugar varieties like fructose, glucose, sucrose, maltose, and lactose occur naturally in foods varying from fruit to milk, and they are utilized by the body as a source of carbohydrate-based calories. Consuming food-based sugar is therefore basically inevitable not only within the Paleo Diet but also any diet that includes fruit, vegetables and tubers. Sugar outside of these foods (I will call it “added sugar” for sake of distinction), however, falls into two categories, both of which are avoided by adherents of the Paleo Diet. The first type, unrefined or “raw” sugar, is the brown, crystallized product that is extracted from either the stems of sugarcane or the roots of sugar beets. It is important to note that the term “unrefined” is misleading in this sense; while it is only refined enough to achieve crystalline form, raw sugar still must be washed, boiled, filtered, and pressed before it is usable by consumers. Nonetheless, this process is much less intensive than that of refined sugar, which is the white “table sugar” or light brown “brown sugar” most commonly found in grocery stores

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<sup>102</sup> Abdelmonaim Azzouz, et al., “Simultaneous determination of 20 pharmacologically active substances in cow’s milk, goat’s milk, and human breast milk by gas chromatography-mass spectrometry,” *Journal of Agricultural and Food Chemistry* 59 (2011): 5125.

and the Western diet. Refined sugar is still derived from sugarcane and sugar beet, but the sucrose is removed from the other plant matter before other impurities are also filtered out and discarded. The sucrose is then bleached with chemicals (typically phosphoric acid and calcium hydroxide) to achieve a white color; in the case of brown sugar, molasses is added at this point for color and added sweetness. Finally, the liquid sucrose is then filtered one last time before drying into powder form.

Added sugars, both raw and refined, are rejected from the Paleo Diet on the grounds of both evolution and nutrition. Human cultivation of sugarcane and sugar beet occurred after the advent of agriculture, and refined sugar simply did not exist until industrialization and colonial output of plantation sugarcane sparked its production within the last 4 centuries.<sup>103</sup> In 1700, the average Westerner consumed approximately 7.5 pounds of sugar; today, the average American consumes 150 pounds per year.<sup>104</sup> Paleo Diet advocates often cite honey as the only added source of sugar in the Paleolithic Era; even so, it was undoubtedly a rare treat due to both seasonal availability and the hardship (and bodily risk) that collecting it entailed.<sup>105</sup> Other added sugars, therefore, are considered recent dietary additions and therefore rejected within the Paleo community.

Nutritional qualities coupled with the myriad of sugar consumption's health effects are cited as evidence for its avoidance on the grounds of evolutionary inadaptability. Sugar contains only carbohydrates; it has no protein or fat, nor does it contain dietary fiber. Raw sugar retains some of the natural vitamins and minerals found in sugarcane and sugar beet (low levels of

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<sup>103</sup> Cordain, *The Paleo Diet*, 47.

<sup>104</sup> Mehmet Oz, "How much sugar does the average person consume every year?" *ShareCare*, accessed December 17, 2013, <http://www.sharecare.com/health/carbohydrates/sugar-consume-every-year>.

<sup>105</sup> Cordain, *The Paleo Diet*, 10.

phosphorus, calcium, iron, magnesium and potassium), but these are removed in the refining process, leaving refined sugar with food energy in the form of calories but absolutely zero nutrients; in other words, refined sugar is a source of “empty calories.”<sup>106</sup> What happens when these empty calories are consumed? To start, blood glucose levels immediately rise and the body is overcome with a rush of sudden energy. Insulin, the hormone central to regulating carbohydrate and fat metabolism in humans, is then secreted (known as an *insulin spike*), which initiates glucose uptake by tissues and organs within the body. The glucose is then either stored as glycogen (its main long-term storage form in the liver and muscles) or immediately utilized for energy production, but the simultaneous fall in blood glucose levels, known as reactive hypoglycemia or a “sugar crash,” brings on feelings of lethargy, headache, lightheadedness, irritability, and hunger that persist until glucose stores are replenished again.<sup>107</sup> In balance, this cycle may seem rather harmless, but if the glucose intake exceeds the body’s energy needs and all available glycogen stores are saturated, it undergoes fatty acid synthesis in the liver and is consequently stored as body fat. According to Paleo blogger Steve Kamb, the process is quite simple: “Sugar causes an energy spike and crash in your system, turns to fat unless it’s used immediately, and wreaks all kind of havoc on our bodies.”<sup>108</sup>

The “havoc” that sugar wreaks on the human body presents itself in numerous different ways, and the medical research on the subject is well documented - so much so, in fact, that the studies could be aggregated in a paper all of their own. For the sake of brevity in this paper, I will simply list the adverse health outcomes that sugar has been linked to in various studies and

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<sup>106</sup> “Sugars, granulated [sucrose],” *SELF Nutrition Data*, accessed January 22, 2014, <http://nutritiondata.self.com/facts/sweets/5592/2>.

<sup>107</sup> Kirstin Hendrickson, “Side effects of a sugar overdose,” *Livestrong*, February 21, 2014, accessed February 24, 2014, <http://www.livestrong.com/article/242637-side-effects-of-a-sugar-overdose/>.

<sup>108</sup> Kamb, “The Beginner’s Guide to the Paleo Diet.”



clinical trials; please note that debates over sugar's health hazards remain rampant and while I do not include individual citations for studies, at least one published, peer-reviewed scientific source exists connecting sugar consumption to each of the outcomes listed below; their existence alone warrants response from Paleo Diet advocates. They are:

- Obesity
- Type-2 diabetes
- Cardiovascular disease
- Alzheimer's disease
- Tooth decay
- Macular degeneration
- Addiction
- Sleep disorders

One final subcategory of sugar is worth noting due both to its prevalence in the modern American diet and its exclusion from the Paleo Diet: high-fructose corn syrup (HFCS). First synthesized in 1957, this sweetener has been classified “generally recognized as safe” (GRAS) by the FDA since 1976 and currently stands as the most-used food sweetener in the United States.<sup>109</sup> HFCS is highly-processed, produced by converting a percentage of the glucose found naturally in cornstarch into fructose, which results in a sweeter product that also exhibits a smoother texture; for this reason, HFCS is added to thousands of foods of both liquid and solid states. Despite insistence from the Corn Refiners Association of America that HFCS is comparable to table sugar, many opponents to its consumption suggest that HFCS is more harmful than regular sugar because it affects normal appetite functions and leads to considerable

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<sup>109</sup> U.S. Food and Drug Administration, “Corn Syrup,” October 31, 2006, accessed January 14, 2014, <http://www.accessdata.fda.gov/scripts/fcn/fcnDetailNavigation.cfm?rpt=scogsListing&id=95>.

more weight gain. Clinical research on the matter was once thought to be largely inconclusive, but a landmark 2007 study provided evidence that increases in sugar and corn syrup-sweetened soft drink consumption are associated with more weight gain than solid, “more appropriate forms” of dietary carbohydrate like cereals, vegetables, legumes and fruit.<sup>110</sup> In 2010, researchers at Princeton University concluded that rats consuming HFCS gained significantly more weight than those consuming table sugar, even though their overall caloric intake was the same.<sup>111</sup> Furthermore, scientists have concluded that increased consumption of refined carbohydrates and HFCS coupled with decreased fiber intake has closely paralleled the upward prevalence of type-2 diabetes observed in 20<sup>th</sup>-century America.<sup>112</sup> For these reasons, HFCS is avoided at all costs by the Paleo Diet community.

The following two pages provide a compact summary of the information presented above: the first lists foods commonly considered part of the Paleo Diet and the second lists its restrictions. With this information in place, macro-level assessments of the evolutionary and nutritional bases of the Paleo Diet can be addressed.

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<sup>110</sup> R.M. van Dam and J.C. Seidell, “Carbohydrate intake and obesity,” *European Journal of Clinical Nutrition* 61 (2007): 97.

<sup>111</sup> Hilary Parker, “A sweet problem: Princeton researchers find that high-fructose corn syrup prompts considerably more weight gain,” *Princeton University News Archive*, March 22, 2010, accessed January 21, 2014, <http://www.princeton.edu/main/news/archive/S26/91/22K07/>.

<sup>112</sup> Lee S. Gross, et al., “Increased consumption of refined carbohydrates and the epidemic of type 2 diabetes in the United States: an ecologic assessment,” *American Journal of Clinical Nutrition* 79 (2004): 778.

## Foods Commonly Considered Part of the Paleo Diet

- **Fruits** – *Limit quantities (esp. citrus and dried fruits) for weight loss; organic preferred*
  - Berries (Strawberries, Raspberries, Blueberries, Cranberries, etc.)
  - Melons (Cantaloupe, Watermelon, Honeydew, etc.)
  - Bananas and Plantains
  - Apples, Pears, Peaches, and Plums
  - Citrus Fruits (Oranges, Tangerines, Lemons, Limes, Grapefruit, etc.)
  - Mangoes and Papayas
  - Grapes, Dates, and Figs
  
- **Vegetables** – *Organic preferred*
  - Greens (Spinach, Lettuce, Chard, Kale, Cabbage etc.)
  - Green Beans and Green Peas
  - Root Vegetables (Carrots, Turnips, Parsnips, Onions, etc.)
  - Broccoli and Cauliflower
  - Brussels Sprouts
  - “Culinary Vegetables” (Tomatoes, Cucumber, Peppers, Eggplant, and Avocado)
  - Squash
  
- **Meat** – *Uncured and additive-free; fatty cuts in moderation*
  - Grass-Fed Beef (Steak, Ground beef, Roasts, Brisket, etc.)
  - Turkey and Chicken (All cuts; free-range omnivorous diet preferred)
  - Pork (Chops, Shoulder, Bacon, Ribs, etc.; omnivorous diet preferred)
  - Wild-Caught Fish and Shellfish (All varieties)
  - Organ Meats (Heart, Liver, Eye, Tongue, etc.)
  - “Obscure” Meats (Insects, Game, Reptiles and Amphibians, etc.)
  
- **Nuts and Seeds** – *Unsalted; limit quantities for weight loss*
  - Almonds, Cashews, Hazelnuts, Pistachios, Brazil Nuts, Walnuts, etc.
  - Sunflower Seeds, Pumpkin Seeds, and Pine Nuts
  
- **Fats and Oils** – *Minimally processed and saturated/monounsaturated fats preferred*
  - Animal fat (Beef tallow, Lard, Fish Oil, Bacon Fat, etc.)
  - Olive Oil, Coconut Oil, Palm Oil, and Avocado Oil (Virgin/unrefined preferred)
  
- **Tubers** – *Limit quantities for weight loss; ideal for athletic carbohydrate replenishment*
  - Sweet Potatoes and Yams (Debated within Paleo Diet community)
  
- **Liquids** – *Avoid dehydration using natural bodily feedback*
  - Water
  - Coffee and Tea (Unsweetened and without creamer; limit caffeine intake)
  - 100% Coconut Water (Without added sugar)

## Foods Commonly Restricted from the Paleo Diet

- **Grains** – *Wheat, Corn, Oats, Rice, Barley, Quinoa, Sorghum, etc.*
  - Bread
  - Cereals
  - Pasta
  - Crackers
  - Chips
  - Rice, Corn, and Oats (either cooked alone or in other products)
  
- **Legumes** – *Beans and Peas*
  - Beans (Navy, Black, Pinto, Kidney, Garbanzo, Lima, etc.; green beans allowed)
  - Peas (Chickpeas, Snow peas, Black-Eyed Peas, etc.; green peas generally allowed)
  - Peanuts and Peanut Oil
  - Lentils
  - Soybeans (Tofu, Soymilk and all other soy-based products)
  
- **Dairy** – *Foods containing milk*
  - Milk
  - Butter
  - Cheese
  - Ice Cream
  - Yogurt
  
- **Processed Meats** – *Those containing chemical additives or excessive fat*
  - Deli Meat
  - Sausages (Hot Dogs, Brats, Mets, etc.; few exceptions apply)
  - Grain-fed beef and farm-raised fish and seafood
  
- **Starchy Tubers**
  - White Potatoes
  - Cassava
  
- **Fats and Oils** – *Heavily processed and most polyunsaturated fats*
  - Vegetable Oil, Corn Oil, Peanut Oil, Soybean Oil, Canola Oil, Sesame Oil, etc.
  
- **Sugars and Sweeteners** – *Sugar, High-Fructose Corn Syrup, Artificial Sweeteners, etc.*
  - Candy
  - Most Processed/Packaged Foods
  
- **Liquids**
  - Alcohol (Beer, Wine, Spirits, etc.)
  - Soda (Including sugar-free varieties)
  - Fruit Juice
  - Energy Drinks

## **Evolutionary Considerations**

In simplest terms, the primary evolutionary assumption underlying the Paleo Diet is that natural selection over a long period of time tends to make a population well adapted to its environment: because hunter-gatherer human ancestors spent such a long time eating the foods that they did, they became genetically adapted to consuming them. Agriculture's advent then provided a dramatic shift in the human diet that was not only sudden but also recent; human genetics have still not yet adapted to this new diet, which causes the "modern" health problems so rampant in today's society. This pattern of thinking seems logical upon first glance, but I argue that a deeper investigation reveals oversimplification and generalization. Interpreting these faults leads to many outcomes; while I hardly believe they destroy the Paleo Diet's nutritional credibility, others consider them evidence of nothing more than pseudoscience based on an imagined, incorrect past.

The first and most obvious criticism of the Paleo Diet's evolutionary argument is that modern Paleo-endorsed foods differ drastically from the ones actually eaten thousands of years ago. Could the full-bodied, leafy broccoli carefully grown in rich soil today bear much resemblance to the sparse wild vegetation that Paleolithic humans scavenged for? Is eating pasture-raised beef cattle really akin to consuming wild game? If the answer to these types of questions is no, would that not uncover a massive, irreconcilable disconnect between then and now? All three of these questions provide an important starting point to an effective critique of the Paleo Diet, but I think that asking them inherently accuses Paleo Dieters of being blind to non-human evolution. Natural selection is constantly at work on all organisms, human or not; as we evolve as a species so does the food we eat. Eating exactly what Paleolithic people ate would

not only be impossible, but trying would also be a waste of time. In order for a productive evolutionary conversation to therefore ensue, the following principle must be loudly established: The Paleo Diet is not about finding out exactly what ancient Paleolithic people ate, but rather using evolution to discover facts about optimal nutrition in the modern day. In order to do this, our established principle of mimicry continues to be essential.

The first major oversimplification I isolate within Paleo-Diet evolutionary thinking deals with the reconstruction of ancient environments. From Konner and Eaton's work in 1985 to Lindeberg's Kitava Study to Loren Cordain's conventionally available model, proponents of the Paleo Diet time and time again put modern hunter-gatherer data at the forefront of their investigative technique. These isolated societies resemble Paleolithic ancestors in their shared lack of agriculture, but it is essential to note that they are still present-day communities eating foods that have undergone evolutionary change. Their societies each have distinct circumstances and history, and they should not stand for too much more than face value. As evolutionary biologist John Hawks puts it, "we can't blithely assume that we can reconstruct the environment relevant to natural selection in the past."<sup>113</sup>

The effect of the common oversimplification stated above has already made an appearance earlier within this paper: there is no such thing as one singular Paleo Diet, which obviously means there is no such thing as one singular macro-nutritional ratio attached to it. By suggesting concrete percentages of protein, fat, and carbohydrates, Paleo Diet advocates only open themselves up to (deserved) criticism. On the other hand, however, anthropologically entrusted methods like examining archaeological remains effectively tell us just as little about

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<sup>113</sup> John Hawks, "Evolutionary biology: Twisting the tale of human evolution," *Nature* 495 (2013): 172.

the “best” or “most accurate” nutrient combinations for ancient society *as a whole*. Perhaps everyone is just the slightest bit hesitant to admit that they truly have no answer.

The second major generalization rampant within the Paleo Diet community is a fundamental assumption that Paleolithic man was well adapted to his environment. The median lifespan for Paleolithic people is generally considered to be somewhere between 30 and 35 years; while high rates of infant mortality naturally bring this number down, there really is not much of a valid argument that cavemen led long, leisurely lives.<sup>114</sup> What Mark Sisson failed to include in his Grok archetype were the intermittent periods of near-starvation, the constant threat of sudden accidental, predator-related or virus-driven death, and the lack of developed social structures in nearly every facet of life. Also curiously absent is the fear of evolutionary disparity at work in the Paleolithic world; time and time again, someone had to play the unfortunate role of finding out which was the poisonous specimen amongst a fresh gathering of unknown plants.

In her 2013 book *Paleofantasy: What Evolution Really Tells Us about Sex, Diet, and How We Live*, evolutionary biologist Marlene Zuk not only reiterates the impossibility of Paleolithic environmental-adaptability, she demonstrates several examples of recent adaptation that show natural selection keeping pace with rapid environmental shifts. Within tropical societies, for instance, the relative abundance of malaria has induced a slew of genetic adaptations helping to resist the disease within the last two *thousand* years, not just the last two million.<sup>115</sup> In the realm of food, Zuk considers the ability of even a minority of the population to

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<sup>114</sup> Lawrence J. Angel, “Health as a crucial factor in the changes from hunting to developed farming in the eastern Mediterranean,” in *Paleopathology at the Origins of Agriculture*, eds. Mark N. Cohen and George J. Armelagos. (Orlando: Academic Press, 1984), 56.

<sup>115</sup> Marlene Zuk, *Paleofantasy: What Evolution Really Tells Us about Sex, Diet, and How We Live* (New York: W.W. Norton & Co., 2013), 6.

digest milk lactose the “poster child for rapid evolution in humans.”<sup>116</sup> As a fairly external observer, I would love to hear a rebuttal of this lactose argument from a central Paleo Diet researcher. Zuk’s insistence on evolution’s modern continuation, however, intelligently goes beyond the Paleo movement’s misconception that human species are in some sort of post-Paleolithic evolutionary limbo.

In 2010, a team of Italian and Czech anthropologists discovered particles of starch grains (the particles were much closer to cattail roots than to cornstalks, but were biologically grains nonetheless) on grinding stones from several different European archaeological sites dating back at least 30,000 years.<sup>117</sup> At the very least, this finding makes the past even murkier; it is the first and only to prove grain consumption so long ago, but at least for that specific community at that specific time, it does just that. In terms of the Paleo Diet, the polarizing reactions to this study from strict adherents like Mark Sisson on one side and strict skeptics like Marlene Zuk on the other both shed considerable light on their epistemological strengths and shortcomings; in all, I hope to conclude this section by suggesting that both sides of the Paleo Diet’s evolutionary debates are more based on comfort than anything else.

Forming hypotheses, according to John Hawks, is essential to his discipline of evolutionary science: “We play with hypotheses, explore their predictions and try very hard to falsify them. So it is, in a way, unremarkable that so many hypotheses proposed by anthropologists about ancient environments now seem to be wrong — and, in a few cases, even ridiculous. It means that science is working.” To me, the emphatic Paleo Diet resistances on the behalf of academics like Marlene Zuk presents a strategy opposed to experimentation. I understand her general logic as this: the past is filled with many unknowns that can be slowly

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<sup>116</sup> Zuk, *Paleofantasy*, 93.

<sup>117</sup> Zuk, *Paleofantasy*, 109.



uncovered by more concrete data and more similar evolutionary examples. Until we get these, it seems to be a poor idea to make sudden lifestyle and diet changes, especially ones not supported by previous evolutionary research.

People like Loren Cordain and Mark Sisson use the same Paleolithic-environment uncertainties and make resoundingly different conclusions. I understand their logic in this way: the past is filled with many unknowns that may be able to slowly be uncovered by more concrete data (or as Hawks notes, perhaps after many unsuccessful tries), but there is nothing holding us back from experimenting in the modern day because “paleofantasy” or not, the negative health consequences rampant in today’s world are real. It is great if there is an evolutionary connection like we think there is, but even if not, there are still modern outcomes in a modern world. I will admit that I admire this openness on the part of Paleo Diet enthusiasts; so much so, in fact, that sometimes I wish they stopped worrying so much about evolutionary connections and started doing a better job of informing the public exactly what the Paleo Diet is in the present or putting more effort into comparing its outcomes in controlled academic settings. The Paleo Diet has largely failed to establish academically-convincing evolutionary arguments, but its lack of success is as much internal as it is from the critiques of others.

### **Health Effects and Nutritional Outcomes**

There are essentially two different pathways for evaluating the nutritional “effectiveness” of any diet, including the Paleo Diet: macro-level comparative studies of the diet as a whole, and

component-based discussions evaluating issues like nutrient composition, elimination of grains and dairy, the healthiness of fat consumption, et cetera. Both pathways have benefits as well as limits, but this paper primarily seeks to engage the former for two reasons: these bigger-picture studies encompass many of the individual components, and this study's previous sections outlining the components and restrictions of the Paleo Diet also addresses the primary nutritional realities and claims surrounding both the Paleo Diet and a more conventional Western diet. In short, the larger scale discussion should affirm component-based considerations once limits have been noted and biases taken into consideration.

Four clinical, peer-reviewed studies (three utilizing human test subjects and the fourth utilizing domesticated pigs) form the extent of Paleo Diet comparative research. To be very clear, I consider this lack of research a large and overarching limit to the overall ability to make a health-related claim one way or the other about the Paleo Diet. Thousands of studies have been conducted on other contemporary diets and their individual components, which inherently outweighs Paleo Diet evidence. Again, however, I will echo my earlier suggestion of individual, controlled diet experimentation in order to make dietary conclusions; a lack of research certainly discredits the Paleo Diet in part but it should not do so in its entirety.

In 2006, Swedish researchers published a study of the long-term effects of the Paleo Diet on risk factors for three "diseases of affluence" (type-2 diabetes, obesity, and cardiovascular disease) in domestic pigs. Over a period of fifteen months, 24 piglets were split into two diet groups: the first consumed cereal based swine feed and the second consumed a Paleolithic Diet; both groups maintained the same caloric intake. At the study's outset the scientists tested for glucose levels, insulin response to glucose consumption, levels of C-reactive protein (a physiologic marker of subclinical inflammation) and blood pressure. They found that in addition

to the Paleo Diet group weighing 22% less and containing 43% less subcutaneous fat thickness at mid-sternum, blood pressure was 13% lower, insulin response to injected glucose was 47% higher, mean C-reactive protein was 82% lower, and no significant differences was seen in fasting glucose levels among the two groups.<sup>118</sup>

In 2008, a second team of Swedish scientists published a study assessing the effects of a short-term switch to the Paleo Diet among already healthy human volunteers. For three weeks, twenty subjects free of observable health issues who self-identified as healthy ate only Paleo Diet foods until they were full in a non-controlled caloric manner. At the study's outset the scientists tested for changes in weight, body mass index (BMI), waist circumference, blood pressure, and caloric and nutrient intakes. 14 of the 20 subjects fulfilled the study, and complete dietary assessment (i.e. nutrient intake levels) was available for 6. The scientists found that mean weight decreased by 2.3 kilograms, mean BMI decreased by 0.8 points, mean waist circumference decreased by 0.5 centimeters, and mean blood pressure decreased by 3 millimeters of mercury. Caloric intake decreased by 36%, while fat composition generally decreased and antioxidant prevalence generally increased. Calcium consumption generally decreased, which the scientists found unfavorable. Overall, the scientists concluded that some favorable effects were shown, but that further studies, including those with a control group, were needed.<sup>119</sup> I identified several limits to this study including said lack of a control group, self-identification of healthiness among volunteers, lack of controlled caloric intake, and the fact that six volunteers failed to complete the study in an already small pool of 20 test subjects.

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<sup>118</sup> Tommy Jonsson, et al., "A Paleolithic diet confers higher insulin sensitivity, lower C-reactive protein and lower blood pressure than a cereal-based diet in domestic pigs," *Nutrition and Metabolism* 3 (2006): Article 39.

<sup>119</sup> M. Osterdahl, et al., "Effects of a short-term intervention with a Paleolithic diet in healthy volunteers," *European Journal of Clinical Nutrition* 62 (2008): 684.

The third macro-level study of the Paleo Diet was published in 2009 by a team of American researchers from the San Francisco School of Medicine. The scientists tested nine non-obese sedentary healthy volunteers; these participants consumed their normal diets for 3 days, three “ramp-up” diets of increasing potassium and fiber for 7 days, and a Paleolithic diet for 10 days. Caloric intake was held consistent to prevent day-to-day weight loss. At the ends of the 3-day baseline diet period and the 10-day Paleolithic diet period, the scientists tested for blood pressure, insulin sensitivity, blood lipid concentrations, total cholesterol, and brachial artery reactivity (a measure of blood flow effectiveness). Compared with the baseline diet period, the Paleolithic diet period brought significant reductions in blood pressure, significant increases in insulin sensitivity, significant reductions in both total cholesterol and blood lipids, and improved circulatory status; in each of these measured variables, either eight or all nine volunteers had nearly identical responses. The scientists concluded that even short-term consumption of a Paleolithic Diet improves metabolic and physiologic status based on these criteria.<sup>120</sup> I consider the short study period, low number of test subjects, and sedentary volunteer nature to be limiting factors in this study.

Swedish researchers published the fourth and currently final comparative study of the Paleo Diet in 2009. The scientists tested thirteen patients with type-2 diabetes; in a randomized order, the subjects consumed a Paleolithic Diet for one three month period and a “Diabetes Diet” (high in cereals and dairy, low in animal protein and total fat) for another. At the end of each period, the subjects were tested for cardiovascular risk factors including weight change, waist circumference, blood lipids, blood pressure, and levels of high-density lipoprotein (HDL) or

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<sup>120</sup> L.A. Frassetto, et al., “Metabolic and physiologic improvements from consuming a Paleolithic, hunter-gatherer type diet,” *European Journal of Clinical Nutrition* 63 (2009): 952-953.

“good” cholesterol. Compared to the Diabetes Diet period, the scientists found that the Paleolithic Diet period brought on lower mean values of weight, waist circumference, blood pressure, and blood lipids, as well as higher mean values of HDL cholesterol. From these outcomes the scientists concluded that the Paleolithic Diet improved glycemic control and several cardiovascular risk factors compared to the Diabetes Diet in patients with type-2 diabetes.<sup>121</sup> Again, I consider the low number of test subjects and their diabetic specificity to be limiting factors in this study.

Despite these successful outcomes in clinical studies, the Paleo Diet is still widely discouraged by nutritionists and commercial media outlets. The former tends to oppose the elimination of entire food groups (dairy, grains, and foods with added sugar) in favor of a balanced diet that meets nutritional requirements. According to Joy Dubost, a registered dietitian and a spokesperson for the Academy of Nutrition and Dietetics, “In theory this may seem like a sensible diet, particularly when removing sugar and salt, it has eliminated several food groups like dairy and grains, which provide essential nutrients, such as calcium, vitamin D, magnesium and phosphorus in dairy and B vitamins, fiber and antioxidants in grains. Legumes also provide a great protein source with little fat and lower in calories while providing essential nutrients and fiber.”<sup>122</sup> While I agree that Dubost’s factual analysis is correct, her logic inherently fails to discount the Paleo Diet; yes, foods are eliminated, but the “essential nutrients” listed can all also be found in the Paleo Diet. Other nutritionists, like New York University nutrition professor Lisa Sassoon, are even more critical: “There’s no real research behind it either. And it eliminates

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<sup>121</sup> Tommy Jonsson et al., “Beneficial effects of a Paleolithic diet on cardiovascular risk factors in type-2 diabetes: a randomized cross-over pilot study,” *Cardiovascular Diabetology* 8 (2009): Article 35.

<sup>122</sup> Meredith Melnick, “Paleo Diet: Healthy or a Hoax?,” *The Huffington Post*, September 20, 2012, accessed December 15, 2013, [http://www.huffingtonpost.com/2012/09/20/paleo-diet-healthy\\_n\\_1898529.html](http://www.huffingtonpost.com/2012/09/20/paleo-diet-healthy_n_1898529.html).

things that do have research behind them: grains, beans, and low-fat dairy.”<sup>123</sup> Perhaps Sassoon should expand her knowledge of research to include both the Paleo Diet studies and those displaying possible negative health effects of the three food groups she cited.

I will admit that I was frustrated by the opinions of Joy Dubost and Lisa Sassoon, but my frustration only increased upon uncovering the following: in its 2014 rankings of “Best Diets Overall,” the U.S. News and World Report classified the Paleo Diet as tied at dead last out of 32 options.<sup>124</sup> According to the nutritionists and “health experts” who served as panelists for the rankings, a top-rated diet had to be easy to follow, nutritious, and safe and effective for weight loss and against diabetes and heart disease. The Report’s highest ranked diet was the government-endorsed Dietary Approaches to Stop Hypertension (DASH) diet, a balanced choice that instructs followers to “emphasize the foods you’ve always been told to eat:” fruits, vegetables, whole grains, lean protein, and low-fat dairy. From a typical nutritionist’s perspective, the DASH diet (if eaten in a balanced way) seems like an incredibly well researched choice that is safe to recommend.

The fact that the DASH diet was ranked considerably above the Paleo Diet on the “Best Diets Overall” list comes as no surprise to me. It also is not what frustrated me. Despite the report’s claims that there is “no way to tell” if someone would lose weight on the Paleo Diet (interestingly enough, the report failed to include simple discussions of caloric intake) and that by shunning food groups, “you’re at risk of missing out on a lot of nutrients,” they ranked the Slim-Fast® Diet a full eighteen places ahead of the Paleo Diet, tied as the thirteenth-best diet

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<sup>123</sup> Melnick, “Paleo Diet: Healthy or a Hoax?”

<sup>124</sup> U.S. News and World Report, “Best Diets Overall,” January 7, 2014, accessed January 7, 2014, [http://health.usnews.com/best-diet/best-overall-diets?utm\\_source=rss&utm\\_medium=rss&utm\\_campaign=top-rated-diets-overall-us-news-best-diets](http://health.usnews.com/best-diet/best-overall-diets?utm_source=rss&utm_medium=rss&utm_campaign=top-rated-diets-overall-us-news-best-diets).

choice.<sup>125</sup> The Slim-Fast Diet advocates its followers to consume just 1,200 calories per day: one 500-calorie self-prepared meal, two Slim-Fast meal-replacement shakes or bars, and three snacks like “half a banana or a Slim-Fast snack bar.”<sup>126</sup> Without even considering how hungry someone would be if they ate only 1,200 calories of mostly liquid day after day (good luck not eating that other banana half), the Slim-Fast Diet is *entirely based* on what nutritionists apparently fear the most: avoiding whole food groups in favor of a substitute. That substitute, a French Vanilla Slim-Fast meal replacement shake, contains 18 grams of sugar (its third ingredient) in addition to things like acesulfame potassium (a “nonnutritive sweetener”), cellulose gel, and citric acid among its forty-plus ingredients.<sup>127</sup> Who needs things like the Paleo Diet’s natural fruits and vegetables or satiating lean meats when the Slim-Fast Diet is a much better option?

Despite these prominent displays of anti-Paleo Diet sentiments, a handful of nutritionists are willing to consider it a viable alternative. Conversely, leading Paleo Diet advocates have admitted that elements of a more contemporary Western diet can work as well. According to New York-based nutritionist Jennifer Andrus, the food groups eliminated from the Paleo Diet “can be” (not *are*) part of a healthy diet, but that more pressing issues are at hand: “I think processed food deserves the criticism, but probably not because we haven’t evolved; more likely because we eat too much of it and most of it is nutritionally void.”<sup>128</sup> Heather Neal, another

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<sup>125</sup> U.S. News and World Report, “Paleo Diet,” January 7, 2014, accessed January 7, 2014, <http://health.usnews.com/best-diet/paleo-diet>.

<sup>126</sup> U.S. News and World Report, “Slim-Fast Diet,” January 7, 2014, accessed January 7, 2014, <http://health.usnews.com/best-diet/slim-fast-diet>.

<sup>127</sup> “French Vanilla Shake,” Slim-Fast, accessed January 8, 2014, <http://www.slimfast.com/products/shakes/french-vanilla.aspx>.

<sup>128</sup> Andrea Sachs, “The Paleo Diet Craze: What’s Right and Wrong About Eating Like a Caveman,” *TIME*, January 7, 2014, accessed January 23, 2014,

dietician and self-described “former hater of the Paleo Diet,” admits that she changed her tune after failing to lose weight or feel better eating a conventional Western diet: “The dairy tore up my stomach. The wheat fogged my brain...I think the Paleo Diet is a great way to get people to open up their minds to a new way of eating.”<sup>129</sup> None other than Loren Cordain mirrors this logic on the other side of things: “Cereal grains obviously can be included in moderate amounts in the diets of most people without any noticeable, deleterious health effects,” Cordain noted in 1999, adding, “When combined with a variety of both animal- and plant-based foods, [grains] provide a cheap and plentiful caloric source.”<sup>130</sup> Statements like Andrus’ and Cordain’s affirm my belief that more dialogue and mutual experimentation needs to occur between the Paleo Diet and contemporary nutritional communities.

Compiling the voices and stories of ordinary Americans who have switched from a contemporary Western Diet to the Paleo Diet is no small task, and there are numerous academic limits and detriments that come with non-controlled, self-reported accounts and outcomes. However, those outcomes exist in large numbers. One of the largest resources for uncovering Paleo Diet stories from “ordinary people” is the social media/news-based interactive online community Reddit, which has a section (or “subreddit” as they are known) where more than 64,000 people read, ask questions, and contribute stories, pictures, and recipes related to the Paleo Diet.<sup>131</sup> As a researcher of the Paleo Diet, I consider Reddit to have the most useful and eye-opening non-academic content of any Internet resource, and I highly encourage both ardent

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<http://healthland.time.com/2014/01/07/the-paleo-diet-craze-whats-right-and-wrong-about-eating-like-a-caveman/>.

<sup>129</sup> Heather Neal, “A Dietician’s Confession: Why I’m Changing My Tune on the Paleo Diet,” *Yahoo Healthy Living*, February 20, 2014, accessed February 22, 2014, <https://shine.yahoo.com/healthy-living/dietitian-8217-confession-why-8217-m-changing-tune-210000698.html>.

<sup>130</sup> Cordain, “Cereal Grains,” 59.

<sup>131</sup> Reddit, “Paleo: The subreddit for modern hunter-gatherers,” <http://www.reddit.com/r/paleo>.



skeptics and Paleo devotees to discover its firsthand accounts in a cautious but open-minded manner.

### **Sociopolitical Forces**

Aside from the critiques already mentioned, a number of factors related chiefly to economics but also to politics and social forces might explain the widespread disdain for the Paleo Diet among nutritionists and the American government. It is my hope that the following two examples serve as starting points for understanding this intricate relationship and recognizing its influence in the future.

The Academy of Nutrition and Dietetics is the “world’s largest organization of food and nutrition professionals,” consisting of over 75,000 registered dietitians (RDs), food researchers, and nutrition educators.<sup>132</sup> In order to become an RD in America, candidates must complete coursework accredited and approved by the Academy, which inherently means that it largely controls the nutritional content taught to aspiring diet advisors. However, this entity is not without external economic influence: the Academy’s corporate sponsors that “generously support” its events and programs are exclusively grain, dairy, and processed food producers: The National Dairy Council, Abbott Nutrition, McCormick, General Mills, Kellogg’s, Coca-

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<sup>132</sup> Academy of Nutrition and Dietetics, “Who We Are and Shat We Do,” accessed March 3, 2014, <http://www.eatright.org/About/Content.aspx?id=7530>.

Cola, PepsiCo, SOYJOY, and Unilever.<sup>133</sup> These companies certainly have profits to gain from the Academy's dietary recommendations being in their favor; to say a conflict of interest is at hand is nothing short of a massive understatement.

Unsurprisingly, the relationship between diet and economics extends into the American political realm. On March 26, 2013, President Barack Obama signed a spending bill entitled H.R. 933 into law; within it was Section 735, the Farmer Assurance Provision. Known as the "Monsanto Protection Act" among its opponents, this provision effectively barred federal courts from halting the sale or production of little-researched genetically modified grain seeds, no matter what health or environmental issues could potentially arise in the future.<sup>134</sup> Missouri Republican Senator Roy Blunt co-authored the provision with representatives from the Monsanto Company, one of the largest crop seed and herbicide producers in the world.<sup>135</sup> The fact that a for-profit company is able to directly create and influence the production standards of food products is not only alarming, it is proof that much more than consumer health goes into the government's assessment of agriculture, food, and diet.

### **Conclusion: Complications and Restrictions**

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<sup>133</sup> Academy of Nutrition and Dietetics, "Current Academy Sponsors," accessed March 3, 2014, <http://www.eatright.org/HealthProfessionals/content.aspx?id=7454&terms=corporate#.UFwrWVGz5Aq>.

<sup>134</sup> Connor Adams Sheets, "Monsanto Protection Act," *International Business Times*, March 27, 2013, accessed January 7, 2014, <http://www.ibtimes.com/monsanto-protection-act-5-terrifying-things-know-about-hr-933-provision-1156079>.

<sup>135</sup> Sheets, "Monsanto Protection Act."

In addition to the evolutionary oversimplification and generalizations, lack of academic support, and startling misconceptions associated with the Paleo Diet, I isolate three current barriers to its widespread application that would at least partly remain even if the former problems were reconciled: cost, user-friendliness, and attachment to commercial enterprise.

The Paleo Diet is generally not cheap to follow. Foods like produce, nuts, and meats are exponentially more expensive than cereal grains per-calorie, and the cost only increases when factors like freshness, organic production, and grass feeding come into play. Because the Paleo Diet eschews most processed and pre-packaged ingredients, the shelf life of most Paleo-approved foods is considerably shorter than many foods central to the contemporary Western diet. However, local farmer's markets and agricultural co-ops often offer lower prices than conventional supermarkets for foods ensured to be locally grown and raised, a vast majority of which fall well within the Paleo Diet's guidelines. Additionally, the extra dollar spent on more nutritious food in the present could very well be the same one saved on medical care in the future.

Until it becomes routine, the Paleo Diet is generally difficult to adhere to. Cereal grains, sugar and dairy have become such food staples in the modern day that many people cannot imagine living without them. Things like sandwiches without bread, breakfast without cereal, and meals without conventional desserts undoubtedly take some getting used to. Because there are very few "on-the-go" Paleo foods (nuts, fruit and raw vegetables being almost the only examples), time spent preparing food becomes a much larger factor. Eating at restaurants or dinner parties is also more complicated in the Paleo Diet confines. The Paleo Diet's large-scale restrictions make it seem unattainable for many people, and its close-knit community can further seem unwelcoming and even self-righteous. For these reasons, many Paleo proponents suggest

both easing into the dietary change and also occasionally violating it: a “cheat” here and there is not only good for the food-mind relationship, it is likely not going to prove too large a physiological setback. “There’s a lot of space between strict Paleo and a crappy diet of Pop-Tarts and McDonald’s,” reminds nutritionist Jennifer Andrus.<sup>136</sup>

Throughout my research, I consistently noted a commercial aspect of the Paleo Diet not entirely unlike a small-scale version of the government connections mentioned previously. From Loren Cordain and Mark Sisson to Steve Kamb and Steffan Lindeberg, it seems that almost every vocal Paleo Diet supporter sells not only books but also products like t-shirts, speaking engagements, or step-by-step nutritional guides. For a movement that seems so desperate to root itself in academic discourse and not be considered a “fad” diet, the commercial aspect of the Paleo Diet seems a step in the wrong direction. I argue that it also contributes to public misconception: pictures (or life stories) of cavemen and catchy slogans stick in the consumer mind for in a stronger manner than academic sources or even simple, straightforward discussion. Perhaps the ties to economics also contribute to a lack of consensus among those in the movement: product differentiation is an essential part of making a profit.

Overall, the Paleo Diet is perhaps best described as a victim of unfortunate circumstances. Its core goal – to improve health by better recognizing what different foods do to the human body across an evolving timespan – has become so buried in rhetoric and false assumptions that debate and controversy are currently the diet’s most prominent and publicized features. The Paleo Diet is deliberately unsettling, and human responses to unsettlement in this deeply personal (yet also public) realm display diet’s prioritized status not just among professionals but also everyday eaters. The innovators and advocates of the Paleo Diet have not

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<sup>136</sup> Sachs, “The Paleo Diet Craze.”

only put their money where their mouths are, they have made space for their minds. It has not been a seamless process, but that is where the concept of time is a supportive element: no matter how much one embraces the past, he still moves ever into the future.

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