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THE HISTORY AND EVOLUTION OF AGRICULTURE AS A HUMAN ACTIVITY

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Abstract
Over the course of the previous few millennia, human societies have often remade their subsistence niches by adjusting both their food-gathering practices and their surrounding environments. According to this idea, the body has a limited quantity of energy, and that energy must be divided amongst its most fundamental needs. Allocating resources in a way that increases fitness over time is favored by natural selection, regardless of environmental or temporal constraints. As a consequence of this hybrid new ecological niche, we propose that energy was redirected from growth and maintenance to defenseand reproduction. We talk about the evidence that supports this idea and where further study is required to learn more about the early stages of agriculture and the role of heterogeneity in that process. Our approach, if applied to other instances of human subsistence niche alteration, may provide light on a wide range of problems, including the effects of globalization and dietary transition on health, height, life expectancy, and reproductive trends. As early as 9000 BCE, Indians had already been cultivating plants and domesticating animals. Shortly afterwards, tools and techniques for agriculture developed, ushering in a time of more permanent settlements.
Keywords: life history theory, origins of agriculture, population growth, niche construction, nutrition transition.

INTRODUCTION

The modern definition of agriculture includes the cultivation of crops for human use, animal husbandry for milk and meat production, and the propagation of fruit and decorative trees. The poultry and seafood industries are also included. The marketing of modern agriculture, including exports and imports, is a key topic in international politics ever since the advent of the World Trade Agreement. As a result, producing agricultural goods at prices competitive on the global market is essential. When compared to farming methods used before the industrial revolution, today's methods are radically different. To fully grasp the radical changes in farming since the industrial revolution, it helps to first trace their roots in the pre-industrial period. As a result, the first section of the course will focus on the origins and historical progression of agriculture in human communities. The European Industrial Revolution is a watershed moment in the history of farming. Agriculture in the contemporary era has seen dramatic changes due to scientific advancements, population increase, and a decrease in accessible land and resources. The lesson concludes with a discussion of some characteristics of contemporary farming. In the next lesson, we will introduce the idea of an Agro-Ecosystem to provide the groundwork for learning about the interplay between agriculture and the natural world.

A wide variety of taxa started agriculture separately in various places of the world. Eleven distinct areas in both the Old and New Worlds may be identified as potential points of origin. Human lifestyles changed dramatically 12,000 years ago with the advent of agriculture. They developed settled agricultural communities as opposed to nomadic hunter-gatherer societies. Since at least 105,000 years ago, people have been harvesting and consuming wild grains. Domestication, however, did not occur until much later. Around 21,000 B.C., the Ohalo II people on the beaches of the Sea of Galilee began cultivating edible grasses on a modest scale. The eight Neolithic founder crops were produced in the Levant by around 9500 BC. These were emmer wheat, einkorn wheat, hulled barley, peas, lentils, bitter vetch, chickpeas, and flax. By 6200 B.C., the Chinese had successfully domesticated rice, and the first evidence of rice cultivation dates back to 5700 B.C. West Africans had domesticated and begun cultivating rice independently by the year 1000 B.C. Sheep were the second domesticated animal in Mesopotamia, after pigs, and this occurred approximately 11,000 years ago.

Around 8500 B.C., people in what are now Turkey and India domesticated cattle from wild aurochs. Domestication of camels occurred very late, possibly about 3000 B.C. Sorghum was domesticated

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about 3000 B.C. in the Sahel area of Africa, and pearl millet around 2000 B.C.Several different regions, including West Africa (at an unknown time), and India (about 2500 BC), were responsible for domesticating yams.By 1000 B.C., rice (African rice) had also been domesticated and farmed independently in West Africa.By 3000 BC, the Ethiopians had developed a variety of crops, including teff, finger millet, noog, ensete, and coffee.Tree crops like the kola nut and oil palm are among the many other plant foods that have been domesticated in AfricaBananas and plantains were both domesticated in Africa by the year 1500 BCE.Domestication of the helmeted guineafowl occurred in West Africa, according to Domestication of Sanga cattle, which were eventually hybridized with other species, probably occurred in North-East Africa approximately 7000 B.C.

The next step after having an idea is to collect the materials needed to put the plan into action. As a result, a toolkit was essential to bringing the concept of cultivation to life. These implements were meant to be used in preparation for planting seeds in the earth and then covering them with dirt. Agriculture expanded beyond its three basic stages as it progressed through the ages. Irrigation was another important factor to think about before planting seeds. Water is essential for agricultural production, thus it had to be directed to the fields at optimal times and in the proper amounts. So, simple devices were constructed to periodically water the meadows.

LITERATURE REVIEW

Bhargava, atul et.al (2019). For the first 250,000 years of our species' existence on Earth, we lived as foragers or hunter-gatherers, scavenging for food in the wild and killing our own food. The oldest evidence of Homo sapiens may be traced back to the late Middle Pleistocene in Africa. Until the end of the Pleistocene, hunter-gatherers were the dominant culture across all continents. The domestication of a few number of formerly wild plant and animal species became the primary focus of food production shortly afterwards. Since it was easier to create a reliable food supply rather than harvest plants from the wild, agriculture was seen as a major advance over the hunter-gatherer lifestyle. Mutualism between people and the population of plants or animals they were trying to domesticate resulted in significant benefits for both parties, Hence, domestication may be seen as a kind of artificially-accelerated evolution driven by human involvement and natural selection. Domestication dramatically altered several plant characteristics to suit the picky needs of people. As a result of selective extinction after domestication, a valley of very low genetic diversity has formed around a subset of advantageous haplotypes including a subset of chosen genes.

Wells, jonathanet.al (2020). Human populations have routinely recreated their subsistence niches during the last several millennia, altering both their food-gathering practices and their environmental settings. Over the course of the previous 12,000 years, for instance, the great majority of human communities made the transition from foraging to agricultural practices. Changes in mortality, population growth, adult body size, and measures of physical health are widely believed to have resulted from the advent of agriculture. These trends, however, have not been incorporated into a comprehensive theoretical framework, and the reasons why population size tends to grow at times when health indicators decrease are poorly understood. Here, we provide a fresh conceptual strategy that draws inspiration from evolutionary life history theory. This theory postulates that there is a limited supply of energy that must be divided among essential tasks including keeping the body running, growing, reproducing, and protecting itself. Energy-allocation techniques that maximize fitness under all conditions and at any time in the life-course are favored by natural selection. We contend that the advent of agriculture resulted in significant changes to human life history tactics, which affected both the quantity of available energy and the manner in which that energy was distributed among various bodily systems.

Yeugeniy m. Gusev (2020) Consideration is given to the role that advances in agricultural technology had in the development of human civilisation. This illustrative case study demonstrates that the 20th century marked the beginning of a new era in soil cultivation techniques. Specifically, it's linked to the shift from conventional "gray" technologies for natural resource management—which are driven primarily by short-term profit maximization—to innovative ("nature-based") "green" agricultural methods. Natural evolution has led us from Ziegler's maximum entropy production to Prigogine's minimal entropy production, which emphasizes making the most efficient use of limited resources to support a dissipative system like Earth's human population. Technology inspired by nature is the basis for justifying humanity's use of natural goods. A long-term biosphere experiment on the evolution of

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agricultural technology provides empirical support for the theoretical explanation of the inevitable transition to "green farming." The term "no-till" or "mulch tillage" refers to a more cost-effective way of tilling the soil, It calls for requiring soil mulching and rejecting or forgoing soil-turn plowing, a lack of vertical mixing of the arable layer, minimum disturbance of the soil cover by agricultural machinery, and so on.

Rohila, anil et.al (2017). It's common knowledge that around a third of the Earth's land area is used for farming. Agriculture relies on the sustainable use of natural resources, which in turn is directly impacted by environmental factors. Without a question, the environmental effect of agriculture on Earth is larger than that of any other human activity. Traditional farming methods will be inadequate to meet future demands for food and fiber. The dilemma of whether or not we can create and implement agricultural farming systems that can produce enough food to feed a growing population while also protecting the environment emerges on a more general level. The question of whether or not the world's natural habitats will be degraded to the point where they are no longer productive and abandoned for future generations to find ways to rehabilitate and repair is not an if, but a when under most current systems of agricultural production. Most of the new technology and methods being developed and used by farmers are not good for the environment. This study therefore examines the effects of agriculture on the natural world and the ways in which the two are intertwined.

Angelakis, andreaset.al (2020). Since Neolithic times, irrigation has been essential in many agricultural producing regions due to the unreliability or complete absence of local water sources. Using a bibliographical approach, this study will examine the history of water management techniques, inventive irrigation methods, and their corresponding land management practices to present a global perspective on the development of irrigation for agricultural areas. Since the Nile River periodically flooded ancient Egypt, It's possible that the early farmers planted crops in areas recently inundated with floodwater and fertilized by silt deposits. In contrast to the river civilizations of Mesopotamia, Egypt, India, and early dynasties in China, farmers in dry and semiarid areas depended on permanent springs and seasonal runoff. We examine the historical development of irrigation techniques in the world's key irrigation locations. The Minoans, Egyptians, and Indus valley peoples of the Bronze Age, the Chinese, Hellenics, and Romans of the Historic Period, the Aztecs and Incas of the Late Classical Period, the Byzantines and Ottomans, and the Arabs and Turks of the Middle Ages are highlighted.

LIFE HISTORY THEORY AND PHENOTYPIC CHANGE

Biologists may explore phenotypic changes in populations through time with the help of life history theory. This theory is helpful for two reasons: first, second, it may account for phenotypic variation or change that occurs from genetic adaptation and processes of plasticity, which can be physiological, developmental, or behavioral, modeling phenotypic variation as a whole rather than as a collection of individual qualities.

Individuals of the same species may have different life histories due to genetic heterogeneity. Heritability analyses and the results of genome-wide association studies (Table 1) have indicated that there is a significant amount of genetic variability in most human life history variables. Intricate studies of a kind of freshwater fish called guppies in Trinidad's mountain streams provide empirical support for the idea that natural selection influences non-human species' life cycle characteristics. The impact of mortality risk on life-planning decisions is made abundantly obvious in this research. Waterfalls along the streams are a common feature that keep predators confined to the lower levels. Guppies that are exposed to more predators upstream tend to grow larger and begin reproducing sooner than those that live downstream. A slower life history emerged within generations after releasing downstream guppies into an upstream habitat, with reproduction starting later and offspring sizes increasing at a slower rate. When predators were introduced upstream, however, guppy life histories shifted to prioritize speeding up reproduction. Research has demonstrated that some of this variation is genetic, lending credence to the idea that ecologically distinct life cycle strategies might develop from shared ancestry.

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TABLE 1 Support for the heritability of life history characteristics and specific instances of their genetic causes.

Trait	Population	Heritability	GWA evidence	References
Birth weight	UK twins	44%		(34)
	Norwegian families	31%		(35)
	Swedish twin pairs	25–40%		(36)
	Meta-analysis of 69,308 Europeans from 43 studies		7 alleles associated with birth weight variability	(37)
Age at Menarche	Australian sister-pairs	69%		(38)
	Dutch families	70%		(39)
	US families (Fels study)	49%		(40)
	Meta-analysis of 182,416 women of European descent from 57 studies		106 alleles associated with variability in age at menarche	(41)
Adult height	Gambian families	60%		(42)
	Indian families	74%		(43)
	European twins	81%		(44)
	~450,000 UK Biobank participants of European ancestry		3,290 near-independent SNPs associated with variability in height	(45)
Body mass index	Finnish twins	80%		(46)
	Nigerian families	46%		(47)
	Chinese twins	61%		(48)
	~450,000 UK Biobank participants of European ancestry		716 near-independent SNPs associated with BMI	(45)
Age at menopause	US families (Framingham)	52%		(49)
	Dutch mother-daughter pairs	44%		(50)
	Dutch twins	71%		(51)
	17,438 women from two US cohorts		13 SNPs associated with variability in age at menopause	(52)

So far, we have thought about the possibility that certain aspects of the human life cycle have arisen as a result of genetic adaptation to changing ecological circumstances. Such reactions may also occur on shorter timescales, as shown by the high degree of flexibility displayed by the same features. In this case, Reaction standards that allow fitness-maximizing features to emerge in response to stimuli and stresses encountered over the life-course have been selected for by natural selection. The reaction norms of a genotype are the distribution of its phenotypes across a variety of environments. Table 2 illustrates long-term shifts in key aspects of the human life cycle, demonstrating how humans have adapted to shifting ecological conditions and created fresh trade-offs.

TABLE 2 Secular tendencies as evidence for life-history plasticity.

Trait (units)	Population	Rate in units per decade	Decade per SD change	References
Birth weight (g)	Canada (1985–1998)	27.7	18.1	(66)
	Norway (1967–1998)	36.8	13.6	(67)
	India (1963–1986)	32.2	15.5	(68)
	Papua New Guinea (1969–1996)	70.4	7.1	(69)
	Vietnam (rural) (1999–2010)	95.0	5.3	(70)
Age at menarche (y)	Spain (1925–1962)	0.26	3.8	(71)
	South Africa (black) (1956–2004)	0.50	2.0	(72)
	India (1979–2003)*	0.20	4.9	(73)
	Korea (1920–1986)	−0.64	1.6	(74)
	Colombia (1944–1984)	−0.55	1.8	(75)
Height (cm)	Czech (f) (1935–1955)$*	1.1	5.4	(76)
	Indian (f) (1979–2003)*	2.2	2.1	(73)
	Portugal (m) (1904–1996)	1.0	6.1	(77)
	Poland (1965–1995)	2.1	2.9	(78)
	Belgium (1830–1980)$	1.0	6.0	(78)
Adult BMI (kg/m^2)	Sweden (f) (1985–2002)	1.2	2.5	(79)
	Greece (m) (1990–2006)	0.6	5.3	(80)
	United States (m) (1980–1987)	0.8	3.7	(81)
	China (1991–2011)	1.2	3.0	(82)
	Brazil (f) (1975–2003)	1.1	2.7	(83)
Age at menopause (y)	Spain (1883–1941)$	0.34	11.7	(84)
	Sweden (1908–1930)$	1.00	4.0	(85)
	United States (1912–1969)$	0.59	6.8	(86)
	Iran (1930–1960)$	0.70	5.7	(87)
	Korea (1927–1947)$	1.7	2.3	(88)

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EVIDENCE FOR LIFE-HISTORY TRADE-OFFS IN HUMANS

The results of numerous studies reveal trade-offs across life cycle functions, but these findings are seldom articulated in a theoretical framework. Possible reasons of trade-offs include fluctuations in the energy supply or differences in the energy needs of different biological activities. Depending on the context, several strategies for prioritizing energy use among conflicting purposes may emerge. how an illness might cause the body to divert more resources toward the immune system at the expense of the other three systems. Most research only allows for binary (choices between two functions) tradeoffs. There are four potential life cycle functions, each with two possible binary trade-offs. Now, we'll take a brief look at the evidence supporting each of them, which may include short-term trade-offs that are easily reversed and long-term trade-offs that are less so, such as those that occur throughout development. Table 3 also provides a summary of the specific cases studied.

TABLE 3 | Evidence for life history trade-offs in humans between maintenance (M), growth (G), reproduction (R), and Defence (D)

Trade-off	Population	Life-history trait	Exposure	Outcome	References
M-G	UK	Longevity	Rapid infant growth	Arterial stiffness	(91)
	UK	Longevity	Post-natal growth	High blood pressure	(92)
	India	Cellular health	Adult weight gain	Telomere attrition	(93)
	US	Cellular health	Adult weight gain	Telomere attrition	(94)
M-R	Global data	Maternal longevity	Reproductive effort	Shorter lifespan	(95)
	UK	Maternal longevity	Reproductive effort	Shorter lifespan	(29)
	Finland	Maternal longevity	Bearing twins	Shorter lifespan	(96)
	UK	Bone health	Early menarche	Reduced bone strength	(97)
M-D	Europe	Longevity	Infant disease load	Shorter adult lifespan	(89)
	Ethiopia	Mental health	Fetal fat deposition	Poorer mental health	(98)
	Meta-analysis	Metabolic homeostasis	Hepatitis C infection	Increased risk of type 2 diabetes	(99)
	Meta-analysis	Metabolic homeostasis	Periodontal disease	Increased risk of cardiovascular disease	(100)
G-R	SS Africa	Child growth	Number of siblings	Growth declines w. sibling no.	(101)
	UK	Child growth	Earlier reproduction	Low birth weight	(102)
	UK	Bone health	Early menarche	Reduced bone size	(97)
	India	Adult height	Early menarche	Short adult stature	(103)
G-D	SS Africa	Child growth	Maternal malaria	Low birth weight offspring	(104)
	Guatemala	Child growth	Diarrhoeal disease	Reduced growth	(105)
	Ecuador	Child growth	Immune activity	Reduced growth	(106)
	Europe	Adult height	Infant mortality rate	Mortality declines predict taller height	(89)
R-D	Senegal	Maternal mortality	Malaria	Reproduction increases infection risk	(107)
	UK athletes	Reproductive investment	Endurance exercise	Decline in testosterone	(108)
	UK athletes	Immune function	Endurance exercise	Increase in immune markers	(108)
	Malaysia	Reproductive investment	Reduced maternal stress	Increased breast-milk transfer	(109)

THE ORIGINS OF AGRICULTURE

Long-term co-evolutionary interaction between humans and domesticated plant and animal species increased population number and density throughout agricultural transition, as is generally acknowledged. When this occurred, foraged and hunted meals were replaced with domesticated varieties and animal by-products, and the grain size index, an indicator of agricultural productivity, was steadily selected for larger. It's also worth noting that some human populations never engaged in agriculture, while others did so just temporarily and yet others engaged in a hybrid of foraging and farming.

Agriculture emerged in many different places and at many different eras, thus its effects on human biology are likely to have been diverse. Farming may have prompted new life history trade-offs that influenced the course of agricultural development, regardless of location where the relationship between niche creation and human biology first emerged. "a continuum of human, plant, and animal relationships... and was driven by a mix of ecological, biological, and human cultural factors" best describes the dynamics of domestication. Crop domestication sometimes preceded animal domestication by many millennia, as in the New World, but in other locations, such as Africa, Arabia, and India, the reverse was true Some advantageous human features may have developed as a byproduct of cultivation/husbandry methods, whereas the role of purposeful human selection for particular traits varied. It stands to reason, given this diversity, that human life history features would

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have changed, either via genetic or plastic processes, anytime there were changes to the socio-ecological niche that were large enough to favor such reactions.

More research is needed to determine which time periods produced the most extreme life history alterations as a result of selection pressures, opportunities, or shocks. The advent of agriculture had a profound impact on the energy ecology of the human dietary niche, which allowed for the accumulation of richer and more stable resources, sustainable dairy animal by-products, food excess storage, and novel types of cooperative behavior. Due to its compact size and short transit time, the human gut limits the amount of food that can be consumed, digested, and subsequently transformed into metabolizable energy. Consuming foods that are both rich in energy and extra-somatically processed may help increase dietary energy supply despite biological constraints. Any claimed changes in human biology during the agricultural revolution must be understood in the broader context of ecological shifts, not just dietary modifications. Changes in the life histories of both humans and agricultural species happened simultaneously.

Many of the characteristics that indicate the life cycle adaptations of crop and animal species were either positively or negatively influenced by human selection throughout the domestication process. For instance, due to human intervention, the plant morphology of wheat, barley, and rice has evolved to produce larger grains with non-shattering spikelet scars. This resulted in bigger, more energy-dense grains that were less likely to be damaged during harvest. However, they typically needed to be processed more before being eaten. forth addition, since people had to put forth more effort to protect their new resources from infections and predators, plant and animal "defense" components had to be eliminated via selective breeding. Because of the increased seasonality of their food supply, early farmers fell into a new "labor trap" over the course of several centuries.

HISTORY OF INDIAN AGRICULTURE

Early History

Domestication of wheat, barley, and jujube began in the Indian subcontinent about 9000 BCE. Sheep and goats were the next livestock to be domesticated. The elephant was the first animal to be domesticated during this time period. By 8000-6000 BCE, barley and wheat were being cultivated in Mehrgarh, along with the domestication of cattle, principally sheep and goat. Threshing, two- or six-row crop planting, and granary storage were all common practices in traditional Indian agro-pastoralist communities. Agricultural villages quickly developed over Kashmir in the 5th millennium BCE. The "first evidence of cultivation of cotton had already developed," according to Zaheer Baber (1996). By the 5th-4th millennia BCE, cotton was being farmed. The Indus Valley civilization had a sophisticated cotton industry, with techniques for spinning and making textiles from the material being employed up to the advent of modern industrialization in India. Mangoes, muskmelons, and other tropical fruits have their origins on the Indian subcontinent.

In addition to using it for drugs, fiber, and oil, the Indians farmed hemp for a variety of purposes. In the Indus Valley, locals cultivated peas, sesame, and dates. Sugarcane was initially planted in the tropical regions of South Asia and Southeast Asia. S. barberi is thought to have come from India, whereas S. edule and S. officinarum are considered to have come from New Guinea. Northern India's Belan and Ganges valleys were the birthplaces of wild Oryza rice about 4530 and 5440 BCE. The Indus Valley Culture cultivated rice. In the second millennium B.C., the production of rice was an important agricultural activity in the areas of Kashmir and Harrappan. The economy of the Indus Valley was founded on a system of mixed farming. The expansion of farmed rice from India to South and Southeast Asia is described in depth by Denis J. Murphy.

Vedic period

Timeframe: after the MahaJanapadas (c. 1500 BCE - c. 200 CE) Gupta suggests that summer monsoons may have lasted longer and provided more moisture than is necessary for regular agricultural output. The necessary winter monsoon rains may have been easier to come by thanks to this extra water. In India, Rabi crops include both wheat and barley, and until irrigation became commonplace, the country would have relied heavily on the winter monsoons. Overly wet conditions would have been detrimental to the development of Kharif crops. India is credited with being the first country to produce jute for the purpose of making rope and cordage. The Indians began to worship many creatures that they saw as essential to their well-being.

Early Common Era

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Later Roman Empire (about 400 CE) Rice, sugarcane, millets, black pepper, a number of cereals, coconuts, beans, cotton, plantain, tamarind, and sandalwood were only few of the many crops produced by the Tamil people. Additionally, Jackfruit, coconuts, palms, arecas, and plantains were all commonplace in their culture. A number of practices, including as methodical ploughing, manuring, weeding, irrigation, and crop protection, were utilized by farmers to keep agriculture continuing. Early attempts at storing water date back to this era. One of the world's oldest operational dams, Kallanai was constructed on the river Kaveri during the first and second centuries CE.

CONCLUSIONS

In conclusion, we have used life history theory to investigate the potential effects of fast environmental alterations on human development and growth via the coordination and synchronization of life-history trade-offs in human populations. Our theoretical framework may shed light on previous dramatic changes, like the Industrial Revolution and the current fast shift in our dietary habits. Reversing the life-history alterations induced by agricultural adoption, public health measures in high-income countries over the past 150 years have simultaneously increased nutrition and lowered infection risk. However, in today's low- and medium-income nations, where infectious illness loads remain high for both newborns and children, and where agricultural yields have been inadequate for decades, the subsistence niche has altered very little through the ages. We can now explain why major secular changes are associated with overweight and obesity rather than adult height: Rapid changes in food are seldom accompanied by equally swift shifts in other aspects of people's daily lives. The goal of developing land and water management systems is to facilitate consistent expansion. A robust agricultural policy was developed in the independent Republic of India notwithstanding some standstill in the later modern age.

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