

Life Stream

A group of dolphins leaping from the water with their mouths open, set against a blue background. The dolphins are arranged in a cluster, with some in the foreground and others slightly behind, creating a sense of movement and energy. The water is a vibrant blue, and the dolphins' bodies are a dark grey color. The overall composition is dynamic and visually appealing.

ANNUAL ISSUE 2013 ON NATURE & COOPERATION

The only thing that will redeem mankind is cooperation - *Bertrand Russell*

THEME: NATURE & COOPERATION**CONTENTS**

A 1. Nature Cooperation in Nature Lifestream Team Page 3	E 1. Economics Cooperatives: The Third Way Lifestream Team Page 32
A 2. Mother Earth Cooperation, Conflict and the Evolution of Complex Animal Societies Dustin R Rubenstein Page 7	F 2. Poems The Owl Edward Smith Page 25
A 3. Farming Why Organic Farming? Part-II Jean English Page 11	G. Food and Diet Eating Together Larry Forthun Page 30
B. Science Cooperation in Science – The Human Genome Project S. Jalaja Page 13	H. Travel Yellowstone Magic Dr. Balachandran Wariyar Page 32
C. Personalities Kurien; The Milkman of India Life science Team Page 19	I. The Universe Cooperation in Space Anup Sinha Page 37
D. Art and Culture Manthan- The Churning Sudha Shrotriria Page 23	

COVER: LAUGHING DOLPHINS Image copyright (c) seacrittergarb.com

LIFE STREAM – ANNUAL ISSUE 2013 is a publication of the Life Science Foundation

WE PRESENT

The year 2012 was declared as the International Year of Cooperatives by the United Nations in order to celebrate the achievements of the cooperative movement. According to the UN Secretary General the 'cooperative model 'empowers people, enhances human dignity and helps achieve the Millennium Development Goals' and 'addresses the social and economic goals that go beyond a one-dimensional bottom line'. As far as the younger generation is concerned 'cooperatives offer a model that not only mobilize young people in their own productive enterprises, but facilitates their broader engagement with their communities'.

Studies have shown that cooperation does exist in nature. Atoms combine to form molecules, cells into tissues; plants and animals cooperate with each other. Human beings live as communities in villages; caste and kinship form strong bonds of cooperation. Community living and taking food together were common in the past. Even in nature



cooperation can be witnessed in myriad cases-air water and sunlight, together support photosynthesis; ideal conditions co-exist on earth for the birth and growth of living things. Vibrant ecosystems are supported by inanimate mountains, rivers, and soil. Geographical formations occur due to a number of factors/forces acting together. We, as human beings, have achieved great heights in science due to cooperation between individuals/amongst scientists, universities, institutions agencies and countries. Poets have shared their pain, anguish and concern at the loneliness and helplessness of the fellow-beings.

Do these examples offer Cooperation/cooperatives as a viable solution to the multiple problems we face today like persistent poverty, broken communities, degraded environment, unabashed consumerism and violence in society?. Life Stream has been promoting cooperation not only amongst the human beings but also between human beings and nature itself. We feel that life ought to be a celebration of cooperation and inter-connectedness, rather than unbridled aggression and competition. We have, therefore, included features and articles depicting the many facets of cooperation in this issue.

We have compiled information on the subjects from the electronic and print media, reports, books, speeches and other sources so as to make it available all at one place, for your consideration . We invite suggestions, i criticismsand improvements from our readers.

*We present here the Annual Issue of Life Stream, 2013 on **Nature & Cooperation**.*

LIFE STREAM TEAM

NATURE: COOPERATION IN NATURE

Lifestream Team

Charles Darwin, while propounding the theory of evolution, described the 'struggle for existence' and survival of the fittest 'amongst plants and animals as the driving forces in the evolution of species in nature. Plants compete with each other for sunlight, food and water; in the animal kingdom animals compete for food, mates and breeding space. But fresh evidence for cooperation among individuals and groups in the plant and animal kingdoms has come to light in recent times, through research studies.

Where do you find cooperation in nature? How extensive is cooperation? Is cooperation beneficial? With the help of illustrations we try to

"Cooperation is the process by which the components of a system work together to achieve the global properties. Individual components that appear to be "selfish" and independent, work together to create a highly complex, greater-than-the-sum-of-its-parts system. How the mechanism of cooperation works in nature is still not understood in full."

Wikipedia

explain cooperation in nature in this and the next section.

1. The components of a cell work together, to keep it living.

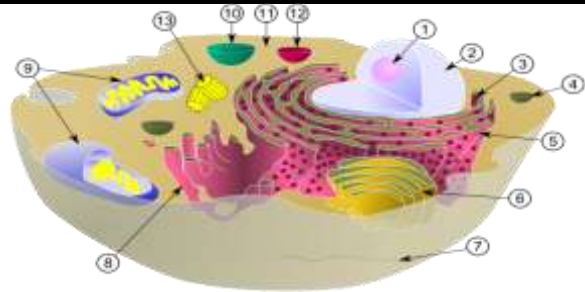


Figure 1. The Cell (users.humboldt.edu)

2. Atoms cooperate in a simple way, by combining to make up molecules.



Figure 2. DNA Double Helix

3. Organisms form food chains and ecosystems.

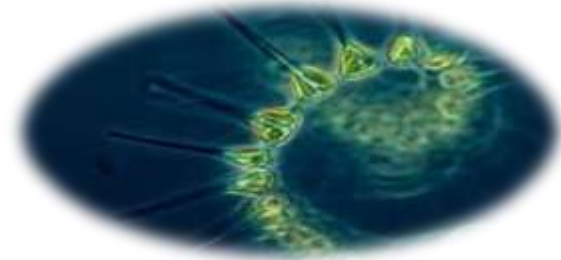


Figure 3. Phytoplankton - the foundation of the oceanic food chain

4. Neurons create thought and consciousness and work together and communicate to produce nerve impulses

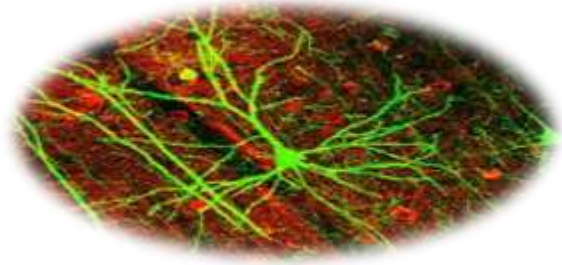


Figure 4. Mouse Neurons

5. People form families, tribes, cities and nations.



Figure 5. Hunter Gatherer Cooperation (nature.com)

DARWINIAN CONTEXT

Charles Darwin's theory of how **evolution** works ("By Means of **Natural Selection**") is explicitly competitive ("survival of the fittest"), **Malthusian** ("struggle for existence"), even gladiatorial ("**nature, red in tooth and claw**"). Species are pitted against species for shared resources, similar species with similar needs and niches even more so, and individuals within species most of all. All this comes down to one factor: out-competing all rivals and predators in producing progeny.

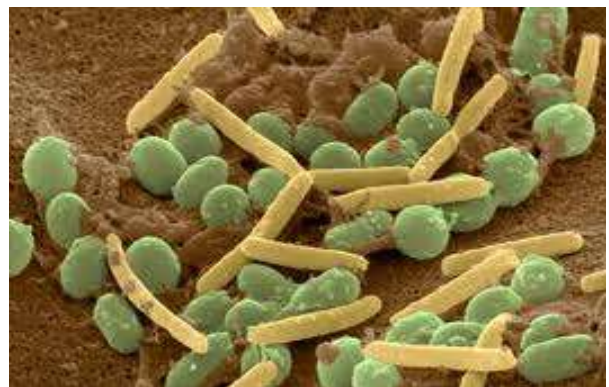
Darwin's explanation of how preferential survival of the slightest benefits can lead to advanced forms is the most important explanatory principle in biology, and extremely powerful in many other fields. Such success has reinforced notions that life is in all respects a war of each against all, where every *individual* has to look out for himself, that your gain is my loss.

In such a struggle for existence **altruism** (voluntarily yielding a benefit

to a non-relative) and even cooperation (working with another for a mutual benefit) seem so antithetical to self-interest as to be the very kind of behavior that should be selected against. **Yet cooperation, and seemingly even altruism, have evolved and persist, and naturalists have been hard pressed to explain why.**

Ref. Wikipedia

Cooperative behavior must have evolved in nature due to its beneficial effects. Bacteria mostly live in colonies.



cooperative bacteria (esciencenews.com)

Cooperation is also explained within the context of group selection. In groups with mostly selfish individuals, everyone would be acting selfishly, eventually resulting in starvation and over-exploitation of resources. **In groups where individuals were cooperative and breeding was at optimal levels conserving resources, the survival rate would be higher.** Therefore, it was assumed that cooperative behavior was selected while the species evolved.



Figure 6. Meerkats (biotechnology.wordpress.com)

Reports appearing in websites show that Meerkats live in groups of up to 30 adults with their offspring. Amongst the adults the dominant ones partake in reproduction, while the subordinate ones help to raise the young.

Power consists in one's capacity to link his will with the purpose of others, to lead by reason and a gift of cooperation

Woodrow Wilson



Figure 7. A troop of Vervet monkeys in South Africa (Wikipedia)

Vervet monkeys display kin selection between siblings, mothers and offspring, and grandparent-grand child. An older female sibling or a grandmother act as a mother in parenting younger

members of the group. Several studies, mostly done with cichlids, have shown that eggs and fry do not survive well when one of the parents is experimentally removed. **Cooperative parenting helps prevent inbreeding paving the way for elimination of harmful genes.**



Figure 8. A small, subordinate cichlid helps a large dominant pair to raise the dominants' offspring (Sciencedaily.com)

“Cooperative breeding” has also been reported wherein off springs from former broods stay with their parents to help raise new broods. These helpers share all parental duties, repelling territory intruders, removing debris, cleaning and fanning the eggs. As they grow older and bigger, helpers have the option of moving out to initiate their own

breeding venture. Cichlids have been cited as an example to explain cooperative breeding.

Prisoner's Dilemma-To cooperate, or not cooperate?

*This simple question (and the implicit question of whether to trust, or not), expressed in an extremely simple game, is a crucial issue across a broad range of life. Why shouldn't a shark eat the little fish that has just cleaned it of parasites: in any given exchange who would know? Fig wasps collectively limit the eggs they lay in fig trees (otherwise, the trees would suffer). But why shouldn't any one fig wasp cheat and leave a few more eggs than her rivals? At the level of human society, why shouldn't each of the villagers that share a common but finite resource try to exploit it more than the others? At the core of these and myriad other examples is a conflict formally equivalent to the Prisoner's Dilemma. Yet sharks, fig wasps, and villagers all cooperate. **It has been a vexatious problem in evolutionary studies to explain how such cooperation should evolve, let alone persist, in a world of self-maximizing egoists.***

Ref. Wikipedia

"From molecules joining together to form compartments at the beginning of life, through replicators joining together to form chromosomes, through prokaryotes combining to form the eukaryotes, cells multiplying into multi cellular organisms and individuals forming colonies, **cooperation is ubiquitous.** We cannot chalk up its existence to a few exceptions and it must be incorporated as a building block in evolutionary theory. This was a groundbreaking insight from William D. Hamilton, one



of the greats of evolutionary theory of the 1960s."



"If you want to lift yourself up, lift up someone else." - Booker T. Washington

MOTHER EARTH: COOPERATION, CONFLICT AND THE EVOLUTION OF COMPLEX ANIMAL SOCIETIES

Dustin R. Rubenstein (Department of Ecology, Evolution and, Environmental Biology, Columbia University) & James Kealey (Columbia University) © 2012 Nature Education

Organisms as diverse as amoebae and elephants frequently live in groups. Why do these and many other animals form complex societies?

Organisms are inherently competitive, yet cooperation is widespread. Genes cooperate in genomes; cells cooperate in tissues; individuals cooperate in societies. Animal societies, in which collective action emerges from cooperation among individuals, represent extreme social complexity. Such societies are not only common in insects, mammals, and birds, but exist even in simple species like amoebas (Figure 1). Animal societies vary in structure from eusocial insect colonies with a single reproductive female supported by hundreds, thousands, or even millions of non-breeding workers, to cooperatively breeding groups of vertebrates with one or more breeders and a small number of non-breeding helpers.

Given the diversity of social taxa, why do some species form complex societies, while other closely related species do not? Within these societies, why do some individuals attempt to reproduce, while others delay their own reproductive efforts to help raise the offspring of others? Determining the answers to these and other questions requires considering how and why groups form, and how individual behavioral roles are determined within groups.

Although many species form temporary associations, such as (a) flamingo (*Phoenicopterus minor*) colonies and (b) zebra (*Equus quagga*) herds, some species such as (c) African elephants (*Loxodonta africana*), (d) snapping shrimps (*Synalpheus brooksi*), and (e) superb starlings (*Lamprolornis superbus*) form more permanent social groups and live together year-round.

THE COSTS AND BENEFITS OF GROUP LIVING

Group-living typically provides benefits to individual group members. For instance, most animals only have one pair of eyes to look for food or to watch for predators. Animals living in groups, however, benefit from many more pairs of



eyes to provide vigilance or help forage. But living in groups may also confer costs to members. As individuals aggregate, they become more conspicuous to predators and competition for food can increase. Therefore, **when deciding to join a group, individuals must weigh the cost-benefit ratio of living solitarily versus with others. When**

may include increased attack rates by predators, increased parasite burdens, misdirected parental care, and greater reproductive competition.

Although many species form short-term, unstable groups (e.g., herds of wildebeest, colonies of gulls), some form long-term, stable social groups



the benefits of living together outweigh the costs of living alone, animals will tend to form groups (Alexander 1974). Other benefits of group-living may include receiving assistance to deal with pathogens (i.e., grooming), easier mating opportunities, better conservation of heat, and reduced energetic costs of movements. Other costs of group-living

"None of us, including me, ever do great things. But we can all do small things, with great love, and together we can do something wonderful." -
Mother Teresa

where interactions among members often appear to be altruistic. For example, when a ground squirrel sounds an alarm call to warn other group members of a nearby coyote, it draws the coyote's attention and increases its own odds of being eaten (Sherman 1977). Similarly, when a meerkat forgoes reproduction and instead feeds the young of another group member, it reduces the number of offspring it will produce

during its lifetime (Clutton-Brock *et al.* 2001). Scientists since Darwin have wondered why animals like these perform cooperative behaviors that may be detrimental to their own evolutionary fitness. One key to understanding such altruistic behavior came from Robert Trivers, who considered a hypothetical group of animals in which one individual is faced with the opportunity to take a small risk in order to provide a large benefit to another (Trivers 1971). **Although choosing not to help is typically the best choice for an individual's fitness in the short-term, it could mean that the individual will not receive reciprocal help from others when it is needed in the future. This provides incentive for altruistic behavior in situations where individuals interact repeatedly, which typically occurs when animals live in stable groups.** For example, many primates like baboons live in large groups and form coalitions where such cooperative interactions are frequent.

KIN SELECTION AND LIVING IN FAMILIES

Altruistic behavior can benefit individuals even when it is not reciprocated. William Hamilton was among the first to realize this when he considered how altruistic behaviors might evolve in living organisms (Hamilton 1963). Based upon observations of social insects, he reasoned that **the extent to which an individual is willing to help another should be determined by the degree to which those individuals are related.** For example, Hamilton would predict that a person should be more willing to run into a burning building to rescue their own cousin than they should be to save an unrelated stranger. This is because relatives share many genes, and evolutionary fitness is determined by the fraction of an individual's genes that enter the next generation's gene pool, regardless of whether those genes come from that particular individual or from identical copies in its relative. If the cousin who is saved goes on to reproduce, then the altruistic act of saving that relative increases the

"If everyone is moving forward together, then success takes care of itself." - Henry Ford

evolutionary fitness of the rescuer by passing on shared genes.

$$rB > C$$

Hamilton's rule details the conditions under which altruistic behavior should evolve. It weighs the benefits and costs (in terms of reproductive benefits, or offspring produced) of a donor performing an altruistic behavior towards a recipient. According to Hamilton's rule, the donor receives a direct cost C (in terms of lost direct fitness) for cooperating, whereas the recipient receives an additional benefit B (in terms of increased direct fitness). However, the donor also receives a portion of the benefit B that is discounted by the genetic relatedness r (i.e., degree of shared genes) between the two individuals. This discounted portion of the benefit is equivalent to the donor's indirect fitness gain.

Although organisms can enhance their direct fitness by reproducing themselves, Hamilton realized that they can also enhance their own indirect fitness by helping relatives. He formalized this argument in what has become known as Hamilton's Rule, a general model that calculates the percentage of genes shared between two individuals, and then uses this value to determine the costs and benefits of a cooperative act (Figure 2). Hamilton's insight, termed kin selection by John Maynard Smith, was particularly appealing to evolutionary biologists because it appeared to explain not only why many individuals in complex societies would forgo breeding to help their relatives reproduce, but also how those societies might evolve (Maynard Smith 1964).

EU SOCIETIES Kin selection theory is particularly relevant to social insect societies because many insects are haplo-diploid. In haplo-diploid species, an individual's sex is determined not by the presence or absence of a sex chromosome, but instead by the number of copies of the genome in an individual's cells. Diploid fertilized eggs

containing two copies — one from each parent — become females, while unfertilized haploid eggs with only a single copy become males. Kin selection theory suggests that the sex-determined differences in relatedness among individuals

studying the causes and consequences of sociality. These groups are called eusocial (i.e., truly social) because they share three key criteria: 1. cooperative care of young; 2. overlapping generations (i.e., parents and offspring

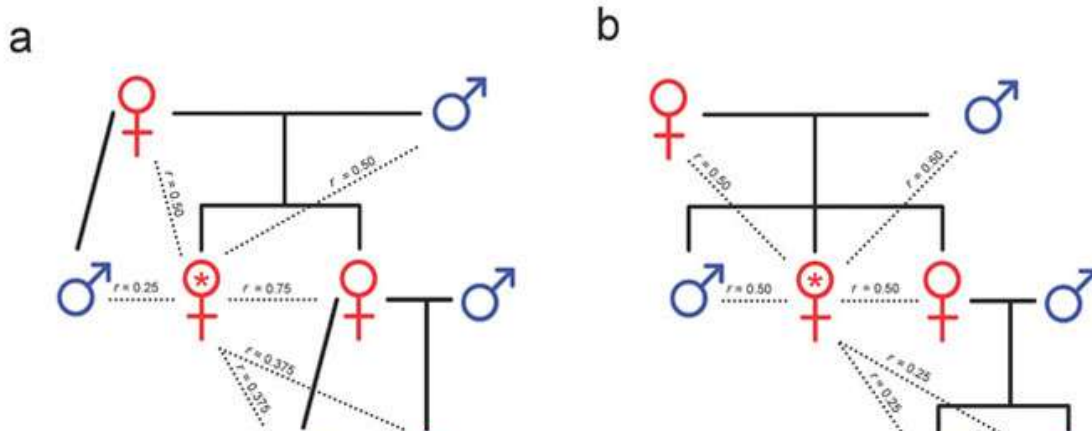


Figure 9. Patterns of relatedness in haplo-diploid and diploid species

(Figure 3) provide incentives for young females to stay at home and help raise their sisters. However, initial excitement over this explanation as a

cohabitating); and 3. a reproductive division of labor, often culminating in caste development (Wilson 1971). Eusociality was first formally

This (A) Haplo-diploid and (B) diploid family trees showing the relatedness of an individual female (denoted by red star) to kin, assuming her mother mates with only one male (i.e., her father). In singly mated haplo-diploid species, females are more closely related to their sisters ($r = 0.75$) than they are to their brothers ($r = 0.25$). Haplo-diploid females are also more related to their nieces ($r = 0.375$, Figure 1b) than diploid females are to their nieces ($r = 0.25$, Figure 1b). However, in many haplodiploid species (including the honey bee) queens are polyandrous and can mate with multiple males, creating broods in which most workers are not full siblings and instead are half-sisters (r between 0.25 and 0.5; the actual value depends on how many males the queen mates with). When queens mate with multiple males, workers are more closely related to the queen's sons (their brothers, $r = 0.25$) than they are to their half-sister's sons (their nephews, r between 0.125 and 0.25). This creates an incentive for workers to police other workers by destroying their eggs.

primary reason for sociality was tempered by observations of non-social haplo-diploid species, as well as subsequent discovery of eu social diploid species like termite. The enormous and highly complex societies formed by some insects have been especially important for

described in ants by Wheeler (Wheeler 1928), and has since been shown to be widespread in numerous other insects, most notably in bees, wasps, and termites, as well as in some other taxa like snapping shrimp and even a rodent.

“We all do better when we work together. Our differences do matter, but our common humanity matters more.”

Bill Clinton

The coordination that makes a eusocial group successful depends upon the majority of group members forgoing personal reproduction. This allows workers to focus their efforts on specialized tasks, creating extraordinary efficiencies of scale. But why don't workers reproduce? Are they being coerced into helping by queens, or are they helping voluntarily to gain the indirect fitness benefits of rearing relatives? Research suggests that helping behavior in insects may be a product of both coercion and voluntary actions. For example, evidence of coercion comes from honeybees, where individuals cannot choose their reproductive role and instead develop into either workers or queens based upon the nutrients they receive from others during their larval stage.

unfertilized eggs that become males. Surprisingly, this rarely occurs when the queen is alive because workers police other workers, destroying any eggs laid. Such behavior maximizes the fitness of the policing worker by ensuring that her energy is devoted to raising the daughters of the queen (i.e., her sisters) and not her more distantly related nieces (Ratnieks & Visscher 1989).

COOPERATIVE BREEDING IN VERTEBRATE SOCIETIES

Although few vertebrates are eusocial, many species live in complex, cooperatively breeding societies in which more than two individuals care for young. Alexander Skutch (Skutch 1935) made the

first

However, there is also evidence from honeybees that workers voluntarily act to maximize their own fitness by rearing relatives. Although worker honeybees are unable to mate and produce diploid offspring, they are capable of laying

observations of cooperative breeding in birds, but subsequent biologists have reported the behavior in a variety of other taxa, including many mammals and fish. In addition to breeders, cooperative groups often contain a variable number of non-breeding auxiliaries, or helpers, that aid in raising

If I have seen further, it is by standing on the shoulders of giants." - Sir Isaac Newton

the offspring of others. Unlike the workers of many social insect societies, vertebrate helpers are totipotent and retain the ability to reproduce throughout their lives. In most, but not all, cooperatively breeding species, helpers tend to be related to the breeders, and, therefore, realize the indirect fitness benefits of raising relatives. In this way, the kin structure of vertebrate societies is similar to that of insect societies, even though group sizes are generally an order of magnitude smaller in vertebrates. Cooperative breeding is especially common in birds, including many well-studied species like Florida scrub jays and white-fronted bee-eaters, and mammals, including many rodents and carnivores.

Whereas kin selection likely underlies the evolution of many cooperatively breeding societies, it alone cannot explain why some species are social, while other closely related species are not. Biologists have long realized that the environment in which a population lives might influence whether or not its members live socially. To breed successfully, animals need a variety of resources including territories, food, and even mates. Without such resources, the likelihood of reproducing successfully is low, and so remaining with one's family to help raise relatives may be a better option for maximizing fitness than trying to breed unsuccessfully elsewhere (Emlen 1982). In many species of birds, mammals, and fish, younger individuals often delay finding their own breeding territories for a few years until a better opportunity arises, instead remaining at home to gain valuable experience and parenting skills, in



addition to the indirect benefits of raising relatives. Similarly, when individuals live in hostile and

unpredictable climates, cooperative breeding may be a conservative strategy to maximize fitness when breeding conditions cannot be accurately predicted from year to year (Rubenstein & Lovette 2007). Thus, cooperative breeding can be thought of as a 'best of a bad job' strategy to maximize fitness, either when opportunities for independent breeding are limited or when breeding conditions are uncertain.

CONCLUSION AND FUTURE DIRECTIONS

Cooperation and sociality are widespread in animals. Seemingly altruistic behaviors, like raising the offspring of others, instead of trying to reproduce, can largely be explained by the shared genetic heritage between interacting individuals. **Most complex animal societies are actually families in which group members are related, and, therefore, share a high proportion of their genes.** The cooperative and often complex collective action that arises from such family groups is a product of the interaction of individuals seeking to maximize their own evolutionary fitness. Genetic structure clearly influences the evolution of animal sociality. But do genes themselves influence an individual's altruistic behavior? As new genomic tools become to what extent, individual genes underlie social behavior. For example, recent studies in wasps suggest that differences in the expression of a relatively small number of genes may be linked to large social differences in closely related species (Toth *et al.* 2007). Over the next decade, new research may determine if similar genetic mechanisms underlie social behavior in different types of species, including both invertebrates and vertebrates.

 No one can whistle a symphony. It takes a whole orchestra to play it." - H.E. Luccock

ORGANIC FARMING : PART- 2 FERTILIZERS

Jean English

This time we bring you another article relating to Organic farming from MOGFA (Maine Organic Farming Association). This time it is a reflection by Jean English based on a lecture by John Ikerd.



Figure 10. Organic Fruit (photocase.com)

Synthetic chemical fertilizers won't kill you outright, unless you ingest some quantity directly, I suppose, or unless certain nitrogen fertilizers explode for one reason or another; all such reasons should be avoided. Still, synthetic fertilizers have their environmental, economic and even health-related costs, and those problems have been amplified as conventional farmers have come to rely on these fertilizers.

Environmentally, synthetic fertilizers tend to be more soluble than more complex, organic soil amendments. **Because they're more soluble, many can readily leach through soils and into well water, streams and lakes; or they can run off the surface of lawns, farms and gardens and into waterways during rains.** Once in the water, they can cause algal blooms, which harm aquatic life; or nitrates from some nitrogen

fertilizers may contaminate wells, potentially harming the health of people who drink that well water.

On a large scale, synthetic fertilizers applied to Midwestern farms (mostly grain farms; increasingly grains grown for ethanol production) have polluted the rivers that feed the Gulf of Mexico, killing most of the aquatic life (and the fisheries) in the Gulf. Many people have pointed out that we taxpayers, who subsidize Midwestern grain farmers, are actually paying to pollute the Gulf.

More complex, more slowly-released organic fertilizers are held more tightly in the soil and released more slowly, so they tend to pollute less. It is possible to have some leaching or runoff from manures (especially poultry), for instance, if they're applied excessively or at the wrong time; but organic growers use manures according to organic standards, minimizing or eliminating such problems. (Many conventional farmers also use manures wisely.) Also, since many organic fertilizers are recycled carbon-containing products that were once plant or animal matter, **using organic fertilizers can sequester carbon in the soil, rather than allowing it to enter the atmosphere as carbon dioxide.**

Organic farming, or any farming that builds the amount of organic matter in the soil, can help alleviate climate change profoundly. Another environmental problem with synthetic fertilizers is that **excess nitrogen inplants (more common with synthetically fertilized plants than with organically grown) can attract pests such as aphids,** which often spur growers to use pesticides, and those pesticides can end up in soils and/or in us.

And synthetic fertilizers can harm soil life. Organic growers rely on soil organisms to hold nutrients in their bodies and release them when plants need them.

Industrial agriculture and the assumptions on which it rests are wrong, root and branch

Wendell Berry

Economically (in addition to the economic costs of environmental degradation), **synthetic fertilizers are increasingly expensive**. Natural gas is required to synthesize some nitrogen fertilizers, and fossil fuels are used to mine, process and/or transport other synthetic fertilizers. Prices for these fertilizers have been high for the past few years and have doubled, at least, in the past year. This is one definition of unsustainable farming. Recycling organic materials that are produced close to home is more sustainable.

fertilizers). Organic fertilizers, by supplying more nutrients to soils and to the organisms that live in soils, cycle these nutrients into crops and into consumers. A number of studies have shown that organically grown foods (fruits, vegetables, grains, meats, dairy products) are more nutritious, in terms of vitamins, minerals and proteins, for instance, than conventionally grown.

The basic philosophy of organic gardening and farming is to feed the soil rather than the plant: A



From a health standpoint, in addition to the potential for nitrate contamination of waters, synthetic fertilizers can push plant growth so much that nutrients in the resulting food are diluted. Buy an organically grown cantaloupe that got an even supply of nutrients over a long period, and you'll get a mouthful of vitamins and minerals (and taste!); buy a conventionally grown, "force-fed" melon, and you're usually buying more water: **The plant grew rapidly in response to the rush of nitrogen available, and that growth stimulated more water uptake.**

Organic fertilizers usually are more complex and supply more nutrients than synthetic fertilizers, which usually are formulated to provide one, two or three major nutrients only (nitrogen, potassium and phosphorus, the N-P-K listed on bags of

rich soil will take care of the plant, and the plant will take care of you.

This article is provided by the Maine Organic Farmers and Gardeners Association (MOFGA), PO Box 170, Unity, ME 04988; 207-568-4142; and published with its permission.mofga@mofga.org; www.mofga.org.

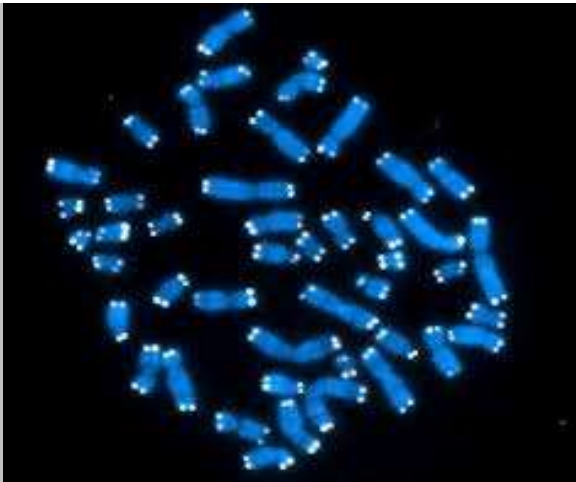
In the spring, at the end of the day, you should smell of dirt

Margaret Atwood

SCIENCE: COOPERATION IN SCIENCE – THE HUMAN GENOME PROJECT

Lifestream Team

“Mapping the human genome has been compared with putting a man on the moon, but I believe it is more than that. This is the outstanding achievement not only of our lifetime, but in terms of human history. A few months ago I compared the project to the invention of the wheel. On reflection, it is more than that. I can well imagine technology making the wheel obsolete. But this code is the essence of mankind, and as long as humans exist, this code is going to be important and will be used.” -Thomas Michael Dexter



BACKGROUND

The Theory of Evolution by Natural Selection put forwarded by Charles Darwin and the discovery of the Laws of Inheritance by Gregory John Mendel led to unprecedented developments in biological sciences in the last century. The publication of a small book with big thoughts-“What is Life” by Erwin Schrödinger inspired young scientists like James Watson to take on the challenge of finding the genetic basis of life and inheritance. This led to the unraveling of the structure of DNA and the mechanism of its replication by Watson and Crick and the genetic code by Francis Crick and others.

By the end of the last century we saw Genetics, Genomics, Molecular Biology, Cell Biology and

Genetic Engineering developing as independent fields, involved in research concerning life at molecular and genetic levels. By the end of the



Figure 11. Francis Collins

century the challenge of sequencing genes in Human genome was taken up by the scientific community both within and outside government. The dawn of the new century saw the announcement on completion of the working draft of the human genome. **The Human genome Project remains one of the largest single investigative projects in modern science. This land mark achievement is the culmination of the combined efforts by individuals, Universities and research institutions and the cooperation amongst themselves.**

“Coming together is a beginning, staying together is progress, and working together is success.” - Henry Ford



Figure 12. James Watson

GOALS

The Human Genome Project (HGP) is an international scientific research project which was started with the following goals (U.S. Department of Energy-genome Project):-

- Identify and map the approximately 20,000–25,000 genes in the human DNA
- To determine the sequence of 3 billion chemical base pairs in the human DNA
- Store this information in data bases
- Transfer related technologies to private sector
- Address the ethical, legal, and social issues that may arise from the project (<http://doegenomes.org>)

HOW IT GOT STARTED

The project was started in 1990 by the US Department of Energy and the National Institutes of Health at a cost of \$3 billion, and was expected to complete in a period of 15 years. **Apart from the United States, the international consortium comprising of scientists from United Kingdom, France, Australia, Japan and others collaborated in the project.** It was initially headed by Aristides Patrinos, head of the Office of Biological and Environmental Research in the U.S. Department of Energy's Office of

The best teamwork comes from men who are working independently toward one goal in unison."
- James Cash Penney

Science. James D. Watson was head of the National Center for Human Genome Research at the National Institutes of Health in the United States starting from 1988. Watson however, resigned from that post on disagreement over the issue of patenting genes in 1992. Francis Collins replaced him in April 1993. The name of the Center was changed to the National Human Genome Research Institute (NHGRI) in 1997. While Collins directed the US National Institutes of Health (NIH) National Human Genome Research Institute efforts, a parallel project was separately launched by the Celera Corporation, or Celera Genomics in 1998. In the government-sponsored project sequencing was done in universities and research centers in the United States, the United Kingdom, Japan, France, Germany and Spain.

THE SEQUENCING OF GENES

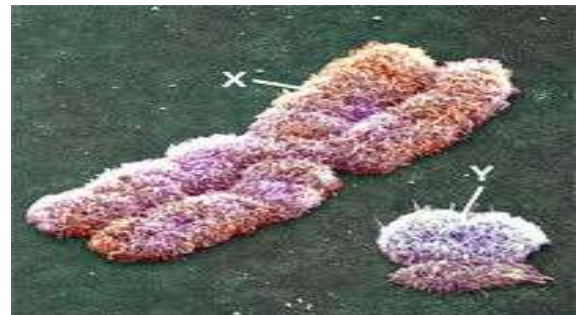


Figure 13. Human X and Y Chromosomes (dailytech.com)

The entire hereditary information of an organization is encoded either in DNA or, for many types of virus, in RNA. The genome includes both the genes and the non-coding sequences of the DNA/RNA. A complete set of human genetic information is stored in DNA sequence within the 23 pairs of chromosomes, the cell nucleus, and the DNA within the mitochondrion. The haploid human genome (contained in egg and sperm cells) consists of three billion DNA base pairs, while the diploid genome (found in somatic cells)

has twice the DNA content.

The sequencing of genes is not an easy task as the genome of any given individual with a few exceptions is unique. Therefore, sequencing multiple variations of each gene becomes necessary.

- The sequencing did not cover the entire DNA found in human cells; about 8% of the total genome remained un-sequenced.
- The project has also focused on several other non human organisms such as *E. coli*, the fruit fly, and the laboratory mouse. It remains one of the largest single investigative projects in modern science.
- The Project originally aimed to map the nucleotides contained in a human haploid reference genome with more than three billion base pairs. However, several Groups announced efforts to extend this to diploid human genomes

Due to major advances in computing technology and better sequencing, and international

cooperation a 'rough draft' of the genome was announced jointly by U.S. President Bill Clinton and the British Prime Minister Tony Blair on June 26, 2000. President Clinton hailed it as the “first draft of the human book of life”.

This first available rough draft assembly of the genome was completed by the Genome Bioinformatics Group at the University of California, Santa Cruz, primarily led by then graduate student Jim Kent. A complete genome was announced in April 2003, 2 years earlier than planned. In May 2006, another milestone was achieved in the completion of the project, when the last of the human chromosomes was sequenced.

ACCESSIBILITY

Some of the scientists had fought to keep the genome data freely accessible to researchers around the world, even before the first draft was announced as Craig Venter was racing to sequence the human genome through his company, Celera, with the intention of charging researchers for access to the information. In 2000 the human

DOWN'S SYNDROME



adaproject.org (US Dept.of Energy)

Down Syndrome is one of the most common genetic disorders, affecting 1 in 650-1,000. It is a common genetic disorder characterised by learning difficulty, dysmorphic facial features and a host of structural abnormalities. It is named after John Langdon Haydon Down - an English physician, 1828-1896. The underlying genetic defect is trisomy 21 in 94% of cases. Mosaicism (2.4%) and translocations (3.3%) also occur. 75% of these translocations are de novo errors. Chromosome 9 is highly structurally polymorphic. It contains the largest autosomal block of heterochromatin, which is heteromorphic in 6-8% of humans, whereas pericentric inversions occur in more than 1% of the population. The finished euchromatic sequence of chromosome 9 comprises 109,044,351 base pairs and represents >99.6% of the region.

Analysis of the sequence reveals many intra- and inter chromosomal duplications, including segmental duplications adjacent to both the Centromere and the large heterochromatic block. We have annotated 1,149 genes, including genes implicated in male-to-female sex reversal, cancer and neurodegenerative disease, and 426 pseudogenes. (Nature)

genome was put in the public domain after intervention by the Governments of US and UK and a deal was agreed to by both sides. John Sulston Nobel laureate who led the HGP in UK was quoted in the Guardian newspaper dated 24-6-2010 as "What that advance is being used for is an attempt to monopolize, through the patenting system, essentially all the tools for genomic manipulation," he said. "Let's be clear that the tools for manipulating genomes should be in the public domain. This is not just a philosophical point of view; it's actually the case that monopolistic control of this kind would be bad for science, bad for consumers and bad for business, because it removes the element of competition."

WHAT WE KNOW ABOUT THE HUMAN GENOME

The human genome is contained in 23 chromosomes. Each chromosome contains 48 to 250 million letters (A, C, G, T) without spaces; the genome contains a total of over 3.2 billion letters.

1. There are approximately 23,000 genes in human beings, the same range as in mice and roundworms. Understanding how these genes express themselves will provide clues to how diseases are caused.
2. The human genome has significantly more nearly identical, repeated sections of DNA than other mammalian genomes. These sections may underlie the creation of new primate-specific genes
3. At least one set of 23 chromosomes is contained in most cells of our body. The only exception in humans is found in mature red blood cells.
4. At the time when the draft sequence was published fewer than 7% of protein families appeared to be vertebrate specific. Researchers continue to identify protein-coding genes and their functions; the objective is to find disease-causing genes and possibly use the information to develop more specific treatments.

ACCURACY OF THE DATA

Although this was reported to be 99% of the human genome, with 99.99% accuracy, a major quality assessment of the human genome sequence was published in May 27, 2004 indicating over 92% of sampling exceeded 99.99% accuracy, which is within the intended goal. Further analyses and papers on the HGP continue to occur.

WHY IS HGP IMPORTANT?

The Human genome project's objective was to sequence the human genome for tracking down the genes responsible for many of the hereditary diseases in humans. Conventional treatments for genetic disorders involve identification of the gene products and finding out the patho-physiology of the disease process, whereas, replacement of the deficient gene or correction of the abnormal can be undertaken through gene therapy. Gene therapy offers hope to those suffering from genetic disorders. Personalized medicine based on sequencing of genes and identification of the diseased condition is another area which is being explored.

“But 150 years on and we have grasped only 2% of its immense complexities. One thing is clear: there is more to genomes than genes. Some of the activity is not directly related to the manufacture of protein, but is instead involved in the regulation of that process by mechanisms that we are only now starting to unravel. Whether this explains all of the activity is far from clear. Trabby or beamer, either way your genome may be the most enigmatic thing about you”. (The Guardian, Saturday 9 February)

SOURCES:

Wikipedia
The Economist 1-7 December, 2012
www.guardian.co.uk mercola.com

Great things in business are never done by one person; they're done by a team of people." - Steve Jobs

PERSONALITIES:

KURIEN: THE MILKMAN OF INDIA

"When we think of Amul, we think of milk.. Yet, if you pause and think, there's so much more to Amul than just milk. Indeed, for people like me who were living (then) in a place like Kolkata or Chennai, Amul was not milk at all. It was so much more. Amul was the butter we spread on the toast every morning, Amul was the cheese we had once in a while as a special treat, and Amul was the metal container of powdered baby food you saw in the kitchen. Amul, later, became the chocolate you shared, breaking up the bar into as many pieces as there were people around. After all, Amul Chocolate was 'A gift for someone you love'.

(Curtsey: [www. Firstpost.com](http://www.Firstpost.com)>business).



Figure 14. Verghese Kurien

BIOGRAPHY

Verghese Kurien (26 November 1921 – 9 September 2012) showed the world what cooperatives can achieve. Today milk pouches are freely available all over the country thanks to the dedication, commitment and passion of Dr. Kurien and a few others like him in developing and

nurturing cooperatives of milk producers. **“He made the ordinary, neighborhood 'doodhwala' (milkman) a key player in the country's struggle for economic development and progress at the grassroots level”**. ‘He was the "Father of the White Revolution", for his 'billion-litre idea' or Operation Flood — the world's biggest agricultural development programme’.

Life and Career

Kurien was born on 26 November 1921 in Calicut, Madras Presidency, British India (now Kozhikode, Kerala) into a Syrian Christian family. He graduated in Physics from Loyola College, Madras in 1940 and then took his Bachelor's degree in Mechanical Engineering from the University of Madras. After completing his degree, he joined the Tata Steel Technical Institute, Jamshedpur, from where he graduated in 1946. He then earned a degree in Master of Science in Mechanical Engineering (Distinction) from Michigan State University in 1948.

ORGANIZING MILK COOPERATIVES

After returning from the United States, he joined Anand in Gujarat's Kheda district. “Four decades ago, the then president of India, Dr Rajendra Prasad, laid the foundation stone of a modern dairy, the dairy of the Kaira District Cooperative Milk Producer's Union. The inspiration for the dairy, which came into existence after a struggle against great odds, was provided by Sardar Vallabhbhai Patel and Morarji Desai. Tribhuvandas Patel, with his dedication and integrity, was the power behind the farmer's organization. Varghese Kurien, then hardly 33, gave the professional management skills and necessary thrust to the cooperative. Over the years

If you want to go fast, go alone. If you want to go far, go together." - African Proverb

the cooperative prospered.” Shri M.V Kamath, author of *How India’s White Revolution Became Possible*, told The Hindustan Times while narrating the fascinating saga of success of Amul and the Operation Flood, which was to make India a major milk producing country in the world. Although he wanted to quit Anand after the bond period, he was persuaded to stay back at Anand by Tribhuvandas Patel who had organized the farmers of Kheda into a cooperative union to procure process and sell their milk, a pioneering concept at the time.

Kurien was a no-nonsense-man. He did not allow any meddling by politicians or bureaucrats in the running of the milk cooperatives. However, seeing their enthusiasm and passion for work he and his mentor Tribhuvan Dasji were backed by the few enlightened political leaders and bureaucrats. Due to his pioneering efforts the Amul pattern of cooperatives became successful so much so that Prime Minister Jawaharlal Nehru personally appreciated his work.

Later, Prime Minister Lal Bahadur Shastri was to give further impetus to the dairy cooperatives by inviting Dr Kurien to replicate what came to be known as the Anand Pattern, after the township of Anand, in Gujarat. His achievements with the Amul dairy led Prime Minister Lal Bahadur Shastri to appoint him as the founder-chairman of National Dairy Development Board (NDDB) in 1965, to replicate Amul's "Anand model" nationwide. A key achievement at Amul was the invention of milk powder processed from buffalo milk abundant in India, as opposed to that made from cow-milk, in the then major milk producing nations.

THE AMUL BRAND

As the founding chairman of the Gujarat Co-operative Milk Marketing Federation (GCMMF), Kurien was responsible for the creation and success of the *Amul* brand of dairy products. As the dairies on

Anand model were being set up in other districts Kurien brought them all under the umbrella of Gujarat Milk Marketing Union (GCMFF) in 1973 and started selling the combined produce of the dairies under a single *Amul* brand. Today Amul products have world- wide markets.

Founder of Institutions

He quit the post of GCMMF Chairman in 2006 following disagreement with the GCMMF management. He founded around 30 institutions of excellence including AMUL, GCMMF, IRMA, and NDDB which are owned, managed by farmers and run by professionals. The National Dairy Development Board expanded the scope of Operation Flood to cover the entire country in its Phase 2 program in 1979.

NATIONAL ACHIEVEMENT

“--Interestingly Kurien, the person who revolutionized the availability of milk in India did not drink milk himself. Nevertheless, the work of Kurien & his team in India took India from a milk importer to a milk & milk-products exporting nation within the span of 2 decades. **The operation took India from being a milk-deficient nation, to the largest milk producer in the world, surpassing the United States of America in 1998**, with about 17 percent of global output in 2010–11, which in 30 years doubled the milk available to every person,. Dairy farming became India’s largest self-sustaining industry. **He made the country self-sufficient in edible oils too later on, taking head-on the powerful and entrenched oil supplying lobby”.**

BOOKS

Kurien's life story is chronicled in his memoir **I Too Had a Dream** as told to Gouri Salvi, and **An Unfinished Dream**.

Success is best when it's shared." - Howard Schultz

The Man Who Made the Elephant Dance is an Audio Autobiography of Dr. Kurien in the voice of Tom Alter with Audio Foreword by Ratan Tata, in his own voice.

HONOURS

Hailed as the "Milkman of India", Kurien won several awards including the Padma Vibhushan (India's second-highest civilian honors), the World Food Prize and the Magsaysay Award for community leadership. Kurien has received 12 honorary degrees from universities around the world, including the Michigan State University, University of Glasgow, University of Ottawa and others.



(Curtsey: Hindustan Times)

in the world.

RETIREMENT AND DEATH

After retirement, he settled down in Anand, the small town he made world-famous through the co-operative movement launched at the instance of his mentor, Sardar Vallabh Bhai Patel. Verghese

Kurien died on 9 September 2012 after a brief spell of illness in Nadiad, near Anand in Gujarat, India. He was 90.

On **kurien's 90th birthday**, advertisements put out across many newspapers by the Gujarat Cooperative Milk Marketing Federation (GCMMF), which markets milk and milk products under the Amul brand (above) said "You changed the lives of 15 million farmers' families." The grateful Amul girl, attired in her trademark polka frock and hairband, told Dr Kurien in the advertisement. "Thank you for making us the largest selling milk producer".

TRIBUTES

A grateful Mr RS Sodhi, the present Managing Director of GCMMF, who had the privilege to work with him for 32 years, told Business Line that Dr Kurien was, perhaps, the only example after Mahatma Gandhi who has contributed so much for the upliftment of rural economy in India. "He created so many world-class institutions in his lifetime, and nurtured talents, which has touched the life of millions of villagers who live at the bottom of the pyramid in the society."

Others paid tribute to his unique personality, talents and achievements:-

- One of the greatest proponents of the cooperative movement in the world, his work has alleviated millions out of poverty not only in India but also outside.
- He was instrumental in laying the foundation of democratic enterprises at


<p>VARGHESE KURIEN 1921-2012</p> <p>MORE THAN A MILKMAN: HE BUILT GREAT BRANDS</p> <p>He founded the Anand Milkman's Union – which gave rise to the acronym Amul – but went far beyond making it an iconic brand that brought ice-cream in plenty to a nation that once was short of milk powder for infants. As he catapulted India to the position of the world's largest milk producer, Kurien became a brand himself, in a stable of brands that covered cheese, condensed milk and health drinks.</p>		<p>THE JOURNEY FROM ANAND</p> <p>The Gujarat Co-operative Milk Marketing Federation (GCMMF), which markets Amul, began with just two village dairy co-operative societies and 247 litres of milk.</p> <p>\$2.5 bn (₹13,750 cr) Current turnover of GCMMF</p> <p>\$2 bn (₹11,000 cr) Turnover of Amul in 2011-12</p> <p>12.5 million kg GCMMF's average daily milk output, from 2.5 mn kg in 1960</p> <p>122 mmt+ /annum India's milk production, a 6-fold rise from 20 MMT in 1960</p>
---	--	---

the remote villages and far flung hamlets which ensured economic justice. And it was with people's voluntary participation.

- Honoured as the architect of India's White Revolution, which catapulted India to be the world's largest milk producer, Kurien managed the feat in the 1970s at a time when it faced grim uncertainties over its food security.
- Kurien's main contribution was to design systems and institutions, which people could develop them, as he believed development of man can best be achieved by putting in his hands the instruments of development.
- He strongly believed that **by placing technology and professional management in the hands of the farmers, the living standards of millions of rural poor could**

Cutting out exploitative middlemen, Kurien's cooperative established a direct link between milk producers and consumers. Milk producers had the control of procurement, processing and marketing and a professional management was engaged.

 Ref: www.Firstpost.com>business
en.wikipedia.org
www.drkurien.com
amul.com

THE 'TASTE OF INDIA' BRANDS	A STELLAR CAREER	BUT HE DIDN'T DRINK MILK!
Amul: Milk, butter, ice cream, ghee, paneer, sandwich spread, processed cheese, chocolate, yoghurt. Kool: Flavoured milk Milhai Mate: Sweetened condensed milk Gold, Taaza, Calci: UHT Milk PRO, Nutramul: Malt-based milk additives Fresh Cream: Low fat cream Fundoo, Chocozoo: Chocolates	<ol style="list-style-type: none"> 1 Kurien and his team were pioneers in using buffalo milk to make milk powder and condensed milk, instead of cow's milk – the reason Amul became so successful and competed well against Nestle, which only used cow milk 2 Founded the National Dairy Development Board (1965-98) 3 Was chairman of GCMMF (1973-2006), and also the Institute of Rural Management, Anand (1979-2006) 4 Created a national milk grid as part of the 1971 Operation Flood or The White Revolution 	<p>"I do not drink milk as I don't like it." The 'milkman' of India</p> <p>"The Amul girl has given the brand just the image we had in mind - that of a precious, 'priceless' product that the consumer would trust completely</p> <p>Dr Verghese Kurien, in a book on Amul's ads, Amul's India.</p> 

*Million metric tonnes/Source PTV/GCMMF

be improved.

- He believed that the greatest assets of this country are its people, and dedicated his life to the task of harnessing the power of the people in a manner which promoted their larger interests He proved it by the Operation Flood in 1971 - creating a national milk grid - which was implemented in three phases.
- He built India's first, modern, organized retail chain, linking primary producers to final consumers through a very short, high-tech supply chain that increased income for the producers while lowering cost for the consumer.

"Satisfaction lies in the effort, not in the attainment." - Mahatma Gandhi

ART&LITERATURE MANTHAN: THE CHURNING

---Sudha Shrotria

Thirty-six years ago Shyam Benegal produced a film on milk cooperatives which overturned the concept of development in the country. Until that time the received wisdom was that it is only either individual initiative or state control/sponsorship can promote economic development. The success of the AMUL milk Cooperatives showed what people themselves could achieve, if they organize themselves into cooperatives and work with zeal and dedication. Shyam Benegal the renowned film maker, and, Verghese Kurien, the doyen of milk cooperatives, jointly worked on this theme and depicted it powerfully in Manthan. Here Ms. Sudha Shrotria sketches the story of Manthan.



Figure 15. Shyam Benegal

ON EQUALITY AND SOCIAL JUSTICE

'*Manthan* (*manthan* literally means churning - deep contemplation, churning of facts, analysis aimed at solution or conclusion) is a 1976 film produced by Shyam Benegal, a strong proponent of socially conscious cinema. The story jointly written by Shyam Benegal and Dr Verghese Kurien, the man known for bringing the 'white revolution' in India, puts forth a social message of power of the collective. This socially relevant movie celebrates the success of milk

Cooperation is the thorough conviction that nobody can get there unless everybody gets there." -
Virginia Burden

cooperatives in Gujarat. For the first time, a film is produced by the financial contribution of some 500,000 farmers of the Gujarat Co-operative Milk Federation. It is set amidst the backdrop of the White Revolution of India (Operation Flood) which started in 1970, ushering an era of plenty, away from times when milk production was scarce and distribution poor. With some of the finest actors of the Indian film industry in the movie, **the film conveys a strong message of how self reliance and collective might can empower marginalized communities, give them economic independence and free them from the clutches of the exploiters.**

The story revolves around a young veterinary surgeon, Dr Rao (Girish Karnad) who is sent to Kheda village in Gujarat to set up a milk cooperative. The milk producing farmers of the village are exploited by the middlemen and a wealthy businessman Mishraji (Amrish Puri) who feels threatened by Dr Rao coming to the village. He runs a local dairy where all the villagers



Figure 16. Smitha Patil (Wikipedia)

come every morning to deposit their milk. In return he pays them a paltry sum. Dr Rao has a challenging task of motivating the villagers to form a Cooperative, so that they get a fair value for their milk based on its fat content. With the help of

Bhola (Naseerudin Shah) and Bindu (Smita Patil), both villagers belonging to the marginalized community of harijans (termed ‘untouchables’) he instills in them a sense of confidence and motivates them to get a fair price for their milk.



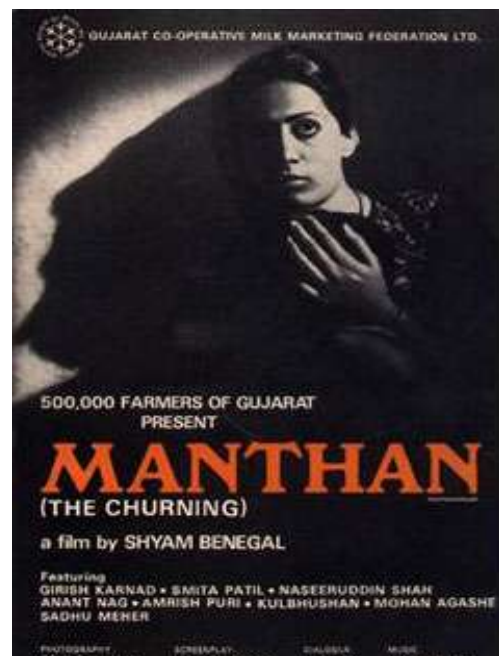
Unable to understand how they would gain economically by being a member of the co-operative society both are initially reluctant to accept the formation of a cooperative society, but eventually come around when they realize its merit. Once the villagers start forming the society they move away from the clutches of the middlemen. Seeing that the cooperative movement will disturb the age old power equation in the village, the *Sarpanch* (Kulbhushan Kharbanda) who is the village headman joins Mishraji in discouraging the farmers from becoming members of the co-operative. They are both unhappy and disturbed about losing their grip on the village politics which is largely based on the exploitation of the poor village community by the upper castes. The villagers, convinced about their welfare, begin to see the merits of the having the co-operative society and are emboldened to stand up for the society election as the leader against the mighty sarpanch. The sarpanch loses the election to the farmer’s representative. Unable to take his defeat,

Individually, we are one drop. Together, we are an ocean." - Ryunosuke Satoro

in retaliation, he has the homes of the villagers burnt down in the dead of the night. The shattered villagers are now afraid to proceed with the society and the businessman starts luring them with loans to build their burnt houses. Bhola fights back and tries to tell the villagers not to fall into their trap.

‘Manthan is an extraordinarily powerful and intense depiction of social change’. This socially relevant movie was Shyam Benegal’s masterpiece. It was a film far ahead of its time. The powerful performances by Girish Karnad, Smita Patil and Naseeruddin Shah gave credence to the social message it conveyed. Smita Patil gave life and depth to the character of a strong willed village woman. Her role was pivotal, but the character played by Girish Karand of the man behind ‘Amul’ constantly drives the focus of the film. Naseeruddin Shah’s convincing performance as the proud villager comes out strong. And both Amrish Puri and Kulbhushan Kharbanda are effective in their roles.

The movie is as relevant today as it was some 37 years ago. In 1977, it received the National Film Award for the Best Feature Film in Hindi and National Film Award for Best Screenplay for Vijay Tendulkar. Preeti Sagar got the Best Playback singer for her song ‘mera gaon.’



How the film was made

As the (Cooperative) movement started to spread its wings, Dr Kurien started touring the country on a war footing. He started Operation Flood 1 and 2. I had been making Amul ads for Dr Kurien during my days at d'Cunha's agency. I travelled with Dr Kurien and saw first-hand all the things that were happening through his efforts.



Shyam Benegal

I felt there was a need for a feature film on the movement. When I asked him, he jumped at the



Credit:mid-day.com

idea. But there was no money since every penny made at Amul went back into the co-operative movement. Dr Kurien suggested that he would make half the million milk farmers of Gujarat give two rupees each for this film. That's how Manthan started. We chose Girish Karnad to play Dr Kurien.

We got Vijay Tendulkar to write the script. He met Dr Kurien and came up with several ideas. We chose one that became Manthan. The script won the National award. Then I made the film.

The song Mero Gham Kathaparey by Preeti Sagar became the Amul song. Not too many people know that Preeti's younger sister, who later died, wrote the lyrics. At the



Credit:Gujarat Milk Marketing Federation

time of the film's release Dr Kurien took charge of showcasing it in Gujarat. It was a resounding success. Distributors wanted to release it all over the country. The National Dairy Development Board (NDDB) used it as a propaganda film, and that was the real success. I then took to the film to the United Nations.



Vijay Tendulkar

When Dr Morarjee Desai became the prime minister, he asked for a print of Manthan and presented it to the government of USSR. The film achieved an impact most entertainment films don't. It's by far my most influential work.---

Subhash K Jha



Only strength can cooperate." -- Dwight D. Eisenhower

ECONOMICS: COOPERATIVES – THE THIRD WAY

S. Jalaja

*In the last century two economic models with their divergent view points took roots- namely capitalism and communism. If individualism, self interest, free markets, free enterprise and competition are the hall marks of capitalism, communism is based on the principles of collectivism, public enterprise and government control. With the collapse of the Berlin wall and the disintegration of the Soviet Union, communism has lost its appeal. With the global economic crisis adversely affecting the economies of the US and many of the European countries, capitalism is too is facing serious challenges today. With low growth, high rate of unemployment, recession, high levels of public debt have put lives of millions of people in disarray. **To a world groping for an alternative to both the systems, the cooperative model offers a third way of development, neutralizing bad aspects of both, at the same time, combining the best of both systems. From ‘one for oneself’ of capitalism and ‘one for all’ in communism, it is ‘one for all and all for one’ in the cooperative model.***



Figure 17. Cooperation (sciencemag.org)

As stated in our lead article, there are over one billion members of the cooperatives in the world. In the United States there are over 29,000 cooperatives employing 2 million people with over

\$652 billion in annual revenue. It has been reported by the United Nations that there are

- 53,000 credit cooperatives and credit unions;
- About one billion people are now members of cooperatives;
- The world's top 300 cooperatives register a combined revenue equivalent to the ninth largest national economy;
- In the United States of America, Japan and many European countries, around 50 per cent of agricultural product marketing is carried out by cooperatives; and
- In India, cooperatives have made the country the largest milk producing nation in the world.

Why are cooperatives important in a world where competition reigns supreme? How is it different from other economic systems?

First and foremost of all, unlike other economic systems, cooperatives are not primarily concerned with capital, labour, labour value, surplus value, collective bargaining, free markets, consumerism etc; **Cooperatives have a human-centric approach to issues concerned with the economy.** It is not concerned only with the creation of material wealth; it is also about the all-round well-being of the individual as well as the community of which she/he forms a part. There is no coercion or compulsion to join a cooperative. **Voluntarism forms the core value of the cooperatives.**



Competition has been shown to be useful up to a certain point and no further, but cooperation, which is the thing we must strive for today, begins where competition leaves off.

— Franklin D. Roosevelt —

The enlarged vision of the role of the

cooperatives can be viewed from the Statement made by José Graziano da Silva, Director General of FAO in the closing ceremony of the celebration of the International Year of Cooperatives on 19-20 November in New York. Important points are:-

- **Eradication of poverty**

As a tried-and-tested approach to social enterprise, cooperatives deliver inclusive development, social protection and sustainable livelihoods in a manner that contributes to poverty eradication.



Figure 18. Green valley Grocers-community effort in UK Guardian- Public domain

- **Ensuring food security**

The cooperatives can play a major role in ensuring food security with the help of farmer's cooperatives.

- **Profit maximisation**

As distinct from mainstream business enterprises, which are motivated primarily by profit-maximization, cooperatives must balance a larger set of objectives. However, this allows them to accommodate broader community goals such as inclusive development and social protection.

- **Employment generation**

Women and youth can obtain or generate

The more complex the world becomes, the more difficult it is to complete something without the cooperation of others-Alexander Fleming

employment directly or indirectly through cooperatives, and even proceed to engage in key leadership roles.

- **Inclusivity**

Excluded groups, such as persons with disabilities, the aged, or indigenous peoples, can band together in productive employment and raise awareness of their cause. Cooperatives have a distinct impact on the poor and promote a people centric approach through a unique method that offers dignity, equity and inclusivity.

Cooperatives serve the vulnerable and unattended communities and contribute to their empowerment and livelihood.

- **Increased access to credit**

Since the rural and agricultural poor are often neglected by mainstream financial institutions, local credit unions and cooperative financial institutions can provide much-needed financial services and outreach.

- **Coping with natural calamities**

The Cooperatives go the extra mile in serving the community during and after calamities or natural disasters, such as the tsunami tragedy in Japan or Hurricane Sandy here in New York. In all these



areas, and others, cooperatives are guided by a core concern for their communities.

Co-operatives are a reminder to the international community that it is possible to pursue both economic viability and social responsibility- Ban Ki-moon, UN Secretary General

- **Green economy**

The cooperative movement is in an excellent position to promote the priority theme of a green economy - especially considering that energy cooperatives are already key providers in many countries. The successful experiences of cooperatives in operating renewable energy sources, such as wind farms and solar fields, can guide and inspire others.

The above vision of cooperatives speaks of an ideal situation wherein they provide a one time quic-fix for all our problems. However, our experience so far suggests that it is not the case. **Cooperatives need care and nurturing like everything else. They can flourish only in a free environment wherein their autonomy and independence are assured.** In a country like India, except for a few state level or national level cooperatives, most of the cooperative societies have not been successful in the past due to excessive state intervention. Government control of registration, supervision, election, dissolution of cooperatives destroys voluntarism autonomy and independence of cooperatives. **Self supporting cooperatives are the need of the day. This does not however mean that governments should completely withdraw from the scene. Creating an enabling environment for the cooperatives to grow, develop and strengthen continue to be the obligation of the governments.** Providing financial and technical support to cooperatives formed by the vulnerable sections of society, assigning functions to cooperatives like procurement and distribution of food grains, fertilizers, agriculture implements, providing credit to farmers, support to small and medium industries and businesses based on cooperative efforts etc can improve service delivery, at the same time improve the quality of governance. Decentralisation and delegation can give a boost to the economy at the grassroot levels.

How it began

The cooperative movement began in Europe in the 19th century, primarily in Britain and France, when the industrial revolution and the increasing mechanization of the economy transformed society and threatened the livelihoods of many workers.

The first documented consumer cooperative was founded in 1769, in a barely furnished cottage in Fenwick, East Ayrshire, when local weavers manhandled a sack of oatmeal into John Walker's whitewashed front room and began selling the contents at a discount, forming the Fenwick Weavers' Society. In the decades that followed, several cooperatives or cooperative societies were formed, including Lennoxton Friendly Victualling Society, founded in 1812.



Figure 20. A Farmer's cooperative, Honduras

By 1830, there were several hundred cooperatives. Some were initially successful, but most cooperatives founded in the early 19th century had failed by 1840. It was not until 1844 when the Rochdale Society of Equitable Pioneers established the 'Rochdale Principles' on which they ran their cooperative, that the basis for development and growth of the modern cooperative movement was established.

"Sometimes you put walls up not to keep people out, but to see who cares enough to break them down." Socrates



Figure 21. A Farmer's Cooperative

Financially, credit unions were invented in Germany in the mid-19th century, In Britain, the friendly society, building society, and mutual savings bank were earlier forms of similar institutions.

Robert Owen (1771–1858) is considered the father of the cooperative movement. Although Owen inspired the co-operative movement, others – such as Dr William King (1786–1865) – took his ideas and made them more workable and practical. King believed in starting small, and realized that the working classes would need to set up co-operatives for themselves.

The cooperative movement has been fueled globally by ideas of economic democracy. **Economic democracy is a socio-economic philosophy that suggests an expansion of decision-making power from a small minority of corporate shareholders to a larger majority of public stakeholders.** Therefore, instead of competition cooperation could be the new basis for organizing business. **Profit maximizing corporate could be replaced by cooperatives with higher level objectives which could benefit both individuals as well as the community.** The world in the 21st century is looking forward to having a system which will be based on cooperation among individuals leading to better and healthier communities. The cooperative movement will have to discard the very factors which have stunted its growth. Instead it has to become a people's movement, covering every village, interconnecting

communities, exchanging ideas, knowledge, wealth and wisdom.

Ms. Shamshad Akhtar, Assistant Secretary-General Department of Economic Affairs put it aptly .In my country there is a song that says "A dream that we dream alone it is only a dream, but a dream that we dream together becomes real."



Credit: thefactfactor.com

He that does good to another
does good also to himself.

Lucius Annaeus Seneca

POEM: THE OWL



Edward Thomas

Philip Edward Thomas (3 March 1878 – 9 April 1917) was an *Anglo-Welsh* poet and essayist. In the last issue of Life Stream we introduced you to the poet who shared a deep friendship with Robert Frost, the famous American Poet. We also gave an account of how the poem ‘The Road Not Taken’ by Frost influenced Thomas to finally take a decision to join the First World War and ultimately led to his being killed in the war.

Thomas was vehemently opposed to wars and his poems became the medium for giving expression to his anti-war sentiments. However, overwhelmed by the desire to defend the English country side which he loved deeply, and, to join his compatriots who were fighting the war, he finally takes the plunge. Thomas is commemorated in *Poets’ Corner, Westminster Abbey, London*.

{It is interesting to ponder over the meaning of this poem. A soldier, tired and hungry, arrives at an inn where he finds food, warmth and shelter. While he rejoices in comfort, he hears the melancholic shriek of an owl, which reminds him of his fellow soldiers and the poor who were lying under the open sky, deprived of those comforts.

The soldier symbolizes the poet himself who has been able to fulfill his basic needs. However, the owl-his conscience- wakes him up from his repose, reminding him of the plight of those who are less fortunate than him. Perhaps it is the same fellow-feeling and pangs of conscience which drove him to join the war and sacrifice his life for a common cause. This poem once again tells us how only by

sharing and caring we ultimately gain our fulfillment.



THE OWL

DOWNHILL I came, hungry, and yet not starved,
Cold, yet had heat within me that was proof
Against the north wind; tired, yet so that rest
Had seemed the sweetest thing under a roof.

Then at the inn I had food, fire, and rest,
Knowing how hungry, cold, and tired was I.
All of the night was quite barred out except
An owl's cry, a most melancholy cry.

Shaken out long and clear upon the hill
No merry note, nor cause of merriment,
But one telling me plain what I escaped
And others could not, that night, as in I went.

**And salted was my food, and my repose,
Salted and sobered too, by the bird's voice
Speaking for all who lay under the stars,
Soldiers and poor, unable to rejoice.**

(www.poemhunter.com)

No man is an island, entire of itself;
every man is a piece of the continent.
John Donne

FOOD: EATING TOGETHER TOGETHER

Larry Forthun

*Eating together as a family or community symbolizes not only cooperation in cooking and eating meals, but also is a celebration of life. In this article Larry Forthun tells us the importance of eating together. We have also added a piece on community cooking, eating/feeding which also involves cooperation amongst the members of the community and reflect the core values of the society. These two aspects of eating together underscore the fact that **it is not the sophistication of the machines which help us in better communication with others but the human factors of togetherness and cooperation amongst the individuals that matter.** We hope you and your family henceforth take pride in the fact that togetherness is a blessing.*

FAMILY MEAL

In a recent book entitled THE SURPRISING POWER OF FAMILY MEALS, author Miriam Weinstein asks this question: What if I told you that there was a magic bullet—something that would improve the quality of your daily life, your children's chances of success in the world, [and] your family's health? Something that is inexpensive, simple to produce, and within the reach of pretty much everyone? You guessed it, that magic bullet is the family meal. According to research, eating together as a family on a regular basis has some surprising effects. When sharing a meal together family bonds become stronger, children are better adjusted, family members eat more nutritional meals, they are less likely to be overweight, and they are less likely to abuse alcohol or other drugs. Given the positive benefits of eating together, why are more families not doing it?

When was ever honey made with one bee in a hive?

Thomas Hood



Eating together: On the first night of Passover families gather for a ritual meal called a seder. Certain symbolic foods are eaten during a seder dinner.

(Photo credit: wikipedia)

TRENDS

Although there has been a growing concern that families are no longer eating together, research over the last decade suggests that this is not the case. In a recent study by the National Center on Addiction and Substance Abuse at Columbia University, over the last 10 years, approximately 58% to 61% of teenagers consistently report having frequent family dinners (five or more times per week) (CASA, 2011). The results of the 2007 National Survey of Children's Health are similar. Approximately 77% of children and youth reported that they eat meals with their families four or more times per week.

These numbers seem to suggest that most children and youth in the U.S. are eating meals with their families more days than not, on a weekly basis. What about the children and youth in the state of Florida? Do they follow the national trend? According to the most recent data collected in 2007 through the National Survey of Children's Health, 48% of youth age 0-17 ate a meal together with their families EVERY DAY during the previous week. This compared to 45.8% nationally. Approximately 80% of Florida children

	0-5 Years Old	6-11 Years Old	12-17 Years Old
0 Days Per Week	3.0%	3.7%	5.7%
1-3 Days Per Week	13.9%	12.5%	21.7%
4-6 Days Per Week	24.7%	33.9%	36.4%
Everyday	58.4%	49.8%	36.2%

National Survey of Children's Health, <http://childhealthdata.org/>

and youth reported eating family meals at least 4 days per week.

As shown in Table 1, the percentages differ based on the age of the child, with younger children eating family meals more frequently. The trends are hopeful, but there are still a large number of children and youth who do not share meals with their families. **Although trying to get the family together for a family meal is very challenging, the benefits appear to outweigh the costs.**

FAMILY TOGETHERNESS

One benefit of eating meals together is the effect on strengthening family bonds. Family meals provide a daily time for the whole family to be together. For younger children, having routine family meals can provide a sense of security and a feeling of belonging in the family (Satter, 1987). Older children and teenagers, too, prefer eating together as a family. In a recent Columbia University study, 71% of teenagers said they consider talking/catching-up, and spending time with family members as the best part of family dinners.

Family meals are also a representation of the ethnic, cultural, or religious heritage of the family (Weinstein, 2005). What the family eats, how they eat, and when they eat reflects this cultural identity. As children participate in these cultural traditions, they begin to learn more about their heritage and their family's history. A study from Emory University found that children who knew a lot about their family history, through family meals and other interactions, had a closer relationship to family members,

higher self esteem, and a greater sense of control over their own lives

COMMUNICATION

Regular family meals provide opportunities for the family to develop better communication. At family meals, parents and children have time to catch up with each other and learn about the events that happened that day. It also provides parents a learning opportunity where they can teach social skills, table manners, and basic cooking skills. Parents should model good communication skills, like the RECIPE for good communication (and encourage all family members to be involved.

WELL-BEING

Regular family meals are related to better adjustment in children and youth. Research shows that youth who have regular family meals report earning better grades in school, are more motivated at school, and get along better with others. **On the other hand, those who do not eat regular family meals together are more likely to smoke cigarettes, drink alcohol, or use other drugs (CASA, 2011). Children and youth who do not eat family meals together are also more likely to report feeling depressed or having trouble at school.**

Even among older teenagers, who often have conflicting schedules and do not eat regularly with their family, the risk is higher when they do not

regularly participate in family meals (CASA,

Families that eat together, stay together-
pinterest.com

2011). A team of researchers at the University of Minnesota's School of Public Health found that even if the family members are not very close to each other, having a meal together as a family reduces the risk for many of these troubling behaviors among youth (Eisenberg et al., 2004).

NUTRITION

Eating meals together as a family also means that family members are more likely to eat healthy foods. Families that eat together are less likely to dine out (fried food and soda) and are more likely to serve fruits or vegetables and other healthy foods during dinnertime. Some researchers found that eating meals together reduces the risk for being overweight, especially in families with an authoritative parenting style..

THINGS TO CONSIDER

There are two caveats to the benefits of family dinners on the health and well-being of family members. The first is eating in front of the television. Although a recent study found that families who eat in front of the TV are still more likely to eat healthy foods than those who do not eat together, they are less likely to eat healthy meals than those who eat together at the dinner table. The second caveat is for families who eat together at the dinner table, but who frequently purchase prepared foods (e.g., take-out). Although the family may receive the benefits of increased family togetherness and well-being, they may not receive the nutritional benefits of a home-cooked meal.

CONCLUSION

Eating together as a family is more than just a meal, it is an opportunity for families to come together regularly in support of family unity. **Most research suggests that both parents and children value sharing a meal together and find the experience rewarding. Although there is no guarantee that eating together as a family will resolve all family problems, it may provide the opportunity to make a fresh start.**

HOW TO GET THE WHOLE FAMILY TO THE DINNER TABLE

- Make shared family meals a priority. Emphasize the importance of being together, not creating an elaborate meal that everyone will enjoy. Set regular meal times by writing them on the calendar. Let everyone know when dinner is served and when they must be home.
- If the family is not used to eating together regularly, start small. At first, get used to eating together by scheduling family meals two or three days per week. Then, as the weeks progress, begin to have more and more regular meals.
- Make family meals fun. Include children in the preparation of the meal and in the decision about what foods will be offered during the meal. Of course, parents have final say about what foods are prepared, but allowing the children to participate can create a fun environment.
- Keep a sense of humor while at the dinner table.
- Eliminate distractions, like TV, telephone, and cell phones.
- Try to limit the conversations to positive or neutral topics. Do not let the conversation get out of hand and allow family members to criticize one another. Keep it light and fun. Create an environment that leads to healthy communication.
- Be a good role model. Show children good etiquette and table manners.
- Eat slowly. Remember, this is an opportunity for the family to spend time together. Do not make it about the food; make it about the family.

{This document FCS8871 is one of a series of the Family Youth and Community Sciences Department, Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida and is reprinted with permission from the University}. Larry Forthun, is Assistant Professor, Department of

Eating together is an occasion that humans have made into a peace making ritual-Paul Theroux

Family, Youth, and Community Sciences, Institute of Food and Agricultural Sciences, University of Florida, Gainesville, FL 32611.

COMMUNITY MEALS

No less important than family meals are community eating/feeding programs. On festive occasions, carnivals, sports events, community and social events like weddings community meals are organized. Feeding programs are also organized for the benefit of the poor, children, old and destitute people. While the former symbolizes the community spirit and sense of cooperation amongst the members, the latter represents the spirit of compassion and feeling for fellow beings. Here we give depictions of both types of community eating from two different parts of the world.



Sadya is a typical feast of the people of Kerala, India. Sadya is traditionally a vegetarian meal served on a banana leaf. People sit cross-legged on the floor on a mat. All the dishes are served on the leaf and eaten with the hands, without using any cutlery. A *Sadya* can have about 24-28 dishes served. The main dish is plain boiled rice served along with other dishes. Since coconut is abundant in Kerala, coconut scrapings as well as coconut milk are liberally used in cooking. The dishes are served on specific places on the banana leaf in specific order. For example, the pickles are served on the top left corner and the banana on the bottom left corner, which helps the waiters to easily identify and decide on offering additional servings.

There are variations in the menu depending on the place and religion. Some communities, especially those in the northern part of Kerala, include non-vegetarian dishes in the *Sadya*. Although custom was to use traditional and seasonal vegetables, it has become common practice to include

vegetables such as carrots, pineapples, beans in the dishes. Tradition has it that onion and garlic are not typically used in the *Sadya*.

The *Sadya* is usually served for lunch. Preparations begin the night before. Traditionally, the people of the neighborhood spent the night helping the cooks and the next day in serving the food. Sadya upholds the spirit of community living. (Ref. Wikipedia.org).

SOUP KITCHENS



Soup Kitchen: This is a faithful photographic reproduction of an original two-dimensional work of art by Van Gogh and is in the public domain.

A **soup kitchen**, a **bread line**, or a **meal center** is a place where food is offered to the hungry for free or at a reasonably low price. Frequently located in lower-income neighborhoods, they are often staffed by volunteer organizations, such as church groups or community groups. Soup kitchens sometimes obtain food from a food bank for free or at a low price, because they are considered a charity which makes it easier for them to feed the many people who visit the soup kitchen. (Ref. Wikipedia).

The fondest memories are made gathered
around the table-anonymous

TRAVEL: YELLOWSTONE MAGIC

Dr. Balachandra Wariyar

Here forces of nature have come together to create hot springs, magical fountains and colorful paint pots



The Yellowstone National Park was set up on 1st March 1872 when Ulysses Grant, the then president of the United State signed a law and is the first National Park in the world. It is named after the Yellowstone River which runs through the park. It was made a World Heritage Site by UNESCO in 1978.

*Yellowstone Park is famous for its geysers and springs. The park has about half the world's geysers, the most famous being Old Faithful Geyser. **It is the largest remaining intact ecosystem in earth's northern temperate zone.***

It includes many types of ecosystems, but the biggest is the sub-alpine forest. It is also home to



grizzly bears, wolves, bison and elk.

Yellow stone offers many beautiful attractions. Here we have included some of the photographs taken by Dr. Balachandran on his family's visit to the Park. The photos give a glimpse of the magical beauty of the sights offered by this unique park. Dr. Wariyar is settled in Nebraska, USA.

The **Snake** is a major river of the greater Pacific Northwest in the United States. It is 1,078 miles (1,735 km) long and is the largest tributary of the Columbia River. The river flows through the Snake River Plain with rugged mountains divided



by rolling plains.

The Snake River Plain was created by a volcanic hotspot which now lies underneath Yellowstone National Park, the headwaters of the Snake River. The river was named after Indians who lived along its shoreline in present-day southeastern Idaho. Early European fur traders noted that the Indians marked their territory with sticks that showed an

image of a snake. The Indians also greeted people by making a snake-like hand motion.



Hydrothermal features are fragile rarities of nature. Yellowstone preserves the largest collection of hydrothermal features on the planet. The Artist's Paint Pots Trail is an easy hike to several geothermal features in Yellowstone National Park. This trail is an easy 0.5 mile (0.8 km) loop boardwalk wherein one encounters various hydrothermal features that are expressions of Yellowstone's volcanism. Although no two features are exactly alike, yet they can be grouped into those with a lot of water (hot springs and geysers) and those with limited water (mud pots and fumaroles). The **Fountain Paint Pot** is a mud pot located in Lower Geyser basin in Yellowstone National Park. Four types of hydrothermal features: geysers, hot springs, mud pots, and fumaroles can be seen here. It has been reported that *Thermus aquaticus*, the



thermophile organism that revolutionized DNA processes, was discovered in this area. The Fountain Paint Pot is named for the reds, yellows and browns of the mud in this area. The differing colors are derived from oxidation of iron present in the mud in various stages. The heat in

largest known carbonate-depositing spring in the world. The most famous feature at the springs is the Minerva Terrace, a series of travertine terraces. The terraces have been deposited by the spring over many years but, due to recent minor earthquake activity, the spring vent has shifted,



the caldera (volcanic) forces pressurized water up through the ground, which is expelled here as hot springs.

GEOGRAPHICAL FORMATION IN HOT SPRINGS



Terrace Mountain at Mammoth Hot Springs is the

'A thousand Yellow Stone wonders are calling, 'Look up and down and around about you'- **John Muir**

rendering the terraces dry. It was created over thousands of years as hot water from the spring cooled and deposited calcium carbonate.

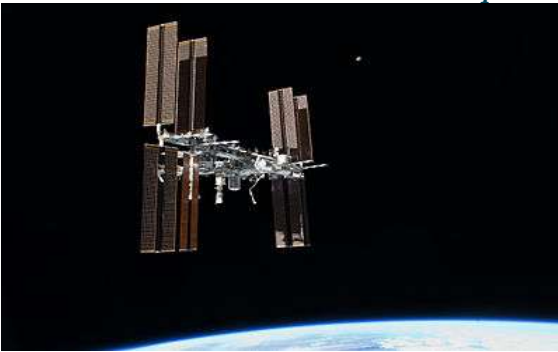
Mammoth Hot Spring, Palette Spring Minerva Terraces etc are geographical formations one can see in the Yellowstone National Park. They were created over a thousand years ago as hot water from the spring cooled and deposited calcium carbonate(reports say that over 2 tons flow into Mammoth in a day).The whole area exhibits glacial activity.



THE UNIVERSE: COOPERATION IN SPACE

Anup Sinha

Recently record-setting Indian-American NASA astronaut Sunita Williams, along with two other cosmonauts, Aki Hoshide of the Japan Aerospace Exploration Agency and Russian Soyuz Commander Yuri Malenchenko returned to earth after spending 127 days in space since their launch from Kazakhstan on July 15 last, including 125 days spent aboard the station. According to NASA, Williams now also holds the record for spacewalking time for female astronauts. This was the second trip into space for Hoshide of the Japan Aerospace Exploration Agency, who visited the station as an STS-124 mission specialist aboard space shuttle Discovery in 2008. Malenchenko the Russian Soyuz Commander wrapped up his fifth spaceflight for 642 days in space, placing him seventh on the all-time endurance list. Their feat inspires us to ask a few questions about space stations. I am sure, you will be interested in knowing the answers to these questions.



WHAT ARE SPACE STATIONS?

Many of us have heard about space stations but do not know whether they are in space permanently and what they do. A **space station** (or **orbital station**) is a spacecraft which is designed to remain in space (most commonly in low Earth orbit) capable of supporting a crew for an extended period of time. Other spacecrafts can dock with it. It lacks major propulsion or landing systems unlike the spacecrafts used for human space travel. Instead other vehicles transport people and cargo to and from the station. (NASA)

WHAT IS AN INTERNATIONAL SPACE STATION?

The International Space Station is the most complex scientific and technological endeavor ever undertaken—a peaceful, cooperative effort involving support from five space agencies representing 15 nations. Expedition-1 marked the beginning of a permanent international human presence in space. The station's first resident crew arrived at the station in a Russian Soyuz capsule in November 2000. **The International Space Station is the longest continuously populated spacecraft ever to orbit the Earth.**

WHAT ARE THEIR USES?

- Space stations are used to study the effects of long-term space flight on the human body and human endurance in space, as well as test new technologies.
- They provide platforms for greater number and length of scientific studies than available on other space vehicles.
- The station, an unprecedented, state-of-the-art orbiting laboratory complex, continues to expand the boundaries of space research.
- The unique capabilities of its laboratories will lead to discoveries that will benefit missions farther into outer space.
- There is a good chance that in future space travel would become a regular affair. The experiments which are being conducted in space stations could therefore, be of immense use in future.



Space station Image - NASA

"I know the sky is not the limit because there are footprints on the Moon – and I made some of them!" - Buzz Aldrin



Figure 22. Astronaut Sunita Williams (Curtsey: NASA)

How the idea developed Sending humans to explore the far reaches of the cosmos has fascinated writers, artists and scientists well before the human space travel started. Scientists have been pondering over the question of keeping humans in space for extended periods, a human in space for extended periods of time to conduct research and experience the nature of our universe outside Earth. These ambitions became a reality in the early 1960s with increasing technological development in the world; specifically, with the progress of human spaceflight programs in Russia and the United States well beyond Earth-based observations.

Three man crews occupied the Skylab workshop for a total of 171 days and 13 hours. It was the site of nearly 300 scientific and technical experiments, including medical experiments on humans' adaptability to zero-gravity, solar experiments and detailed Earth resources experiments.

With the success of Russian and American human spaceflight initiatives, a new era for international cooperation dawned. In 1975, the Apollo-Soyuz Test Project would send NASA astronauts in an Apollo command and service module to meet Russian cosmonauts in a Soyuz capsule. A jointly designed, U.S.-built docking module fulfilled the main technical goal of the mission, demonstrating that two dissimilar craft could dock in orbit.

In 1981, America then launched its first space shuttle, STS-1, and resumed human spaceflight. The world had now seen that humans could learn about the universe in an environment outside of our own atmosphere.

In 1984, President Ronald Reagan voiced this vision by announcing the construction of a permanently crewed space station. This marked the birth of what is today the most complex scientific and technological project ever undertaken—the International Space Station.

What initially started as an eleven-nation agreement with NASA to develop and construct Space Station Freedom soon became a platform for 15 nations, including Russia, to work on space station operations, with an emphasis on affordability.

In February 1986, Russia began construction of its modular space station, Mir. NASA sent seven astronauts and 11 space shuttle visits to Mir as Phase- I testing for the future station. The experience gained from these flights was invaluable and set the stage for the design, development and construction of today's International Space Station. (Wikipedia)

WHICH ARE SPACE STATIONS PAST AND PRESENT?

Last year the two stations in orbit were the International Space Station, and China's *Tiangong- 1*. Previous stations include the Almaz and Salyut series, Skylab and most recently *Mir*.

How many people stay in space stations and how long? All space stations have been designed with the intention of rotating multiple crews, with each crew member staying aboard the

I'm sure the universe is full of intelligent life. It's just been too intelligent to come here---- ARTHUR C. CLARKE

station for weeks or months, but rarely more than a year. Since the ill-fated flight of Soyuz 11 to Salyut 1, all manned spaceflight duration records have been set aboard space stations. The duration record for a single spaceflight is 437.7 days, set by Valeriy Polyakov aboard *Mir* from 1994 to 1995. As of 2011, three astronauts have completed single missions of over a year, all aboard *Mir*. Station crews generally stay on orbit for six months at a time. (wikipedia.org)

ARE SPACE STATIONS USED ONLY FOR CIVILIAN PURPOSES?

Space stations have been used for both military and civilian purposes. The last military-use space station was Salyut 5, which was used by the Almaz program of the Soviet Union in 1976 and 1977.

WHAT IS A SPACE STATION LIKE?

A model space station is designed to include nine rooms, two toilets, two kitchens and two mini-gyms, and are made to be comfortable for the crew to stay over extended periods of time. The station also has a laboratory complex with zero gravity effect. The crew is able to control the variable of gravity in experiments, and to quickly change the variables of experiments they conduct.

WHERE IS THE STATION PLACED IN SPACE?

The station is clearly visible with the naked eye in the night sky. The International Space Station is a working laboratory orbiting 240 statute miles (386.24 kilometers) above the Earth, traveling at 17,500 mph (32,410 kilometers per hour). An international crew mans the space station.

WHAT IS ITS PRESENT STATUS?

It is the most complex scientific and technological endeavor ever undertaken. The space station is now complete with its several component parts that include living modules, research modules, robotics elements, and payload elements with the truss. Living modules now include: The Russian-

built, U.S.-funded Zarya Module and the Russia-provided Zvezda techniques, NASA will prepare for longer journeys to other entities, such as Mars and beyond.. (Ref Wikipedia.org; NASA).



Figure 23. In the International Space Station's Unity node, NASA astronaut Sunita Williams, Expedition 33 commander; along with Japan Aerospace Exploration Agency astronaut Aki Hoshide (center) and Russian cosmonaut Yuri Malenchenko (left), both flight engineers (NASA)

The stars will never be won by little minds; we must be big as space itself.

ROBERT A. HEINLEIN

LIFE STREAM is a quarterly magazine on holistic life published by a group of people who are committed to spreading the message of living in harmony with nature.

EXECUTIVE EDITOR	S.JALAJA
CONSULTING EDITOR	ANP SINHA
ASSOCIATE EDITOR	SUDHA SHROTRIA
EDITORIAL COMMITTEE	S.JALAJA, ANP SINHA, SUDHA SHROTRIA
COVER DESIGN	UNNI WARIYAR
PAGE DESIGN	ANP SINHA
PHOTOS/PICTURES	SUDHA SHROTRIA, VISHAKH, INTERNET
WORD PROCESSING	LIFE SCIENCE TEAM
CONTACT	sjalaja@hotmail.com
WEB SITE	http://www.lifesciencefoundation.in/

LIFE SCIENCE FOUNDATION

SERVICE IN TRUSTEESHIP

ABOUT US

The Life Science Foundation is a Not- for- Profit Public Charitable Trust registered on 30th December, 2009. It is a unique initiative by two officers belonging to the Indian Administrative Service (Bihar cadre) namely S. Jalaja and A.N.P. Sinha (IAS-1974) who have retired as Secretaries to Government of India. Their long experience with Governments at the National and State levels have instilled in them the will to continue to serve people, although from a different platform. Service through the medium of a public charitable Trust is in keeping with the Gandhi's ideal of Trusteeship.

OUR VISION

The term Life Science encompasses all aspects of life from Right to life- an inalienable right of every human being- to the interconnectedness of the entire web of life. Our vision, therefore, is to promote holistic understanding of life and its purpose, and improvement of quality of life of all.

OUR MISSION

Our mission is to improve quality of life through policy formulation, applied research and real life action. The Gandhian ideals of Sarvodaya and Trusteeship will be the guiding spirits.

OUR AIMS AND OBJECTIVES

To accomplish the above vision and mission, the Foundation will initially have the following aims and objectives. In course of time, more could be included:

1. To promote strategic thinking and suggest policy interventions on holistic and sustainable development.
2. To promote holistic health care system based on simple living, preventive healthcare, and both modern and traditional health systems.
3. To undertake studies, research and action-oriented projects pertaining to holistic life.
4. To undertake pilot projects of good governance including e-governance and eventually support the governments in adopting and up scaling successful pilots.
5. To work towards promoting quality of life of vulnerable sections of population, including women and children.
6. To promote all- round human resource development.
7. To design self- sustaining livelihood projects which minimise subsidies and donor-dependency.
8. To undertake other activities which are conducive to pursuit and fulfilment of the vision, Mission and Objectives of the Foundation.
9. Network with institutions and agencies to achieve the above objectives.

