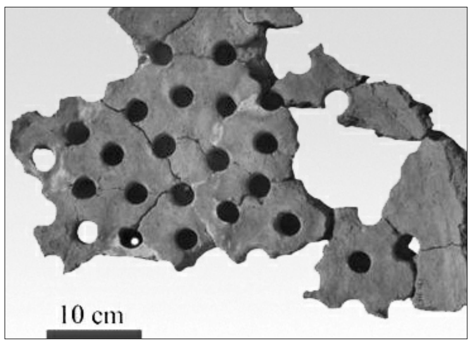
Beer bars in ancient France

It appears French homes made their own ale back in the fifth century BC, says s ananthanarayanan

Carbonised germinated barley grains recovered at Rocquepertuse.

THAT France was a leader in the Mediterranean industry of making wine from the grape is legendary. Wine-making in that country rapidly grew into a fine art and became ubiquitous, each region becoming known for the wine perfected with its strain of grape and wine yeast. Archaeological evidence in Provence, southeast France, shows that beer-making had also developed and was regularly practised as a domestic activity since ancient times.

All alcohol, of course, comes from sugar and the first object of fermentation was the sugar content of fruit. The Mediterranean region is rich in grapes and at the end of a good summer the fruit is rich in sugar. The skin is also covered with a fine coat of yeast, the so called "mould", which gets active if the skin is punctured and the sugar is exposed. The action of yeast is to break the molecules of glucose into alcohol and carbon dioxide, the process of fermentation. The process was undoubtedly discovered by accident when grapes got crushed during harvesting and storage, and the juice, after a few days, was pleasantly different.



Fragment of oven.

Most fruits do contain glucose, the simplest sugar, or fructose, which easily changes into glucose, to take part in fermentation. The formal method of wine-making, then, is to extract the fruit juice, check for the correct sugar content and allow fermentation to take place, under control, and not by accident. This is fine in the case of fruit, which naturally contain sugar for fermentation. But another, cheaper and more abundant raw material for generating alcohol is the starch, another carbohydrate like sugar, which is contained in most varieties of grain. If the starch could be extracted and converted into a form of sugar, this could be another route to alcohol, and with different style and flavour.

Laurent Bouby

From starch

Getting alcohol from grain is a lot more complex, compared to making wine from fruit. Like the sugar in fruit, the starch in grain is the means of the plant to store food. But in seeds, the starch first needs to be changed to a sugar, before it can be used by the plant. The seed contains the mechanism for this conversion in the form of an enzyme, but it is locked away so that the seed and its treasure are safe till the conditions are right. When the seed is in damp and warmth, it begins to germinate, which is to say it starts using its food reserve and begins to grow. When this happens, a film separating the enzyme and starch breaks down and exposes the starch, ready for conversion to sugar.

When this change has taken place, the germination needs to be stopped, else there will be a grown plant but no starch to use for fermentation! This is done by blowing hot air or by heating the germinating seeds in a kiln – in a process called *kilning*. The dried and partly germinated grain (in the case of beer, the grain is barley) is called *malt* and it contains starch that can be converted to the sugar, *maltose*. The process also releases the enzyme *diastase*, which carries out the conversion of starch to sugar. The grains are then crushed and kept in warm water, a process called *mashing*, for a period typically of 45 minutes. The diastase acts on the starch and converts it mainly to maltose, along with a few other sugars and with efficiency that depends on the temperature and mashing process. The ideal temperature is 149? Fahrenheit and most *maltsers*, which is the name for persons who make malt, keep to this temperature for most of the 45 minutes. Variations cause changes in the mix of sugars and then in the flavour of the resulting beer.

What an ancient brewery might have looked like.

When the mashing is done, the liquid, which is called the *wort*, is rich in sugar and ready to be fermented. Fermentation cannot start by itself and an external culture of *brewers' yeast* has to be added to the wort, which is left to ferment for a few days. When the sugar is all consumed, we have simple beer, the *ale* of earlier times. In modern beer, *hops*, a bitter tasting flavourant root, is added during mashing and the beer is finally carbonated, traditionally by adding a little sugar before bottling, but now externally, as done with soda water.

Raw materials

Laurent Bouby from France's National Centre for Scientific Research and colleagues at the Centre for Bio-Archaeology and Ecology, in Montepellier, southern France, report in the journal *Human Ecology* that raw materials and equipment for making beer have been found in the remains of an ancient French village.

Rocquepertuse, north of Marseilles, is an ancient sixth to third centuty BC Celtic village that was discovered in 1860 and excavated in 1924. While the site has been of archaeological interest as a settlement with a Celtic monastery and for the sculpture found there, the Montpellier group collected the sediments found at the site for more evidence of the lifestyle followed. The material found on the floor of one of the dwellings, close to a hearth and oven and also in ceramic vessels and in a pit, was seen to contain carbonised plant remains. Analysis showed that they were poorly preserved, predominantly germinated and carbonised barley grains. The largely germinated grains found carbonised near a hearth and oven suggest that they had been allowed to germinate and got carbonised through a malting process to stop germination.

Based on the equipment found at the Roquepertuse dwelling, the authors suggest that the habitants soaked the grain in vessels, spread it out and turned it during germination on the flat paved floor area, dried the grain in the oven to stop germination and used domestic grindstones to grind the malted grain. Then hearths and containers were likely used for fermentation and storage.

The authors conclude, "The Roquepertuse example suggests that beer was really produced within the context of domestic activities. Compared to other archaeo-botanical and archaeological evidence, it contributes to portraying a society which combined an intricate use of various alcoholic beverages, including beer, which was probably of long-standing local tradition, and wine, which was, at least in part, promoted by colonial contacts with Mediterranean agents."

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Confluence of research

The basic principles of genetics are presented with detailed description of allied scientific material to assist comprehension of the types of experiments from which concepts evolve, writes tapan kumar maitra

GENETIC research is alive with excitement and revolutionary advances. Important to the development of science and. to the evolution of social structure, genetic thought is widening its impact on many areas: immunology, protein chemistry, cellular physiology, developmental biology, medicine, agriculture and industry. So many partnerships and such rapidly expanding methodology demand a fresh approach to genetic training.

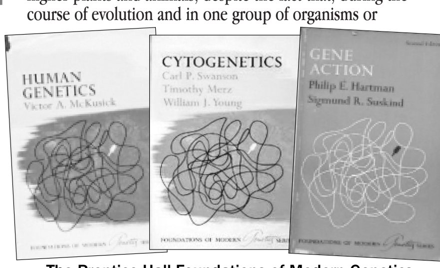
The basic principles of genetics are few and simple. We present them with enough description of accessory scientific areas to allow comprehension not only of the principles themselves but also of the types of experiments from which the concepts have evolved. Such an approach compels the reader to ask: What is the *evidence* for this concept? What are its *limitations*? What are its *applications*?

The Prentice-Hall Foundations of Modern Genetics Series presents the evidence upon which current genetic thought is based. It is neither a history nor a survey of all genetic knowledge. The possible stimulating, selective treatment of the various aspects of genetics at the intermediate level and sectional division allow free choice of emphasis in differently oriented college genetics courses.

The science of cytogenetics has its foundation in the fact that the hereditary material of an organism is ordered into chromosomes. Such an arrangement possesses obvious advantages. An economy in numbers of segregating units becomes possible, efficiency in segregation with reduced danger of gain or loss of otherwise individual units is enhanced and a functional division among the chromosomal components becomes a possibility. Furthermore, the chromosomal arrangement permits degrees of interaction and control not possible among a random group of genetic units, each acting independently of all other similar units. The chromosome thus possesses many of the advantages which accrue to organised biological structures but which are denied by natural selection to genetic units operating individually and independently.

We do not wish to imply by this statement that the most efficient, genetic system is the one having the fewest number of segregating units. Our knowledge of the meaning of chromosome numbers, other than their more general evolutionary relationships, is too meagre to make such an unequivocal statement. Rather, what we are implying is that the chromosome, as an aggregate of genetic units, is a survival product of evolutionary vicissitudes and must, therefore, have had a high selective value from the very beginning of its existence.

As far as we are aware, no gene exists as a solitary and independent molecule. The only possible exception to this statement is found in the so-called satellite virus, which seems to possess a single gene capable only of coding for its own protein coat. When used in its generic sense, therefore, the term "chromosome" includes the genetically compound heritable units of viruses and bacteria as well as those of all higher plants and animals, despite the fact that, during the course of evolution and in one group of organisms or another, these units have come to differ in modes of transmission, size, molecular complexity and genetic constitution. But wherever found, chromosomes are similar in several respects. They are capable of regular transmission, they can be rendered visible by one technique or another and they contain DNA (RNA in some viruses). Consequently, the cytogenetic behaviour of a viral or bacterial chromosome is as relevant to our understanding of inheritance as is that of the more familiar chromosome of maize, *Drosophila,* or man.



The Prentice Hall Foundations of Modern Genetics ***series presents evidence on which a large part of current thought is based.***

The universal occurrence of chromosomes as compound units of inheritance suggests that they made their appearance early in the history of life. Their adaptive value must have been high and rapidly asserted. Whether they competed with, and displaced, other mechanisms of inheritance we do not know. Wherein lies their adaptive value? At present, answers can be framed in a variety of terms: mechanics of segregation and recombination, geometry of genes and biological economy in general.

Chromosomes can reproduce themselves time and again with a remarkably low margin of error. They are distributed to daughter cells or viruses with an equally great degree of exactitude. Continuing irregularity in chromosome distribution among daughter cells can produce extensive genetic repetition as well as loss. Although the problem of genetic redundancy is avoided in principle, the possible multi-strandedness of the chromosomes of higher organisms would indicate that a measure of redundancy has been retained for reasons as yet unknown. The chromosome that meets the requirements of the geneticist is thus simpler in structure than that observed by the cytologist.

For an individual cell or virus to function in a normal fashion requires that each gene be present in the genome. As studies of genie imbalance imply, single copies of each gene in a haploid cell (two in a diploid cell) are not only necessary, but also sufficient. Indeed, exceeding this limit often leads to pathological development. If genes were independent replicating units, each would also have to possess the ability to segregate exactly. Otherwise, each gene would have to be present in every cell in sufficient numbers to ensure the daughter cells of adequate genie representation. In such a situation, the effects of genie imbalance would, in some manner, have to be minimised or remain an ever-present problem.

The grouping of genes into chromosomes circumvents these difficulties of redundancy and unwieldly numbers. Organised into chromosomes, genes can be assembled into convenient and maneuverable units and even a single molecule can be assured of transmission when it is part of a chromosome. It is only necessary that each chromosome, rather than each gene, be capable of movement during division in order that regular distribution to daughter cells is ensured.

Economy is further fostered by specialisation among the genes in a chromosome. All genes, of course, are capable of self-replication. Structural genes function in the usual manner — by making the several kinds of RNA, as cellular occasion demands. Others act as operator or regulator genes, governing the action of structural genes. Some are concerned with movement: these are the centromeres (conceivably compound genes, as judged by their large size and complex structure). Still others, also compound in nature, are engaged in the formation of nucleoli: these are the nucleolar organisers.

It would be impossible for each gene to perform all these varied roles, yet this would be necessary if each gene were independent of every other gene. It would be a mistake, however, to assume that chromosomes, particularly those of higher organisms, represent only a device for the packaging of a large amount of DNA in a maneuverable form. The amount of DNA in some fungi is no greater than that in some bacteria, yet their chromosomes are organised quite differently. The reason for the difference must be sought in other directions: those which relate to the chromosome as an integrated unit, that is, with the grouping of genetic units having associated roles in cellular economy and with the coordinated turning off and on of these functioning units.

Cytogenetics, therefore, focuses its major attention on the chromosome. It is concerned with the chemical and genetic organisation of chromosomes and the manner by which this organisation determines the behaviour of chromosomes in non-dividing as well as in dividing cells and nets the patterns of inheritance; metabolic function and its timing; arid differentiation at cellular, organ and organismal levels. In another sense, cytogenetics is also concerned with both the conservatism of heredity — the preservation of type and the diverse modes of genetic expression. It is the former that perpetuates the species as an entity. It is the latter that confers uniqueness on the individual.

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Giving children a shot at life

We must call on government leaders to immediately prioritise rapid access to new rotavirus vaccines to save our future leaders, writes g balakrishna nair

EVERY day across India, children die needlessly from a little-known disease with a devastating impact. It is called rotavirus, the leading cause of severe diarrhoea and one of the most urgent public health threats we face today. Worldwide, rotavirus kills more than 500,000 children under the age of five each year. In India alone, it kills more than 100,000 children under the age of five — more than 300 each day — while many more fall ill or are hospitalised. More children die from rotavirus every year in India than in any other country by almost double. Rotavirus attacks our families and threatens our nation's future by targeting our most precious resource – our children.

But the true tragedy is that most of these deaths and suffering can be prevented right now if Indian children had the same access to life-saving interventions as children in the USA and Europe, where the disease barely has an impact. Provision of low-osmolality Oral Rehydration Salts therapy can be used to prevent severe dehydration from diarrhoea until the child's immune system is able to clear the infection. Unfortunately, the most severe cases require intravenous fluids, as frequent vomiting makes Ors ineffective. In the USA, rotavirus vaccines have been widely available for five years, but the disease only kills a handful of children a year. Here in India where the need is much greater, this option doesn't exist for the vast majority of children.

Vaccines are one of the most cost-effective and impactful interventions in health — a few shots or drops can protect a child from devastating disease. They are one of the best long-term investments to prevent illness, even in a country like ours with many competing health priorities. India has long been a global leader in producing drugs at affordable cost both for domestic use and for low-income countries around the world. India is now also a global supplier of vaccines; roughly two-thirds of all vaccines procured by UN agencies are from India. Last year, a new vaccine against Meningitis produced by an Indian company became the first vaccine specifically made for developing countries. At a much more affordable price than any other comparable vaccines, it could potentially save some 15,000 lives a year.

With rotavirus, existing oral vaccines have been shown to provide significant protection against the disease and are already widely available in the USA and Europe. The challenge is that until recently rotavirus vaccines were much too expensive, both for India and other countries where health resources are scarce. In addition, donors have been hesitant to support the vaccine until costs come down.

There is new cause for optimism and India is playing a critical role. Recently, the Global Alliance for Vaccines and Immunisation, an international organisation that supports the rollout of vaccines to low-income countries, welcomed significant price reductions for rotavirus vaccines, lowering the cost to $5 to fully immunise a child. This is an important step for ensuring that no more children die needlessly, starting today, but an Indian company is taking it one step further. Bharat Biotech is currently developing a vaccine for rotavirus that should be just as safe and even more affordable than those that exist today. Representatives from Bharat Biotech joined the announcement from the Gavi and promised the low price of $3 to fully immunise a child. The vaccine could be available as early as 2015. These Indian-made vaccines will help ensure we can deliver life-saving tools to all children who need them in the long term, whether at home or abroad.

This is good news for India and people in African and Asian countries where rotavirus is an all too common part of life. It is estimated that broad access to rotavirus vaccines in low-income countries could save up to 225,000 children annually. The World Health Organisation strongly recommends including the rotavirus vaccine in all immunisation programs because of its potential impact.

Two Indian manufacturers, Serum Institute of India and Panacea Biotec, also announced that they would significantly reduce the price at which they offer their pentavalent vaccines that protect against five deadly diseases. While Indian manufacturers are leading the charge in making lifesaving vaccines available to the world, the pentavalent vaccine is not yet widely available in India's public sector.

Now it is up to us to take advantage of this new momentum and provide access to this life-saving tool. We must call on our government leaders to work with Gavi and immediately prioritise rapid access to new vaccines for every child across the country. The longer we wait, the more lives are lost — those of our future leaders.

As India moves forward in planning its vaccine strategy, it should look not only within its borders but at the millions in Africa who also need help. The government of India has made clear its desire to be a long-term partner with Africa, evidenced by the recent announcement of a $5-billion credit line to Africa over the next three years. As India's trade with Africa accelerates rapidly, to a projected $120 billion by 2015, our ties to the global south will continue to strengthen and we should not let these ties be limited to just economic contracts when there is so much more that can bring our people together.

Unicef's latest announcement of vaccine prices shows that for many diseases Indian manufacturers are able to produce vaccines at significantly lower prices per dose than manufacturers in Europe or the USA. By devoting resources to the development of rotavirus vaccines, India can provide more assistance at a lower price to developing nations in Africa and elsewhere, helping save the lives of countless children.

Vaccines alone will not rid the world of rotavirus completely, nor will they solve all our health problems. We still need to focus on India's long-term challenges such as improving sanitation and strengthening our health infrastructure — steps that can impede the ability of any disease to thrive and spread. However, offering routine immunisation against rotavirus and other leading causes of childhood mortality now is a simple step that could save the lives of tens of thousands of Indian children.

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