Registered with the Registrar of Newspapers of India: R.N. 70269/98

ISSN : 0972-169X
Postal Registration No. : DL-11360/2002

Monthly Newsletter of Vigyan Prasar

DREAM 2047

April 2002 *Vol. 4* *No. 7*

VP News

Science Communication Through WorldSpace Radio

A new beginning is being made to utilize the WorldSpace satellite digital radio system for science and technology popularization in the country by Vigyan Prasar in association with WorldSpace. In the days to come, Vigyan Prasar hopes to utilize this powerful technology of satellite digital radio communication for science and technology popularization, and for education and management of natural disasters, and so on, along with other established technologies. The signals are received directly from ASIASAT - one of the three WorldSpace geo-synchronous satellites placed at 120 degrees apart at a height of 36,000 kilometres.

On May 06, 2002, three talks on different aspects of science and technology communication, interspersed with slides would be broadcast. Visuals can be viwed by downloading the files in advance using your radio sets and a personal computer attached to an adapter card or from our web site www.vigyanprasar.com,. The first talk would be by Professor V.S. Ramamurthy, Secretary, Department of Science and Technology, Government of India, and a noted nuclear physicist of the country. His talk will cover various aspects of science of communication. Second talk would be byDr. Narender K. Sehgal who is primarily a science communicator. He is recipient of the prestigious Kalinga prize of UNESCO for science popularization. He was the founder Director of Vigyan Prasar. He would speak on various aspects and activities of science and technology communication in the country. The last talk would be by Dr. Vinay B. Kamble, Director, Vigyan Prasar. He would talk to us about the various activities of Vigyan Prasar.

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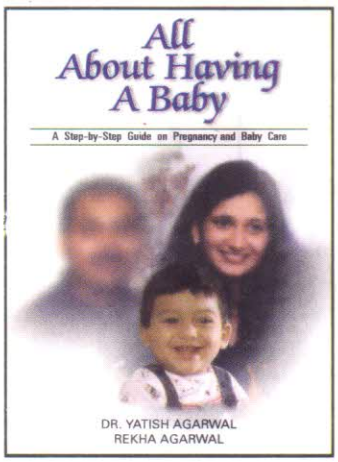
All About Having A Baby

The birth of a baby in a happy, healthy family means that the bond between husband and wife has come of age. Together you create a new human being who embodies a part of each of you-your bodies, minds, and spirits, and is in a true sense, your own vision of yourselves carrying on your love and work and life into the future.

The moment conception occurs, the mother takes the responsibility of nurturing the seed of life. Bit by bit, cell-by-cell, perfused by her arteries the tiny fertilised egg grows into a complete baby! A single cell grows and matures into billions of cells; still each baby is unique.

Finally, the big day arrives. You take up a new role. Bringing up that helpless bundle of life has both its rewards and punishment. The sleepless nights, the splitting headaches are salved when the baby smiles or when those tiny fingers clasp yours. Knowing the simple rules of baby care prepares you for the tasks that lie ahead.

This book packs the present-day modern knowledge about conceiving, carrying and caring of your baby without renouncing the wisdom of old. It sifts facts from myths and fulfils the role of a friend who has the answers to most of your questions.



All About Having a Baby : Dr. Yatish Agrawal & Rekha Agrawal, Published by Vigyan Prasar, 2002, ISBN 81-7480-074-3, PP 243, Rs. 195 Paperback edition: ISBN 81-7480-078-6, PP 243, Rs. 95

...think scientifically, act scientifically ... think scientifically, act scientifically ... think scientifically, act...

Published and Printed by Dr. Subodh Mahanti on behalf of Vigyan Prasar, C-24, Qutab Institutional Area, New Delhi-110 016
& Printed at Rakmo Press Pvt. Ltd, C-59, Okhla Industrial Area Phase-I, New Delhi-110 020. Editor: Dr. V.B.Kamble

The Great Indian Arc of the Meridian

Two hundred years ago, 10 April, 1802 to be precise, a daunting and audacious scientific endeavour began in our country. Called "The Great Indian Arc of the Meridian", it was the longest measurement of the Earth's surface ever to have been attempted. The idea was to map the entire Indian sub-continent and determine the exact curvature of the Earth. The intrepid band of the surveyors, initially under the leadership of Colonel William Lambton and after his death in 1823 under Sir George Everest took fifty years to traverse 2400 kilometres from Cape Comorin to Dehra Dun along the 78^0 East longitude. It is said that the inch perfect survey along the entire path took cost more lives than most contemporary wars, and involved equations more complex than any in the pre-computer age! It has been hailed as 'one of the most stupendous works in the history of science'. Through hill and jungle, flood and fever, the survey carried the Arc from the southern tip of the Indian subcontinent up into the snows of the Himalayas. William Lambton, an endearing genius, had conceived the idea; George Everest, an impossible disciplinarian, eventually completed it. Malaria wiped out whole survey parties; tigers and scorpions also took their toll. Besides the physical hardships, the technical difficulties were enormous. Their measuring instruments - theodolites, weighed half a ton, and observations had often to be conducted from make-shift platforms ninety feet above the ground or from mountain peaks enveloped in blizzard. A theodolite needed 12 men for carrying it around. Using these monstrous instruments, the survey covered the country with multiple strings of triangles in the north-south and east-west directions. Such surveys extensively employ application of trigonometry. Consequently, this gigantic project also came to be known as "The Great Trigonometric Survey".

In 1843 Andrew Scott Waugh took charge of the project as Surveyor-General, and gave special attention to the Himalayan peaks. Because of clouds and haze, those peaks are only rarely seen from the lowlands, and until 1847 few measured sightings were achieved. Even after they were made, the results had to be laboriously analyzed by "computers" performing trigonometric calculations in the survey's offices - of course human computers, not machines! In 1852, Waugh's team succeeded in observing the highest peak in the world, its height being calculated at 29,002 feet (accepted height now is 29,035 feet or 8850 metres). From a distance of over 160 km, the peak was observed from six different stations, and "on no occasion had the observer suspected that he was viewing through his telescope the highest point on Earth." Originally it was designated as Peak XV by the survey, but in 1856 Waugh named it after Sir George Everest, his predecessor in the office of Surveyor-General. Everest was the one who commissioned and first used those giant theodolites. They are on display in the Museum of the Survey of India in Dehra Dun. It was the Chief Computer, Radhanath Sickdhar (that is how he spelt his name!), who first realized that Peak XV was the world's highest.

Now we can determine the position on Earth accurately using the global positioning system (GPS) of 24 satellites in precise orbits, constantly broadcasting their position. A small hand-held electronic instrument receives their signals and gives one's position quite accurately. A great deal of trigonometry is involved, but all calculations are done by a computer inside the gadget. The Great Arc made possible the mapping of the entire Indian subcontinent and the development of its roads, railways and telegraphs. The Great Trigonometric Survey can be considered as foundation of all the topographical surveys. More important still, by producing new values for the curvature of the Earth's surface, the Arc significantly advanced our knowledge of the exact shape of our planet

To commemorate the great expedition, the Survey of India has chalked out a year-long programme. The major events would include a Treasure Quest, Geo Quest Quiz, Great Arc Exhibition, Great Arc Documentary Film Series, and Great Arc Pictorial publications and so on. Indeed, this event could be utilized to generate an interest in mathematics and study of geography through a host of activities like students' projects in measuring heights and distances using method of triangulation and applications of principles of trigonometry, mapping local areas with the help of civil engineering departments of engineering colleges, field trips for familiarization with the local terrain - say, forest cover, water bodies, agricultural patterns, alongwith lectures and demonstrations, essay competitions, and so on. This is yet another opportunity, especially for the VIPNET clubs, to popularize science with activities built around the Great Arc of India. Indeed, it would be a fitting tribute to Lambton, Everest, Waugh, Sickdhar and countless others who helped define our country as we know today.

❒ V. B. Kamble

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The Old Monk and the Pea

❒ V.B. Kamble

It requires indeed some courage to undertake a labour of such far-reaching extent; this appears, however, to be the only right way by which we can finally reach the solution of a question the importance of which cannot be overestimated in connection with the history of the evolution of organic forms.

- Gregor Johann Mendel in his famous paper of 1865

Gregor Johann Mendel was born in Hyncice, Moravia on 22 July1822 in what is now the Czech Republic. He was the only son of a peasant farmer. Mendel attended local schools and the Philosophic Institute at Olomouc. In 1843, he entered the Augustinian Order at St. Thomas Monastery in Brünn and began his theological studies at the Brünn Theological College. He was ordained to the priesthood on 6 August 1847.

The Augustinians had been established in Moravia since 1350, and St. Thomas Monastery was a centre of creative interest in the sciences and culture. Its members included well-known philosophers, mathematicians, mineralogists and botanists who were engaged in scientific research and teaching. The library contained precious manuscripts, as well as textbooks dealing with problems in the natural sciences. The monastery also held a mineralogical collection, an experimental botanical garden and a herbarium. It was in this atmosphere, that Mendel's preference for the natural sciences must have developed.

Gregor Johann Mendel

After his ordination as a priest, Mendel was assigned to pastoral duties, but it was soon discovered that he was more suited to teaching. In 1849, he was assigned to a secondary school in the city of Znaim, where he was well received by his students. However, when he took the qualifying state examination for teacher certification, he failed! Recognizing that Mendel was largely self-taught, he was recommended for further studies in the natural sciences. The abbot of the monastery agreed, and Mendel was sent to the University of Vienna in order to improve his preparation for the re-examination. Mendel spent two years in Vienna (1851- 1853), where he attended lectures and seminars in the natural sciences and mathematics. **It was there that he acquired the empirical, methodological and scientific research skills which he was to apply to his later investigations.** Mendel returned to teaching in Brünn in 1854 but when, two years later, he again attempted the state certification examination he became ill, and withdrew. He did not pursue the examination further but returned to Brünn in 1856 where he continued to teach part-time.

Soon after he returned from Vienna, Mendel began his experiments. He brought to his experiments as unusual talent in plant breeding and mathematics. At the time no one thought both were related at all. He embarked upon an amazing project, one that absorbed tremendous energy for years - like most scientists; insatiable curiosity. How did it all start? Soon after he entered the monastery, Mendel began trying to breed different colours in flowers. Of course this was nothing new. For centuries, plant and animal breeders had been controlling the outcome of breeding. It was then that Mendel gained experience in the process of artificial fertilisation in plants. But, he noticed something odd about his results. When he crossed a particular species, as a rule, he would get the same hybrid results. But, when he crossed his hybrid plants - whose parents had contrasting traits, sometimes their offspring had very odd traits, and it puzzled him a lot. He decided to try to find an explanation. True, there were others who had noticed this earlier. But, no one ever bothered to count the number of offspring exhibiting different forms or had tried to classify them. No one had tried to keep track of generations nor to do a statistical study. **But this seemed to be the logical approach to him**. We shall describe in this article how he set about this wonderful task.

On 30 March 1868, Mendel was elected abbot of St. Thomas Monastery. His new duties involved many civic responsibilities that took him away from his scientific work. Almost immediately he became involved in a confrontation with the government over the payment of past taxes. A new taxation law in 1874 increased the tax on the monasteries to cover the expenses of Church institutions. Mendel, alone among the monastery superiors, vigorously contested the tax and refused to recognize the validity of the law. He became isolated both in the monastery and in public life until his death.

Mendel died in Brünn on 6 January 1884. In his last years, Mendel lived a solitary life. Just before his death he commented: "My scientific labours have brought me a great

deal of satisfaction, and I am convinced that before long the entire world will praise the result of these labours." His serene confidence despite the lack of recognition his work received was to be vindicated. Mendel remains one of the great biologists of the nineteenth century and the inspiration for one of the most challenging sciences of our time - **genetics**.

Early theories of inheritance

Many theories of inheritance were proposed, and some date back as far as ancient Greece. Aristotle proposed the theory of *pangenesis* which held that particles (called pangenes) from all parts of the body come together to form the eggs and sperm. He argued that changes that occurred in the various body parts during an organism's life could be passed on to the next generation. As a matter of fact, pangenesis was accepted by many including Lamarck and Darwin and was the prevailing theory in the the nineteenth century. However, pangesesis is incorrect because reproductive cells are not composed of contributions from body cells and changes in body cells do not influence egg and sperm cells.

In the seventeenth century, Aton van Leeuwenhoek "observed " the *homunculus*, a miniature human being, in human sperm cells. He and his followers (*spermists*) believed that: the mother serves only as an incubator for the homunculus and all characteristics are inherited from the father. Also during the seventeenth century, Regnier de Graaf and his followers (*ovists*) proposed that: the egg contains an entire human in miniature and that semen only stimulates its growth; and that all characteristics are thus inherited from the mother. Regnier de Graff was the first person to describe the ovarian follicle in which human egg cells are produced.

However, based upon their observations with ornamental plant breeding, scientists in the nineteenth century realized that both parents contribute to the characteristics of offspring. The "blending" theory then became the favored explanation of inheritance. According to this theory: hereditary materials from male and female parents mix to form the offspring, and once blended, the hereditary material is inseparable. Further, since the hereditary material is inseparable, the population should reach a uniform appearance after many generations. This theory, however, was inconsistent with the observations that: populations do not reach a uniform appearance; and that some traits are absent in one generation and present in the next. As remarked earlier, modern genetics began in the 1860's with the experiments Johann Gregor Mendel.

The garden of the Augustinian Convent in Brünn. *This view is looking towards the entrance to the garden, with Mendlovo namesti, Mendel Square, beyond. In the shadows in front of the tree can just be seen part of the foundations of the greenhouse that Mendel used. His peas were planted in the beds against the building on the left.*

Mendel's Experiments

Mendel realized that he would have to raise many generations of many plants to obtain the statistical information he needed. Using just a few plants, it would not be possible to have a large enough sampling and the results could be misleading. For eight years from 1856 to 1864, he grew peas in he monastery garden, carefully keeping records of traits from generation to generation. He conducted meticulous experiments in hybridization, carefully examining and recording details about thousands of plants. His best-known observations, however, were made with garden peas.

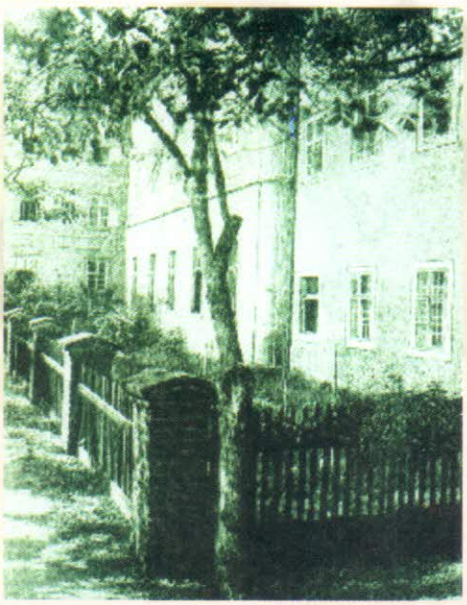
He realized that to avoid the risk of questionable results from the outset, the experimental plants must necessarily possess the following characteristics: 1) constant differentiating characteristics or traits, 2) the hybrids of such plants must, during the flowering period, be protected from the influence of the foreign pollen, or be easily capable of such protections, and 3) the hybrids and their offspring should suffer no marked disturbance in their fertility in the successive generations.

He used peas because, over time, gardeners had bred pure strains. For example, dwarf peas that always bred dwarf plants, and tall peas that always bred tall plants. Further, the peas were self-fertilizing but also could be cross-fertilized. As stated by Mendel in his now famous paper:

"At the very outset special attention was devoted to the *Leguminosae* (an order of angiosperms characterised by the legume. Angiosperms are flowering plants in which the seeds are in a closed ovary, not naked as in the case of gymnosperms) on account of their peculiar floral structure. Experiments which were made with several members of this family led to the result that the genus *Pisum* was found to possess the necessary qualifications.

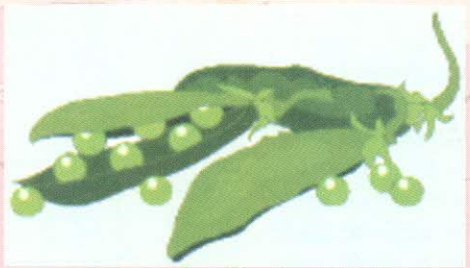
Some thoroughly distinct forms of the genus *Pisum* possess characters which are constant, and easily and certainly recognizable, and when their hybrids are mutually crossed they yield perfectly fertile progeny. Furthermore, a disturbance through foreign pollen cannot easily occur, since the fertilizing organs are closely packed inside the keel

(the two lowest petals of a papilionaceous, or butterfly-like, flower, arranged like a ship's keel) and the anthers (i.e. part of the stamen that contains the pollen) burst within the bud <http://www.netspace.org/MendelWeb/MWgloss.html>, so that the stigma becomes covered with pollen **even before the flower opens**. This circumstance is especially important. There are other advantages as well, say, the easy culture of these plants in the open ground and in pots, and also their relatively short period of growth. Artificial fertilization is certainly a somewhat elaborate process, but nearly always succeeds. For this purpose the bud is opened before it is perfectly developed, the keel is removed, and each stamen (pollen bearing organ in the plant) carefully extracted by means of forceps, after which the stigma (the free upper tip of the style of the flower, on which pollen falls and develops; style is the slender, stalk-like part of a carpel between the stigma and the ovary) can at once be dusted over with the foreign pollen".



This view is looking in the opposite direction and shows a close up of the garden arealt is precisely here that Mendel grew his peas.

In all, Mendel obtained 34 more or less distinct varieties of peas from several seedsmen and subjected to a two year's trial. In the case of one variety there were noticed, among a larger number of plants all alike, a few forms which were markedly different. These, however, did not vary in the following year, and agreed entirely with another variety obtained from the same seedsman; the seeds were therefore doubtless merely accidentally mixed. All the other varieties yielded perfectly constant and similar offspring; at any rate, no essential difference was observed during two trial years. For fertilization 22 of these were selected and cultivated during the whole period of the experiments. They remained constant without any exception.



Garden Peas

No doubt, their systematic classification was difficult and uncertain. If we adopt the strictest definition of a species, according to which only those individuals belong to a species which under precisely the same circumstances display precisely similar characters, no two of those varieties could be referred to one species. The majority, however, belonged to the species *Pisum sativum*; while the rest were regarded and classed, some as sub-species of *P. sativum,* and some as independent species, such as *P. quadratum, P. saccharatum,* and *P. umbellatum.* The positions, however, which may be assigned to them in a classificatory system were quite immaterial for the purposes of the experiments in question. It was found to be impossible to draw a sharp line between the hybrids of species and varieties as between species and varieties themselves.

As stated by him in his paper of 1865, the characters he selected for experiment related to the following differences:

1. To the *difference in the form of the ripe seeds.* These are either round or roundish, the depressions, if any, occur on the surface, being always only shallow; or they are irregularly angular and deeply wrinkled (*P. quadratum*).
2. To the *difference in the colour of the seed albumen* (endosperm, that is, tissue within the seed-coat other than the embryo itself). The albumen of the ripe seeds is either pale yellow, bright yellow and orange coloured, or it possesses a more or less intense green tint. This difference of colour is easily seen in the seeds as their coats are transparent.
3. To the *difference in the colour of the seed-coat.* This is either white, with which character white flowers are constantly correlated; or it is gray, gray-brown, leather-brown, with or without violet spotting, in which case the colour of the standards is violet, that of the wings purple, and the stem in the axils of the leaves is of a reddish tint. The gray seed-coats become dark brown in boiling water.
4. To the *difference in the form of the ripe pods.* These are either simply inflated, not contracted in places; or they are deeply constricted between the seeds and more or less wrinkled (*P. saccharatum*).
5. To the *difference in the colour of the unripe pods. They are either light to dark green, or vividly yellow, in which colouring the stalks, leaf-veins, and calyx* (the outer whorls of protective leaves, or sepals as they are called, of the flower) *participate.*
6. *To the* difference in the position of the flowers. *They are either axial, that is, distributed along the main stem; or they are terminal, that is, bunched at the top of the stem and arranged almost in a false umbel* (a cluster of flowers with stalks of nearly equal lengths which spring from about the same point, like the ribs of an umbrella)*; in this case the upper part of the stem is more or less widened in section (P. umbellatum).*
7. *To the* difference in the length of the stem. *The length of the stem is very various in some forms; it is, however, a constant character for each, in so far that healthy plants, grown in the same soil, are only subject to*

Pea Plant

unimportant variations in this character. In experiments with this character, in order to be able to discriminate with certainty, the long axis of 6 to 7 ft. was always crossed with the short one of 3/4 ft. to 1 [and] 1/2 ft.

Each two of the differentiating characters enumerated above were united by **cross-fertilization**. It is interesting to look at the number of fertilizations he made in each experiment that included contrasting charecteristics enumerated above and in that order:

1st experiment	:	60 fertilizations on 15 plants.
2nd experiment	:	58 fertilizations on 10 plants.
3rd experiment	:	35 fertilizations on 10 plants.
4th experiment	:	40 fertilizations on 10 plants.
5th experiment	:	23 fertilizations on 5 plants.
6th experiment	:	34 fertilizations on 10 plants.
7th experiment	:	37 fertilizations on 10 plants.

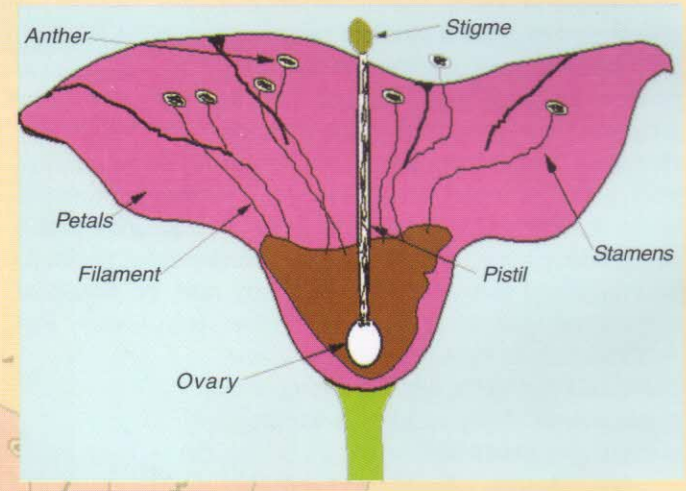
Dominant Vs Recessive

In each experiment enumerated above, Mendel crossed a plant having one of these seven traits with a plant having the contrasting trait. He then placed on the stigma of the flower a small amount of pollens from a plant with the contrasting trait. He took care to prevent any further fertilization via wind or insects. The cross-fertilized plant would bear seeds. He collected those seeds, catalogued and replanted to observe that traits would appear. He observed that when crossed pure tall plants with pure dwarf plants, the hybrids that resulted were all tall, as if they were produced from two tall plants. Furthermore, in all the experiments reciprocal characteristics were effected in such a way that each of the two varieties which in one set of fertilization served as seed-beares in the other set was used as the pollen plant. **Thus, it did not matter whether tall or dwarf plants furnished the male or the female germ; the results appeared to be the same**. Mendel called the trait that showed in this case *tall*; the **"dominant"** trait; the trait that did not show in this first hybrid generation, in this case *short*, he called **"recessive"**. Of the seven differentiating characters which were used in the experiment, he observed that the following characters were dominant.

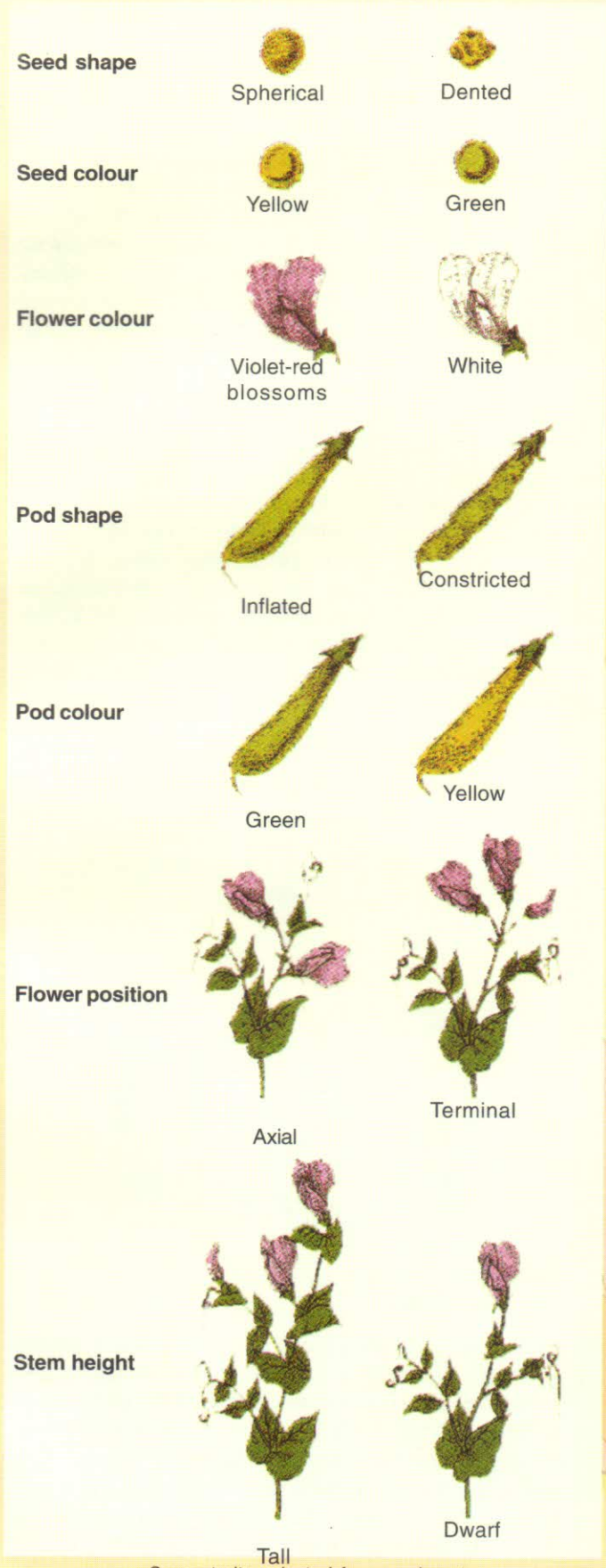
1. The round or roundish form of the seed with or without shallow depressions.
2. The yellow colouring of the seed albumen.
3. The gray, gray-brown, or leather brown colour of the seed-coat, in association with violet-red blossoms and reddish spots in the leaf axils.
4. The simply inflated form of the pod.
5. The green colouring of the unripe pod in association with the same colour of the stems, the leaf-veins and the calyx.
6. The distribution of the flowers along the stem.
7. The greater length of stem.

The first generation from the hybrids

During the next phase of his experiment, Mendel crossed two of the hybrid plants together - for example both of which looked tall, but had a dwarf parent. He did several hundred of these crosses and found that he got



*Mendel's experimental plants were a flowering species of the pea, or Leguminosae family, called Pisum sativum, or garden peas. The drawing above illustrates the basic structure of a flower, like those found in Pisum. The flower can be considered the specific part of, or site in, the plant where reproduction takes place. Pisum sativum belong to a sub-family called Papillonaceae, a group named for the butterfly-like appearence of their flowers. And like many flowers, the pea flower contains both male and female parts. The female part of the flower, called the **pistil** usually has a sack at its base called the **ovary**, which contains egg cells called **ovules**. Coming out of the ovary is a column called the **style**, which is crowned by a sticky structure called the **stigma**; the stickiness makes the stigma suitable for receiving and retaining pollen grains. The pistil is nearly surrounded by the male parts of the flower, which are called the **stamens**. Each stamen consists of a slender stalk, called the **filament**, topped by an enlarged structure called the **anther**; it is the anther that carries the pollen grains. In Pisum sativum, the sepals on the flower are united, covering and protecting the stamens and pistil from foreign pollen and other seeds.*



Seven traits selected for experiment

Pisum Sativum

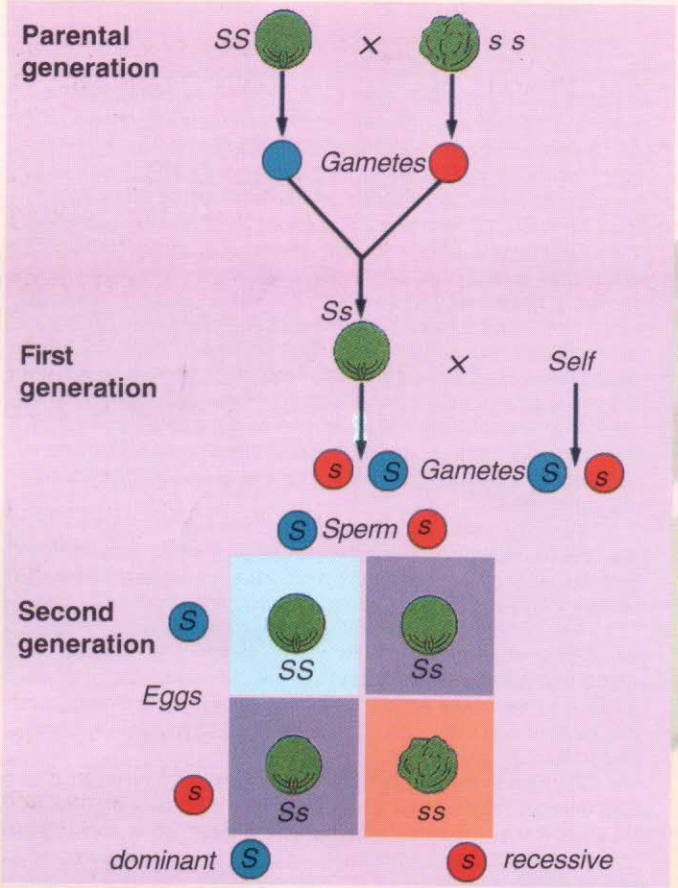
Peas originate from the Near East where they have been found in archaeological sites that date back to 7500 BC. However, the characteristic features of domestication (e.g. smooth seed coats) only become clearly evident by 6500 BC. Cultivation of peas in the Near East therefore occurred a long time ago but seemingly not as long ago as wheat and barley which were being cultivated by about 7800 BC. Nevertheless, it appears that peas were growing or being grown in company with wheat and barley during the agricultural revolution of the Neolithic. Lentil and Chickpea were also being grown and together with Pea were the main non-meat protein food sources (peas have about 22 % protein). Pea cultivation had spread to central Europe by 4000 BC and by 2000 BC it had spread throughout Europe and also east into India. *Pisum sativum* is morphologically highly variable and is predominantly self-pollinated which means one can easily develop different true breeding lines. Peas originally were grown to full size and stored dry. However, in modern times they are more often picked green before maturity and eaten fresh.

Pea *(Pisum sativum)* gets its English name indirectly from the Latin *pisum*. In AngloSaxon the word became *pise* or *pisu*; later, in English it was "pease." So many people thought pease was plural that they persisted in dropping the "s" sound, thus making the word "pea." The Latin name resembles the older Greek *pisos*, or *pison*. Many different species have long been called "pea," so that this word alone is not definite. In much of our own South today "peas" usually means some edible variety of cowpeas. In referring to what most of the United States understands as "peas" (*P. sativum),* the southerner says "English peas."

The main center of origin and development of this pea is middle Asia, from northwest India through Afghanistan and adjacent areas. A second area of development lies in the Near East, and a third includes the plateau and mountains of Ethiopia. In these areas wild peas of related species have been found, along with a remarkable diversity of cultivated forms of *P. sativum,* but wild *P. sativum* has never been found. This pea was first grown only for its dry seed. Some varieties are grown extensively today for the dry seeds for "split peas" for soup. The varieties known until about a thousand years ago had seeds that were much smaller, dark coloured, and otherwise different from our garden types.

Seeds of primitive peas have been found in lake mud beneath the positions of houses of the Swiss lake dwellers, dating back perhaps 5,000 years to the Bronze Age. Peas also were found buried in a cave in Hungary, believed by some to date back even further. Despite recurrent claims, this species of pea has not been found among any of the ancient Egyptian treasures, but it has been found in diggings on the site of ancient Troy. The Aryans from the East are supposed to have introduced peas to the Greeks and Romans, who grew them before the Christian Era. Greek and Roman writings indicate that the crop was held in no special favour.

There is no hint of "green peas" until after the Norman Conquest of England. In the 12th century, among other foods stored at the famous old Barking Nunnery, near London, were "green peas for Lent." Nothing really definite was recorded about them, however, until 1536, when they were described in detail in France. The edible-podded pea was also known at that time. Before the end of the 16th century, botanists in Belgium, Germany, and England described many kinds of peas-tall and dwarf, with white, yellow, green seed colors; smooth, pitted, and wrinkled seeds. Garden peas were not common until the 18th century. Toward the end of the 17th century they were still such a rare delicacy that fantastic prices were sometimes paid for them in France. "This subject of peas continues to absorb all others," Madame de Maintenon wrote in 1696. "Some ladies, even after having supped at the Royal Table, and well supped too, returning to their own homes, at the risk of suffering from indigestion, will again eat peas before going to bed. It is both a fashion and a madness. " The English developed fine varieties; hence the common designation "English peas" in America.



Mandel's Explanation of Experiment 1

some dwarf plants and some tall plants as a result. He counted them and worked out the ratio. There were 787 tall plants and 277 short ones, or roughly three times as many tall plants as dwarf plants or in the ratio 3:1. He crossed other hybrid plants similarly, say hybrid plants with inflated pod, but had a wrinkled parent, and so on for each pair of differentiating characters. Mendel found the identical statistical distribution for all the seven traits he studied. This is what he observed in his experiments.

Expt. 1: Form of seed. From 253 hybrids 7324 seeds were obtained in the second trial year. Among them were 5474 round or roundish ones and 1850 angular wrinkled ones. Therefrom the ratio 2.96:1 is deduced.

Expt. 2: Colour of albumen. 258 plants yielded 8023 seeds, 6022 yellow, and 2001 green; their ratio, therefore, is as 3.01:1.

Expt. 3: Colour of the seed-coats. Among 929 plants, 705 bore violet-red flowers and gray-brown seed-coats; 224 had white flowers and white seed-coats, giving the proportion 3.15:1.

Expt. 4: Form of pods. Of 1181 plants, 882 had them simply inflated, and in 299 they were constricted. Resulting ratio, 2.95:1.

Expt. 5: Colour of the unripe pods. The number of trial plants was 580, of which 428 had green pods and 152 yellow ones. Consequently these stand in the ratio of 2.82:1.

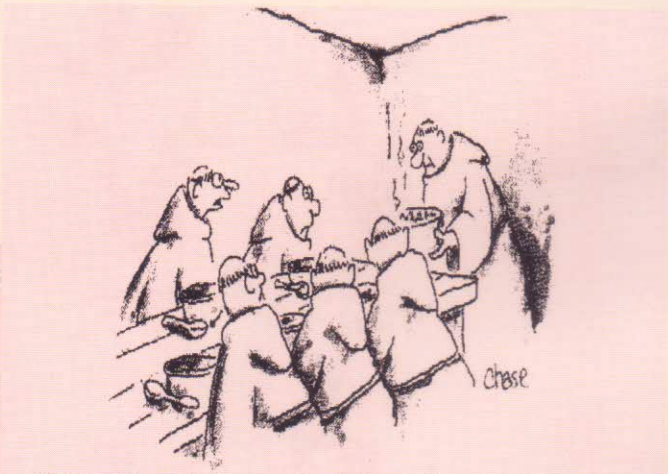
Expt. 6: Position of flowers. Among 858 cases 651 had inflorescences axial and 207 terminal. Ratio, 3.14:1.

Expt. 7: Length of stem. Out of 1064 plants, in 787 cases the stem was long, and in 277 short. Hence a mutual ratio of 2.84:1. In this experiment the dwarfed plants were carefully lifted and transferred to a special bed. This precaution was necessary, as otherwise they would have perished through being overgrown by their tall relatives. Even in their quite young state they can be easily picked out by their compact growth and thick dark-green foliage.

If now the results of the whole experiments be brought together, there is found, as between the number of forms with the dominant and recessive characters, an average ratio of 2.98:1 or 3:1. Mendel had, to be sure, focused on simple traits that had only two alternative forms. But, this is why he was readily able to perceive the pattern produced when he traced how parental traits were passed to their offspring. **His studies implied that while individuals exhibit many differences on the surface, beneath the surface even more complex differences existed.**

Subsequent Generations

Mendel observed that those forms which in the first generation exhibit the recessive character do not further



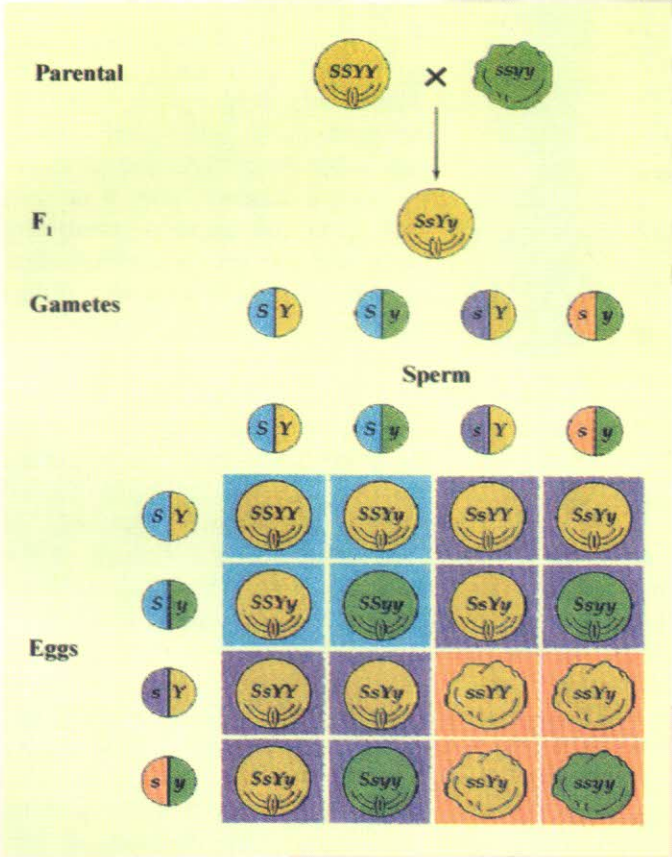
"Brother Mendel! We grow tired of peas!"
Cartoon by J. Chase

vary in the second generations as regards this character. They remain constant in their offspring. However, it is otherwise with those which possess the dominant character in the first generation. Of these two thirds yield offspring which display the dominant and recessive characters in the proportion 3:1 and thereby show exactly the same ratio as the hybrid form, while only one-third remains with the dominant character constant. The proportions in which the descendents of the hybrids develop and split up in the

first and second generations hold good for all subsequent progeny. He carried out his experiments to five or six generations producing different but always consistent ratios. The offspring of the hybrids separated in each generation in the ratio of 2:1:1 into hybrids and constant form.

When several diverse characters are united

Till now we have described experiments involving plants which differed only on one essential character. Mendel's next task consisted in ascertaining whether the conclusions derived above applied to each pair of differentiating characters when several diverse characters are united in the hybrid by crossing. As regards the form of the hybrids



Independent Assortment

in these cases, the experiments showed throughout that this invariably more nearly approaches to that one of the two parental plants which possesses the greater number of dominant characters. If, for instance, the seed plant has a short stem, terminal white flowers, and simply inflated pods; the pollen plant, on the other hand, a long stem, violet-red flowers distributed along the stem, and constricted pods; the hybrid resembles the seed parent only in the form of the pod; in the other characters it agrees with the pollen parent. Should one of the two parental types possess only dominant characters, then the hybrid is scarcely or not at all distinguishable from it.

Mendelian Principles

From what we have described above, Mendel came up with conclusions that have since become known as the two Mendelian principles: the principle of segregation and the principle of independent assortment.

The principle of segregation: According to the principle of segregation, in sexually reproducing organisms (including plants), two units of heredity control each trait. When the reproductive cells are formed, though, the two units become separated (segregated) from each other, so that the offspring gets one unit for each trait from each parent. Mendel's work gave the first indication that inheritance might be carried by discrete particles in this way (which it is), and not blended.

The principle of independent assortment: When reproductive cells are formed, according to the principle of independent assortment, the distribution of the units of heredity for each trait doesn't interfere with the distribution of others. For example, he found that he could produce either tall or short pea plants that bore wrinkled peas and either short or tall pea plants with smooth peas.

Of course, we have to admit that Mendel came up with this clear, uncluttered picture as a matter of luck. The particular traits he chose in the pea plant had distinct, discontinuous variations for each pair, with no intermediate grades. And each was simple, not controlled by more than one hereditary unit. So he didn't end up, for example, with any offspring pea plants that were of medium height instead of tall or short. In humans, for example, we now know that height is controlled by several genes. So is skin colour. So it's possible to get intermediate height and shades of skin colour. Albinism (the absence of skin pigment) is a simple two-gene trait in humans, however, like Mendel's models (more about genes later). So a father and mother who have normal skin colour but each carries a gene for the recessive trait of albinism could have a child that had no skin pigmentation at all. In fact, the chances would be one in four.

In addition, Mendel happened to choose traits that were not "linked" in any way. He thought of the units of heredity as separate "particles", which we now know they not. Therefore in his experiments, none of the odd results caused by what is now known as "linkage" occurred in his studies. Consequently, while his principle of independent assortment still applies, it holds only for those traits that are not linked.

The tragedy of a brilliant scientist

We know from contemporary written reports that the audience received Mendel's lectures courteously but with blank incomprehension. He must have been bitterly disappointed at the indifference with which his revelations were greeted. Mendel's approach and the nature of his experimentation were simply too unconventional for his age. Nobody before him had ever attempted to use mathematical

and statistical analysis as a means of interpreting the results of biological inquiry. Additionally, Mendel was known as a relatively shy person and might not have presented his results with the necessary emphasis and stress. Another reason for the absence of any response from the scientific fraternity of the day will have been the limited number of people who read the Brno Association's records. Mendel asked one of his fellow monks to send forty special reprints to botanists and other distinguished scientific figures known to be interested in the hybridisation of plants. One of the recipients was Carl Wilhelm von Nägeli, probably the most highly acclaimed botanist of the mid-nineteenth century, who was then teaching in Munich. He was the only one of the forty who was prompted to embark on an extended correspondence with Mendel. However, it appears likely that Nägeli had only glanced at the reprint because - although it in fact dealt with no fewer than 355 cross-bred strains and 12,980 resultant hybrids - he described Mendel's work as "incomplete" and urged him to carry on with his experiments. Nägeli also offered Mendel "fatal" advice: to continue his investigations using the hawkweed (*Hieracium*), a plant belonging to the family of the asters. It was only later that botanists discovered these plants' asexual reproduction, which meant that experiments in hybridisation with hawkweed were bound to be inconclusive, since the genetic information is transferred exclusively via the maternal line.

The Mendel memorial Mendel holds his hands out protectively over marble pea plants. Rather more moving is the fact that the plants growing at the foot of the plinth are also *Pisum sativum*. The previous photograph of the whole garden was taken from just beside this rather idealised statue.

Mendel had discerned patterns that no one else had ever seen, and his work should have made big news. However, when he read his paper on the results of his experiments to the local natural history society, he met with complete silence and disinterest. No one asked any questions, nor was there any discussion! However, Mendel did succeed in publishing two papers in *Transactions of the Brünn Natural History Society* in 1865 and 1869, but few people noticed them. **It is said likely that his papers probably contained too much mathematics for the botanists and too much botany for those at home with mathematics!**

At this stage Mendel abandoned the clearly delineated approach which had been a feature of his published investigations of hybridisation in garden pea plants. The lack of response to his publication and the failure of his experiments with hawkweed induced him to devote less time to his scientific work. His unanimous election as Abbot in 1868 afforded only partial compensation for his disappointment. His hopes of being able to resume his experiments were dashed by the sheer work load entailed in running the monastery. In 1883, only a few months before his death in the following year, Mendel commented, with a hint of resignation mingled with the awareness of the importance of his discoveries: *"My scientific studies have afforded me great gratification; and I am convinced that it will not be long before the whole world acknowledges the results of my work."* Modern-day research has shown that Mendel did not work in isolation but that the monastic community included other distinguished scholars. These men not only knew of and understood the nature of Mendel's work but also regarded it as very important. Had Mendel's experiments been viewed as mere "whimsicality", then he would have been dismissed as a "freethinker" devoid of the slightest incentive to vindicate the church's dogmas. In this case Mendel would hardly have been elected Abbot only two years after the publication of his "Treatises".

Mendel's Earliest Experiments with Peas : A summary

Parents	1st Generation	2nd Generation	Ratio
Rs x Wr Rs = Round seed Wr = Wrinkled seed	All Rs.	5474 Rs. 1850 Wr	2.96 : 1
Yc x Gc Yc = Yellow cotyledons Gc = Green coptyledons	All Yc	6022 Yc, 2001 Gc	3.01 : 1
GB x Wh GB = Gray-brown seed coat Wh = White seed coat	All GB	705 GB, 224 Wh	3.15 : 1
Ip x Cp Ip = Inflated pods Cp = Constricted pods	All Ip	822 Ip, 299 Cp	2.95 : 1
Gp x Yp Gp = Green pods Yp = Yellow pods	All Gp	428 Gp, 152 Yp	2.82 : 1
Af x Tf Af = Axial flowers Tf = Terminal flowers	All Af	651 Af, 207 Tf	3.14 : 1
Ls x Ss Ls = Long stem Ss = Short stem	All Ls	787 Ls, 277 Ss	2.84 : 1

Mendel's scientific achievement

Mendel's outstanding intellectual achievement as a scientist was his ability to make deductions from the observed results of individual experiments - in other words, to perceive a distinct pattern despite the random inaccuracies of a few observations. This enabled him, for example, to ascertain the 3:1 segregation ratio in the heredity of red and white pea flowers in the face of a diversity of possible hereditary patterns. This insight long predated the advent of biometrics or even of probability calculus.

Mendel's Laws, his famous principles of hereditary transmission were to revolutionise the cultivation of plants and the breeding of domesticated animals in the twentieth century. Biochemistry and molecular biology have found the molecular basis of Mendel's Laws in form of gene expression in cells and gene transmission in the germline. Mendel's work made it possible for the first time to exploit the genetic resources of organisms systematically. Mendel's name marks not only the beginning of genetics as a scientific discipline in its own right but also the beginning of the systematic use of mathematics, quantified measurements and applied statistics in biology.

However, it was to take thirty-four years before Mendel's prediction came true. The year 1900 saw the now famous rediscovery of Mendel's Laws by Carl Correns in Germany, Hugo de Vries in the Netherlands and Erich von Tschermak-Seysenegg in Austria. Their achievement was to realise that Mendel had not merely conducted experiments in successful hybridisation but had in fact studied the heredity of specific characteristics as they were passed on from parent plants to their offspring.

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   Paper read by Gregor Johann Mendel at the meetings of 08 February, 1865 and 08 March, 1865 of the Brünn Natural History Society. It brings out the scientific and mathematical genius in him. It clearly brings out the method of science, and the importance of statistics in arriving at conclusions when the population is large. It is a treat to read his paper. The English translation is available at http://www.netscape.org/MendelWeb/Mendel.html.
   Indeed, The site http://www.netscape.org/Mendel is a treasure-site on Mendel.The present article heavily draws on it.
2. In Memorium - Gregor Mendel
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4. http://www.ecotao.com/holism/conc_gen.htm. A good site giving brief history and landmarks in a sufficiently exhaustive manner.
5. http://ridge.icu.ac.jp/gen-ed/mendel.html.
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The Old Monk and the Pea : Glossary

Important terms used in connection with this article are given below. The terms given do not necessarily appear in the present article.

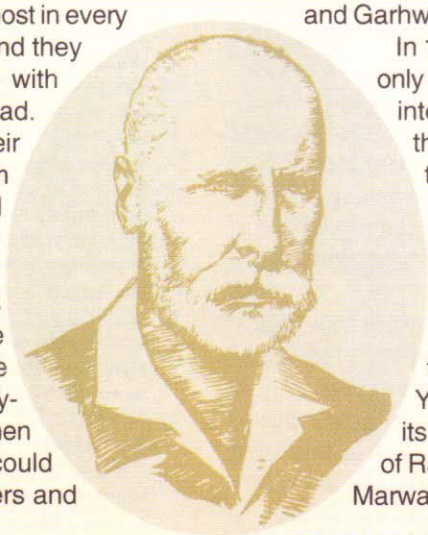
Albumen : The white of an egg, composed principally of albumin.
Anther : The pollen-producing structure of a flower.
Axil : The upper angle formed by a leaf, twig etc. and the stem from which it grows.
Endosperm : The nutritive protein material within the embryo sac of seed plants.
Fertilization : The physicochemical processes involved in the union of the male and female gametes to form the zygote.
Gamete : A mature germ cell.
Gene : The basic unit of inheritance.
Genetics : The science that is concerned with the study of biological inheritance.
Germ Cell : A egg or sperm or one of their antecedent cells
Gymnosperm : The common name for members of the division Pinophyta; seed plants having naked ovules at the time of pollination.
Gymnospermae : The equivalent name for Pinophyta.
Hybrid : The offspring of genetically dissimilar parents.
Legume : A dry, dehiscent (spontaneously bursting open) fruit derived from a single simple pistil; common examples are alfalfa, beans, peanuts, and vetch.
Leguminosae : The legume family of the plant order Rosales characterized by stipulate, compound leaves, 10 or more stamens, and single carpel; many members harbour symbiotic nitrogen-fixing bacteria in their roots.
Magnoliophyta : The angiosperms, a division of vascular seed plants having the ovules enclosed in an ovary and well-developed vessels in the xylem.
Papilionoideae : A subfamily of the family Leguminosae with characteristic irregular flowers that have a banner, two wing petals, and two lower petals united to form a boat-shaped keel.
Pedicel : 1. The stem of a fruiting or spore-bearing organ. 2. The stem of a single flower.
Peduncle : A flower-bearing stalk.
Pinophyta : The gymnosperms, a division of seed plants characterized as vascular plants with roots, stems, and leaves, and with seeds that are not enclosed in an ovary but are borne on cone scales or exposed at the end of a stalk.
Pistil : The ovule-bearing organ of angiosperms; consists of an ovary, a style, and a stigma.
Pollen : The small male reproductive bodies produced in pollen sacs of the seed plants.
Principle of independent assortment: According to the principle of independent assortment, the distribution of the units of heredity for each trait doesn't interfere with the distribution of others. For example, he found that he could produce either tall or short pea plants that bore wrinkled peas and either short or tall pea plants with smooth peas.
Principle of segregation: According to the principle of segregation, in sexually reproducing organisms (including plants), two units of heredity control each trait. When the reproductive cells are formed, though, the two units become separated (segregated) from each other, so that the offspring gets one unit for each trait from each parent.
Stamen : The male reproductive structure of a flower, consisting of an anther and a filament.
Stigma : The rough or sticky apical (i. e. with a short sharp point on an otherwise blunt end) surface of a pistil for reception of the pollen.
Style : The portion of a pistil connecting the stigma and ovary.

Plague – A Disease of Antiquity

❒ P.K. Mukherjee*

The stunning reports of the outbreak of plague in some parts of Himachal Pradesh and Punjab were carried by all national dailies and also found coverage in the electronic media. Going back to history, the celebrated English writer Daniel Defoe of Robinson Crusoe fame and portrayed the sad and dismal days when London hit by plague way back in 1665. Wrote Dafoe : "The face of London was indeed strongly altered..... Sorrow and sadness sat upon every face. Tears and lamentations were seen almost in every home.... Death was before their eyes... and they poisoned themselves beforehand...some with mercury and some with other things as bad. Mothers murdered their own children, in their lunacy....the cart collected the lead from door to door. The buryers were so wicked as to strip the dead in the cart and carry them quite naked to the ground..."

London was not the only city which was visited by the 'black death', which plague was known in Europe then. In the Middle Ages, black death took toll of nearly twenty-five million victims in Europe. Europe was then in the grip of a wild panic. All those who could run away did so leaving behind old mothers and infirm fathers, the sick and the ailing.

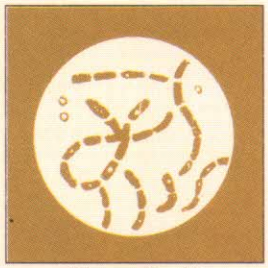


Yersin

There was a mad scramble to sail away in ships only to discover that plague killed on the waters as swiftly as on land. There were occasions when the whole crew perished and the ship floated about or floundered on rocks, with not a soul alive on board.

Italy was ravaged no less than sixteen times by the menace of plague. The Italians disinfected their houses with vinegar and scented 'plague water'.

In London the disease was named 'poor man's plague' because the rich, including the king and his nobles, abandoned the city on the outbreak of the epidemic. Their maxim was 'Quick, Far, and Late', that is, leave quickly, run the farthest and return as late as possible. The courts collapsed. The prisons became cemeteries. Even the physicians took to their heels. The English heaped coal fires in the centre of streets and killed dogs because they suspected them to be the plague-carriers. But, ironically, nobody suspected the rats.



Plague bacilli

Plague in India

In the ancient literature of our country, there are references in the *Bhagwata Purana* (1500-600 B.C) to plague, the disease being characterized as one of man as well as rats. The *Purana* recommends that homes where rats have been found should be abandoned peremptorily.

After that, we have records of the activity of plague from the 11th to the 17th century. The plague disappeared for no ostensible reasons for a whole century. From 1812 to 1821, Gujarat, Katiawar and Kutch were overrun by the ravages of plague. From 1836 to 1838, Marwar and Rajputana suffered the same fate. After 1838, till about 1894, the endemic focus of plague could be traced from the Kumaon and Garhwal Hills of Uttar Pradesh (now Uttaranchal).

In 1895 plague hit Calcutta (now Kolkata) and only one year later it took Bombay (now Mumbai) into its grip. The year 1907 saw the horror of the 'black death' in the worst form with death toll running a staggering high of 13,15,692.

Plague - different names

Plague is known by different names. It has been called 'Oriental Plague' 'Pestis, and 'Pestilentia'. The Russians name it 'Chuma', the Japanese 'Yeki' and the Chinese 'Snu-Yi'. In our own country, it has been known by its original name plague. However, the people of Rajasthan christened it 'Pali' when plague hit Marwar and Rajputana in 1836-1838.

Plague in antiquity

Rufus, who lived in 100 A.D., is said to have referred to a resembling bubonic plague in Egypt, Libya and Syria some 200 years earlier. However, the first clear mention of plague occurs in an old Chinese literature dating back to 610 A.D. in a medical literature by Ch'ae Yuan-fang. The malignant disease was given the name 'E-he'.

Plague very often than not took the form of an epidemic. During the Justinian reign, a plague epidemic occurred in 543 A.D. Beginning in South Egypt the disease took into its clutches the entire Roman Empire and then it spread to Europe and Asia. This epidemic lasted for nearly half a century killing about a hundred million people.

However, as noted by the Chinese physician Wu-Lien-teh, the first epidemic of plague broke out in 1320 B.C. in Philistine. The Philistines made offerings that comprised golden images of mice and buboes.

Plague-rat nexus

Surprisingly, nobody connected rats with plague till 1892 when plague hit Pakhoi, a town of South China. At that time, physician Lowry observed that in nearly every house where the disease broke out, the rats had been

coming out of their holes and lying on the floors. So, rats have something to do with plague, Lowry thought.

In 1894, again, China was hit by plague. Slowly, the Hongkong city came under its grip. An investigator by the name of Rennie started dissecting a large number of rats. He found congestion of the lungs in about half the rats and glandular enlargement in nine out of every ten rats he cut open. So, Rennie confirmed Lowry but he could not go further into the plague mystery.

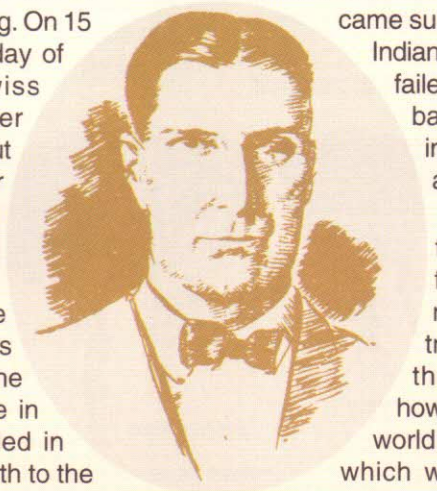
On request from the Chinese officials, the Japanese Government sent Kitasato. Accompanied by Aayama and several associates, Kitasato, who was known as the 'Japanses Koch' being the follower and the pupil of Robert Koch, arrived in Hongkong on 12 June 1894. Two days later, on 14 June Kitasato along with his team was busy in doing post-mortem examination of a plague victim.

Kitasato

He spotted a large number of plague bacilli in the buboes as well as the viscera of the victim's body. On that very day, Kitasato examined the blood of a plague patient and declared that he had located bacilli resembling chicken-cholera bacilli. He inoculated this bacilli into various animals and birds. Barring pigeon all of them died.

Kitasato published his findings in the 25 August, 1894 issue of England's famous medical journal *Lancet*.

However, a controversy was in the offing. On 15 June, 1894, that is exactly on the third day of Kitasato's visit to Hongkong, a Swiss bacteriologist by the name of Alexander Yersin also arrived Hongkong from Paris. But the Chinese authorities did not extend their cooperation to him. As a result, Yersin had to put up in a tent outside, in the hospital's lawns.



Otten

Yersin cut the buboes of dead plague victims and prepared smears and cultures from the matter he took from them. These he arranged to send to the Pasteur Institute in Paris. In this way, Yersin also succeeded in identifying the plague bacilli. This gave birth to the sad controversy. The contest was who actually found the plague bacilli first - Kitasato or Yersin ?

This resulted into unhealthy, unscientific claims and counter claims between the followers of Pasteur and Koch. A via media was, however, ultimately found which set the controversy at rest. It was agreed that the credit for giving the earlier account of the organism should be given to Kitasato while Yersin should be accredited for giving the first detailed and accurate description of the organism.

The plague bacilli was given the name *Pasteurella pestis* as its detection first took place in the Pasteur Institute of Paris. However, to honour Alexander Yersin the name of the bacilli was later on changed to *Yersinia pestis*.

The Plague bacillus is a short, ovoid bacillus with a length of 1.5 to 1.8 microns (1 microns = 10^{-6} metre) and a width of 0.5 to 0.7 micron. In practice, the microbiologists find the bacillus to be highly variable in shape resembling even mould or yeast-like formations. Its temperature range is a very wide on ranging from 0^0 to 43.5^0 C. Just as the bacillus adapts itself to varying temperatures it accommodates itself to all kinds of media, commonly used in the laboratory.

Method of transmission

Even though the murderer was spotted out and the scientists had been able to study its habits, measure it and watch it grow on different media the actual method by which the infection was transmitted from rats to human remained under a cloak of mystery.

This mystery was finally resolved, thanks to the investigations carried out in the India by the Indian Plague Commission. However, before coming to the details and results of these investigations let us first be seized of the attempts made by other workers in the field.

In 1897 Ogata suggested that the plague bacillus is transferred from rat to man by the vehicle of rat-fleas. The came suggestion same the following year from the Indian investigator named Simond. However, both failed to provide conclusive evidence that could back up their claim. The evidence did come in 1903 from two French scientists, Gauthier and Rayband.

By performing experiments on rats in their laboratory, Gauthier and Rayband finally established the connection between rat-fleas and plague. They claimed that the transmission of plague to man takes place through the rat-fleas. Their claim was, however, not received favorably by many of the world scientists who said that their experiments, which were done under controlled laboratory conditions, did not go to prove how plague transmission actually takes palce in nature.

Another investigator Liston in 1905 also advanced a theory leading to the supposed explanation of the method of transmission of the infection. But, Liston's theory also visited the hostility of the scientists.

The Indian Plague Commission

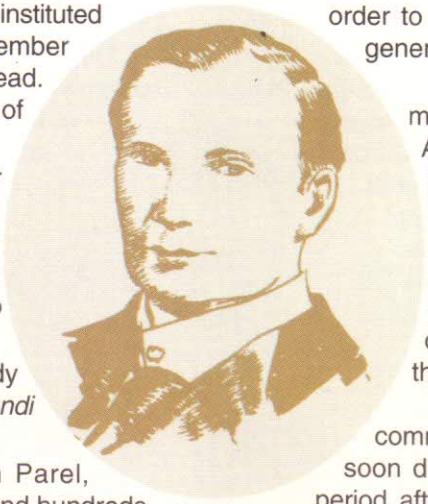
As all these attempts toward understanding the method of transmission of the infection were going on, all of a sudden Bombay (now Mumbai) was badly hit by plague in 1907. To go into the genesis and causes of the outbreak of the

disease, the Indian Plague Commisson was instituted by the Government of India. It was a six-member Commission with Sir Charles Martin as its head. Liston was one of the esteemed members of the commission.

The commission functioned in our country in 1907 and rendered invaluable service in unraveling the mystery that surrounded the transmission of plague from rat to rat, from rat to man,and from man to man.

The commission made a detailed study of the rat-flea, its habits and the *modus operandi* under controlled laboratory conditions.

A special laboratory was set up in Parel, Mumbai. Six godowns were also erected and hundreds of guinea-pigs and rats collected for controlled laboratory tests.

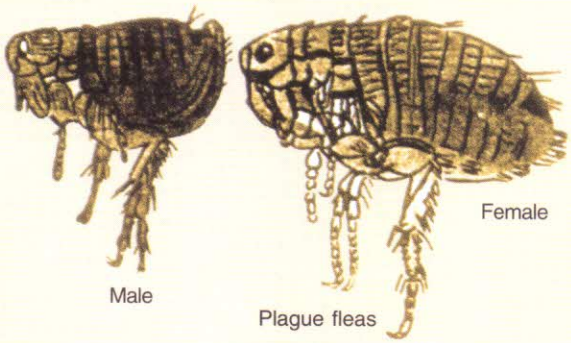


Haffkine

One of the major conclusions reached by the commission was that the rat-fleas do not travel from the infected rat to a healthy man in a straight bee-line.

Fleas deprived of food for more than three days and nights avidly and eagerly attack man in search of food. As long as there are rats, the fleas prefer them to men. The percentage of infected fleas taken from plague rats dwindles rapidly from fourth day onwards, the commission noted. Putting these facts together, the commission came to the conclusion that rat-fleas become a source of danger to man after the third day of the disease in rats.

The life style of the flea next engaged the attention of the scientists. It was revealed that a rat-flea when denied food does not thrive longer than a week; fed on human blood, however, it ekes out an existence of three to four weeks.



Plague fleas

The scientists began a systematic study of the rat-flea and offered interesting data. It was found that the flea sucks the blood from the wound it makes by the aid of the pricker and passes it down its gullet by successive waves of muscle contractions. The stomach of the flea, the scientists observed, is a pear-shaped organ occupying a considerable part of the abdomen, and is guarded by a valvular arrangement. Surprisingly, the commission found, a rat-fleas can store up to no less than five thousand germs at a time.

The commission observed that the plague bacilli are rarely found in the gullet of the flea. The salivary glands are equally free. The only organ to which they are traced in abundance is the stomach. The bacilli multiply inside the stomach of the flea and are thrown out through its faeces in order to relieve the choking overflow of the new generation of bacilli, found the commission.

When a flea bites a healthy animal, it makes a wound with its pricker on the skin. An interesting side-light on the mystery was the discovery by the scientists that a flea has a habit of squirting blood from the anus, as it sucks blood through the pricker. So, even when one avoids rubbing the itching pricker-wound, there remains a good chance for the bacilli to gain entrance into the body, the commission noted.

A very revealing result found by the commission was that the plague bacillus very soon dies in the soil or on floors. The longest period, after gross contamination, is never more than twenty four hours. It has no substantial existence in nature outside an animal body, noted the commission.

The Commission came to the conclusion that rat-fleas can travel from one place to another in one of the following three ways :1. on the natural host, the rat, (2) hiding in merchandise - hay, cotton, grain etc. (3) on a human being.

The commission also explored the conditions that govern the rise and fail of a rat epizootic or human epidemic. It was found that the temperature considerably affects the flea's power to infect. A high temperature, the scientists found, affects the breeding process in fleas themselves. It restrains the adult flea from depositing eggs, and deters the development of eggs into larvae.

The Commission also observed that the breeding of rats is vigorous during the off season which precedes the breeding of fleas.

Protective measures : Serum and Vaccine

When scientists were busy going into the roots of the plague mystery, some others had directed their attention towards evolving an effective protection against plague.

Yersin along with his associates Calmette and Borrel succeeded in evolving an anti-plague serum in 1895 by immunizing a horse by intravenous injections of living virulent cultures. A year later, Haffkine introduced a killed vaccine that rendered immunity against plague for at least six months. He used a six weeks old culture of plague bacilli incubated at 25-30^0 C and killed by heat at 65^0 C for one hour with an addition of 0.5 per cent carbolic acid. Subsequently, Halfkine's vaccine was greatly improved by two Indian scientists – S. S. Serve and S.Sheel. This improved vaccine is now prepared by the famous Haffkine

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Recent Developments in Science & Technology

Scientists develop Herbal Drug for Ringworm

A team of researchers from Allahabad have claimed that they have developed a herbal drug for treating ringworm and patented it in the United States. Dr. Anupam Dikshit, Reader in Botany Department of Allahabad university said that intensive research would provide a cheaper, natural and more effective cure for ringworm. He also emphasised the fact that this drug will help in removing the fungal disease in countries like India. The team had applied for patenting of the drug in four countries US, UK, Japan and India. On November 6, 2001 drug was granted patent in the US.

He said that project was undertaken in 1980 and experimental trials of about 900 aromatic herbs were carried out on guinea pig and out of which one gave positive and satisfactory result.

Source: PTI News

Supercomputer Calculations Confirm Predicted Black Hole Behaviour

Scientists have turned to supercomputers to better understand the behaviour of black holes. Specifically, researchers at NASA's Jet Propulsion Laboratory (JPL) and Toyama University in Japan have modelled the behaviour of extremely powerful energy jets expelled by spinning black holes, confirming that their rotation produces power.

Not even light can escape the gravitational pull of a black hole. As material is sucked toward the void, however, it can put up a fight. Astronomers have witnessed evidence of such struggles, including emanating streams of energy, using radio and X-ray telescopes but cannot observe a black hole's behaviour directly. Borrowing techniques from weather prediction, the team applied their understanding of gravitational and magnetic fields to data gathered from plasma swirling into a black hole. "We have modeled a rotating black hole with magnetized plasma falling into it", Shinji Koide of Toyama University explains. "We simulated the way that the magnetic field harness energy from the rotation of the black hole".

Astrophysicist David Meier of JPL says, jets of pure electromagnetic energy ejected by the magnetic field along the north and south poles above the black hole. "The jets", he notes, "contain energy equivalent to the power of the sun, multiplied 10 billion times and then increased another one billion times".

Source:ScientificAmerican

complied by : Kapil Tripathi

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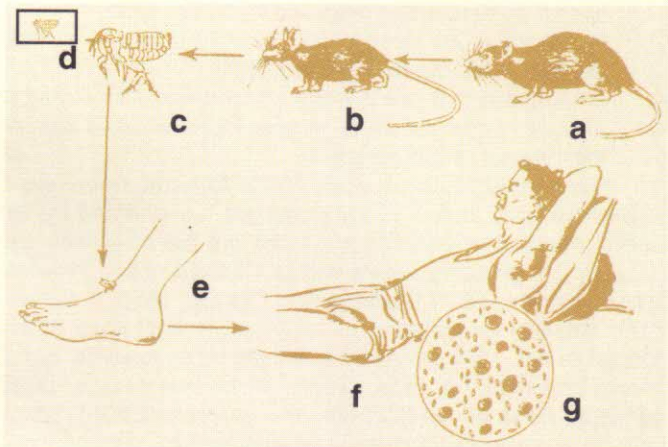
contd from page. 27

Institute of Mumbai.

Efforts towards developing a living vaccine, which is supposed to be superior to killed vaccine prepared from dead cultures, were also underway. In 1935, Otten and de Vegel, experimenting in Java, were successful in evolving such a vaccine which was prepared from a virulent, living plague bacilli. Between 1935 and 1941, excellent results were achieved with this vaccine in no less than 2,365,642 incolcations.



The plague circuit

a) The brown sewer rat–victim Number One
b) The black house rat–victim Number Two
c) *Xenopsylla cheopsis,* the rat-flea, agent of transmission
d) Natural size of the rat–flea
e) Human leg–the usual spot attacked by the flea
f) A plague patient with buboes in the groin and armpit
g) slide showing *Pasteurella pestis,* the plague bacilli

A living vaccine was also developed by Girard in Madagascar. In French West Africa, a lipovaccine, prepared with vegetable oil, and an aqueous vaccine prepared with water were also tried.

Treatment

As treatment for a patient of plague, various drugs have been evolved. Sulphanilamide was initially used in the treatment. However, the discovery of antibiotics in the fifties virtually ushered in a revolution in the treatment of various diseases. Some of the antibiotics were found effective in the treatment of plague too.

Streptomycin was found to be very effective against plague. Subsequently, tetracycline also came in use in the treatment of the disease.

However, the recent resurgence of plague in Himachal Pradesh and Punjab has necessitated taking long-term measures and research toward development of potential new drugs so that in the event of an outbreak, we are fully equipped to deal with the menace of the killer disease.

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Know More About Copyright

❒ Subodh Mahanti

Copyright plays an important role in the complex world of communication including science communication. The basic objective of copyright law is to promote progress in society by providing legal protection to the rights of authors of creative works and also those concerned with the dissemination of these works in order to prevent unauthorized appropriations. The copyright law is about 300 years old. A copyright law needs to be constantly reviewed and revised because of methods of communication and using works keep changing and developing all the time.

Copyright protection rules are fairly similar worldwide, due to several international treaties, the most important of which is the Berne Convention. Under this treaty all member countries must offer copyright protection to authors who are nationals of any member country. This protection must last for at least the life of the author plus 50 years, and must be automatic without the need for the author to take any legal steps to preserve the copyright. The goals of the Berne Convention provide the basis for mutual recognition of copyright between sovereign nations in foreign works and promote development of international norms with regard to copyright protection. It has been revised five times since 1886. Of particular importance are the revisions in 1908 and 1928. In 1908, the Berlin Act set the duration of copyright at life of the author plus 50 years, expanded the scope of the act to include newer technologies and prohibited formalities as a prerequisite of copyright protection. In 1928, the Rome Act first recognised the moral rights of authors and artists - giving them the right to object to modification or to the depiction of a work in a way that might prejudice or decrease the artist's reputation.

The scholars of ancient Greece and the Roman Empire were the first to be concerned about being recognized as the authors of their works. However, they did not have any economic rights. It was only after the invention of printing in the late fifteenth century that a form of copyright protection was derived. Prior to the invention of the printing press, the copyright of a manuscript was very laborious and a slow process. This was mainly undertaken by the religious priests.

The ability to print books easily and cheaply raised the issue of piracy. In 1662, the King of England, exercising his royal prerogative, enacted the Licensing Act of 1662 to regulate the book trade and protect printers against piracy. This was the first of many decrees to control what was being printed. The Licensing Act of 1662 established a register of licensed books, along with the requirement to deposit a copy of the book to be licensed. Deposit was administered by the Stationer's Company who where given the powers to seize books suspected of containing matters hostile to the church or Government. By 1682, the Licensing Act had been repealed and Stationer's Company had passed a by-law that established rights of ownership for books registered to a number of its members so as to continue regulating the printing trade themselves. The Statute of Anne was enacted in 1709 and it became law on 10th April 1710. It was the first Copyright Act in the world to deal with this issue. It introduced two new concepts — an author being the owner of copyright and the principle of a fixed term of protection for published works. The Act also brought about depositing of nine copies of a book to certain libraries throughout the country. Since the Statute of Anne almost three hundred years ago, copyright law has been revised to broaden the scope. The World Intellectual Property Organization (WIPO) is addressing a number of proposals for changes to meet the global information infrastructure. In addition, the courts in all countries continue to address copyright issues.

In India the Copyright Act 1847 (Act XX 1847) was the earliest statute law relating to copyright. This was enacted during the regime of East India Company. It was passed by Governor General of India (then under British rule) in Council on 15 December 1847 to affirm the applicability of the law that obtained in England to India. However, we don't have much information on the operation of this Act during 1847 to 1911. In England the law of copyright was codified in 1911 by the Copyright Act of 1911 and which became applicable to all countries under the British Crown. The Act stipulated that the legislature of any such country to which the Act is extended can modify or alter its provision by necessary legislation. By virtue of this power, the Governor General of India enacted the Indian Copyright Act of 1914 (Act III of 1914), which continued to apply to India without being amended till 1958. This Act was a brief enactment of 15 sections, to which was added as its first schedule the text of the British Copyright Act of 1911, with a few omissions which were not applicable to India. So it was a modified version of the British Copyright Act of 1911. The main features of the Act were :

i. Registration of the author's work was not necessary, the author's right came into existence as soon as the work was created.
ii. Only an original work could be protected under this Act.
iii. The term of copyright protection was fixed as the lifetime of the author and 25 years after his death. However, special periods were prescribed for certain types of works.
iv. It authorized the destruction of infringing copies or their delivery to the owner of the copyright.
v. It laid down that non-registration of a book for copyright protection was not a bar to take legal remedies against the infringer of the copyright.

The Government in free India felt the need for a comprehensive review of the copyright law enacted by the British rulers. The Government spelt out the objectives and reasons for enacting a new comprehensive copyright while introducing the bill in Parliament in October 1955. It stated : "The existing law relating to copyright is contained in the Copyright Act, 1911 of the United Kingdom, as modified by the Indian Copyright Act, 1914. Apart from the fact that the United Kingdom Act does not fit in with changed constitutional status of India, it is necessary to enact an independent, self-contained law on the subject of copyright in the light of growing public consciousness, and the rights and obligations of authors and in the light of experience gained in the working of the existing law during the last 50 years. New and advanced means of communications like broadcasting, lithography etc. also call for certain amendments in the existing law. Adequate provision

has also to be made for fulfillment of international obligations in the field of copyright which India might expect. A complete revision of the law of copyright therefore seemed inevitable".

The new Act, the Copyright Act of 1957 was enacted on 4 June 1957 and it came into force on 21 January 1958.

The Act is divided into fifteen chapters, and contains 79 sections. Its basic features are in harmony with the Berne Convention and the Universal Copyright Convention. India is a member of both these conventions. The Act extended copyright protection to works of nationals of countries who are signatory to either the Berne Convention or the Universal Copyright Convention.

The section 14 of the Act defines the nature of protection offered by the Act. According to this section the copyright owner is authorized to do the following :

1. to reproduce the work in material form
2. to publish the work
3. to perform the work in public
4. to produce, reproduce, perform or publish any translation of the work.
5. to make any cinematograph film, or a record in respect of the work.
6. to communicate the work by broadcast or to communicate to the public by a loud speaker or any similar instrument the broadcast of the work
7. to make any adaptation of the work
8. to do in relation to a translation or any adaptation of the work any of the acts specified in relation to the work in classes (1) to (6).

The Act, for the first time, made provision for copyright in films and broadcast.

A Copyright Office under the control of Registrar of Copyright was set up in the Ministry of Education for copyright registration.

A Copyright Board was set up and vested with powers to resolve certain types of disputes relating to copyright and its infringement.

According to the Copyright Act of 1957 the term of the copyright extended to the lifetime of the author plus 50 years after his death. The postmortem term of the copyright has been extended from 50 years to 60 years by the Copyright (Amendment) Ordinance 1991. The postmortem period is to be calculated from the beginning of the calendar year following the year in which the author dies.

In case of a joint work, the postmortem period of copyright protection of 60 years is to be calculated from the date of the joint author who dies last.

For works published anonymously or psedonymansly, the period of copyright protection is 60 years from the date it is published. Similarly copyright protection for photograph, cinematograph films records and works published by Government and public sector undertaking is also 60 years.

The Parliament of India enacted the Copyright (Amendment) Act 1983 to take into account the revision of the Berne Convention and the Universal Copyright Convention in 1971 at Paris.

To check widespread piracy of books, sound recordings and films, the Copyright (Amendment) Act, 1994 was enacted.

The Copyright (Amendment) Act, 1994 was enacted by the Parliament and came into force on 10 May 1995. The objective of the 1994 amendment was to meet new situations created by technological advances. It also made provision for promoting collective administration of the rights of authors, composers and other creative artists through copyright societies. The amendment extended protection to all performers by means of "performer's right".

The amendments to the Copyright Act introduced in June 1994 were in themselves, a landmark in the evolution of Indian copyright law. For the first time in India, the copyright law clearly explained :

1. the rights of a copyright holder
2. position on rentals of software
3. the right of the user to make backup copies, and
4. most importantly the amendments imposed heavy punishment and fines for infringement of copyright of software.

In India the intellectual property right on computer software is covered under the copyright law.

As per the provision in Indian Copyright Act, 1957 and as amended in 1994/95, any person who knowingly makes use of computer programme shall be punishable with the imprisonment for a term which shall not be less than 7 days but which may exceed to 3 years and with fine which shall not be less than Rs. 50,000 but which may extend to 2 lakh rupees.

Under the Copyright Act, the owners of copyright can enforce their rights through the Registrar of Copyright and the Copyright Board and also through the courts. Any person whose copyright is violated can institute necessary civil and criminal proceedings in the appropriate court.

Copyright law provides protection to the expression of ideas and not to the ideas themselves or procedures or methods of operation or mathematical concepts as such. A work becomes eligible for copyright protection only if it is original and fixed in a tangible medium and be one of the following categories of works :

1. Literally works, including computer software
2. Musical works, including any accompanying words
3. Dramatic works, including any accompanying music
4. Pantomimes and choreographic works
5. Pictorial, graphic and structural works
6. Motion pictures and other audio visual works
7. Sound recording
8. Architectural works

Copyright has two main purposes — the protection of the author's right to obtain commercial benefit from the work, and more recently the protection of the author's general right to control how a work is used.

To be eligible for copyright protection the work need not be novel or useful but it has to be original. A work must be the result of at least some creative effort on the part of its author. There is no hard and fast rule as to how much creativity is enough. A telephone book's pages which involve a straight forward alphabetical listing of telephone numbers is not original work but if it involves a creative selection of listings it may be original. The requirement of 'originality refers to the manner and material forms of expression. Titles and short phrases are not eligible for copyright protection, if used in commerce, a description title may be eligible for trademark protection.

The term "copyright" refers to a bundle of rights enjoyed

by the original creators and their heirs. They have exclusive right to :

- Make copies of the work.
- Make derivative works based on the original work.
- Distribute the work.
- Perform the work publicly.
- Display the work in a commercial setting.
- The author of a visual work has also the right to claim authorship of the work (attribution).
- Prevent others from attributing distorted works to original author (integrity).

Copyright and its related rights are essential to human creativity. These rights give creators incentives in the form of recognition and fair economic awards. The advancement in technology has brought new ways of spreading creation by such forms of worldwide communication as satellite broadcast and compact discs. The progress in communication technology has widened the scope of copyright. Moreover dissemination of works via the internet has raised new questions concerning copyright. WIPO Copyright Treaty and WIPO Performances and Phonogram Treaty (often known together as the "Internet Treaties"), have set down international norms aimed at preventing unauthorised access to and use of creative works on the internet or other digital network. The World Intellectual Property Organisation (WIPO) is responsible for promotion of the intellectual property through out the world through co-operation amongst states.

Copyright does not protect facts whether scientific, historical, biographical and so on. For instance, anyone is free to use information included in a book, say, about how the brain works provided that they express the information in their own words.

Facts are not protected even if the author spends considerable time and effort discovering things that were previously unknown. For example, the author of a book on the Himalayas may take ten years to gather all the necessary materials and information for his or her work. And in the process the author ends up spending a lot of money. But once the book is published, any reader is free to use the results of this ten year research project to write his or her own book.

Copyright is effectively never lost these days, unless explicitly given away. Copyright protection is automatic. This is not true in case of patents. A work becomes protected under copyright law the moment it is fixed in a tangible form. One need not place a copyright notice on work for it is to be protected. But then it has other purpose. A copyright notice tells others to whom the work belongs. So when a work contains a valid notice, an infringement cannot claim in court that he or she did not know it was copyrighted. The very existence of a notice might discourage infringement. A copyright notice may make it easier for a potential infringer to track down a copyright owner and legimately obtain permission to use the work.

A copyright notice should contain:

i. the word "copyright"
ii. a "c" in a circle ©
iii. the year of publication, and
iv. the name of either the author or the owner of all the copyright rights in the published work.

For example ***Copyright © 1995 Vigyan Prasar***, means the work was published in 1995 and the copyright belongs to Vigyan Prasar. The symbol (c) is often used on electronic works but it has not been accepted as a substitute for © or the word "copyright".

It should be emphasized that copyright itself does not depend on official procedures. The Berne Convention for the Protection of Literary and Artistic Works provides copyright protection to literary and artistic works without any formalities in the countries party to the convention. WIPO does not offer any kind of copyright registration system. But many countries have a national copyright office and their laws allow for registration of works to help in identifying and distinguishing titles of works. In certain countries, registration can also serve as prima facie evidence in a court of law with reference to disputes relating to copyright.

Copyright of a particular work in generally owned by the original creator except under certain specific conditions. For example :

1. A work is created by an employee in the course of his or her employment. In such a case the employer owns the copyright
2. The original creator has sold the entire copyright. In such a case the purchasing business or person becomes the copyright owner.

When two or more authors prepare a work with the intent to combine their contribution into inseparable or interdependent parts, the work is considered joint work and the authors are considered to be joint copyright owner. However, when a book is written primarily by one author and an another author contributes a specific chapter to the book and gets credit for that chapter, the work may not be considered a joint work. This is because the contributions are not inseparable or interdependent.

A copyright owner can transfer some or all of his/her specific rights. In fact when a copyright owner wishes to commercially exploit the work covered by the copyright the owner typically transfers one or more rights granted by copyright law to the person or entity who will be responsible for getting the work to market such as book or software publishers. The copyright owner may place some limitation on the exclusive rights being transferred. For example the copyright owner may limit the transfer to a specific period of time, allow the right to be exercised only in a specific part of the country or world, or require that the right : to be exercised only through certain media. If a copyright owner transfers all of his/her rights unconditionally,

Indian Copyright Board

The Copyright Board, a quasi judiciary body composed of persons of judicial standing was constituted in September 1959. It is vested with certain powers of a civil court under the Civil Procedure Code. Unlike a regular civil court the Copyright Board is not a standing body. It functions by meeting as often as it is necessary. The purpose of setting such a body was to ensure speedy and in expansive process of setting disputes about copyright.

The Copyright Board consists of a chairperson (usually a retired High Court Judge) and not less than two and not more than fourteen other members. It was Copyright (Amendment) Act 1994 which raised the maximum membership of the Board from 8 to 14. The Registrar of Copyrights acts as the secretary of the Board. The Chairman constitutes benches of three or more members to discharge the function of the Board.

The Board goes on circuit to various parts of the country to hear and dispose of disputes. For this purpose the country has been divided into five zones - Northern, Eastern, Western, Southern and Central.

it is generally formed an "assignment". When only some of the rights associated with the copyright are transferred, it is known as a "licence". A licence is called exclusive when the transferred rights can be exercised only by the owner of the licence (the licensee) and no one else (including the licensor) that is the person who granted the licence. However, if the licence allows others (including the licensor) to exercise the same rights being transferred in the licence, the licence is said to be non-exclusive.

Registering a copyright is a simple process. Unlike filing of a patent you can register a copyright without the help of an attorney. All you will need to do is to fill up a brief application form, which requires some basic information about the work including:

1. the title of the work
2. who created the work and when and
3. who owns the copyright

Works that are not copyrighted are considered to be in the public domain. A work in the public domain can be freely used for any purpose. The term "public domain" is often misunderstood. In the past, works without a copyright notice were considered to be in the public domain. However, this is not valid today. The Berne Convention Implementation Act of 1988 provides that copyright protection accrues automatically when a work is first created and notices were no longer mandatory.

Many works without containing a copyright notice or any information on the copyright owner are not really in the public domain. E-mail, postings to USENET news groups and electronic mailing list, and software retrieved at ftp sites should be considered copyrighted works of the author. Most works enter the public domain because their copyrights have expired. So to determine whether a work is in the public domain and available for use without the author's permission, you first have to find out when it was published. In some cases the owner of the copyright dedicate their works to the public domain.

The Internet and the World Wide Web (WWW) present tremendous opportunities for sharing information but it is important to remember that what is freely available most likely is not to be in the "public domain". Most works distributed electronically are protected by copyright. In fact you should assume all works including images, text, logos, software, sounds, movies clips, e-mail and postings to newsgroups available on the computer and the WWW are protected by copyright. In many case one may find that permission statements are included with the work and such works can be used for the purpose stated without any further permission or licence.

Certain uses of copyrighted works are not considered to infringe rights of copyright owner and so one does not require permission from the copyright owner. These uses are known as "Fair Use". Under the fair use clanse of copyright law an author may make limited use of another author's works without asking for permission. The fair use privilege is for perhaps the most significant limitation on copyright owner's exclusive rights. So a writer or publisher should have a basic understanding of what is and what is not fair use. The following types of uses are usually considered fair uses.

- Criticism and comment — for example, quoting or excerpting a work in a review or criticism for purposes of illustration or comment.
- News reporting -- for example, summarizing an address or article, with brief quotations, in a news report.
- Research and scholarship — for example, quoting a short passage in a scholarly, scientific or technical work for illustration or clarification of the author's observations.
- Nonprofit educational uses — for example, photocopying of limited portions of written works by teachers for classroom use.
- Parody — that is, a work that ridicules another, usually well-known work, by imitating it in a comic way

Often it is not that easy to decide whether a proposed use is fair or not. The purpose and character of your intended use of the material involved is the single most important factor in determining whether a use is a fair use. While deciding whether it is a fair use or not the following questions are taken into account :

1. Is it a competitive use ?
2. How much material was taken compared to the entire work of which the material was a part ?
3. How was the material used ?

In case if you are using a small portion of somebody else's work in a non-competitive way and the purpose of your use is to benefit the public then there is no question of you being accused of copyright infringement. But if you take large portions of someone else's expression for your own purely commercial reason then there is every chance that you will be accused of infringement.

As a general rule, never quote more than a few successive paragraphs from a book or article or take more than one chart or diagram. One should not include an illustration or photograph without the artist's permission.

There is no absolute word limit on fair use. It all depends on the circumstances. The more important the material is to the original work, the less likely your use of it will be considered a fair use. To preserve the free flow of information, authors have more freedom in using material from factual woks like scholarly, technical, scientific works etc. than to works of fiction such as novels, poems and plays.

One should remember that a work does not need to bear a copyright notice to be protected. So if, you are not sure that the work is in the public domain, assume it is copyrighted and you must seek permission from the copyright owner to use the work. In case the publisher is not the copyright owner they can probably direct you to the copyright owner. Depending on the nature of the work, permission may be required from more than one source. While asking for permission to use a copyrighted work, you must provide specific information on your intended use of the work. You should describe in detail what you want to use, how many copies you intend to make, how the work will be distributed, and for what fee if any. One should remember that often it is not hard to ask for permission.

Making of what are called "derivative works" - works are derived from another copyrighted work - is the exclusive province of the owner of the original work. This is true even though the making of these new works is a highly creative process. If you write a story using settings or characters from somebody else's work, you need that author's permission.

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Smell over the Internet

❒ Kinkini Dasgupta Misra

The cutting edge will endeavour to bring to you path - breaking breakthroughs in technology in various fields. To start with is a breakthrouh in the field of information technology.

"Imagine smelling perfumes online before buying or sending a scented greeting card to your friend".

This is not science fiction but a soon-to-be-realized reality. Technology has till date been able to use our sense of sight and sound, but soon you will be able to smell and taste the virtual world's offerings, bringing virtual reality nearer to reality.

Do you know creating a smell is a complex process because our nose has 10 million olfactory cells, each of which have thousands of receptors and each receptor can respond to and recognize only one fragrance. The smell or olfactory system in human body can distinguish thousands of odours that travel from receptors in the nose to the brain. The brain then identifies the odour. Scientists have calculated that a thousand basic odours should be able to create almost all other odours, and companies so far have been successful in creating about 200-250 of these.

The transmission of scent from one computer to another starts by the remote computer digitizing the scent and transmitting it over the network in the form of packets. The receiver regroups the packets and syntheses it to re-produce the scent transmitted to it by the remote computer. The scent is reproduced by a peripheral device called the **iSmell Personal Scent Synthesizer.** Scents have an immediate and compelling effect and when applied to communication, become a new information channel.

iSmell is a personal scent synthesizer developed by California-based DigiScents company (www.digiscents.com). To create scents that can be put onto web sites, DigiScents has indexed thousands of smells based on their chemical structure and their place on the scent spectrum, and attached a digitized code to them. The iSmell machine is loaded with these codes and when you visit a scent-enabled web site or click on a scented email, the iSmell uses a mix and match of odours to recreate and release the appropriate aroma using a palette of 128 scents. The device, which is about the size of a PC speaker, contains a replaceable cartridge of basic scent chemicals. Just as a colour printer mixes basic colours to create a full palette of colours, the iSmell mixes the basic scents in the cartridge to produce thousands of different aromas. The chemical cartridges that produce the smells can be replaced like ink jet cartridges in the printer.

The iSmell device uses 32 sensors to classify molecules within a half-inch of its airspace by shape, electrical charge, polarisation, etc. A microprocessor then logs the scent and pattern recognition software assesses, detects and emits smells into the user's personal computer. This peripheral device is connected to the USB or serial port of the computer and plugged into a standard electrical socket. It is activated either by a mouse click or a timed response. In practice only one or two persons around a PC can smell anything. And just like other peripherals, the iSmell comes with an on/off switch, so you do not have to smell everything. Chemicals used in iSmell are the same safe materials used in food and cosmetics.

There are many companies who are working on digitizing smell to incorporate it into everyday experiences such as playing video games, online shopping, watching movies, music, and online advertising. The Texas-based AromaJet Company has developed an aroma-generating device for video games. It can be positioned next to a video screen or worn around a player's neck. The technology enables the software code to release odours at various points in a game to coincide with on-screen events (http://www.aromajet.com).

Other companies are also working on ways to download smells over the Internet, which would enable people to choose various products, such as perfume, shampoo before they buy them. The TriSenx, a Georgia based company has built a desktop printer like device that lets you smell as well as print out flavours that you lick and taste (http://www.trisenx.com). Digiscents is also creating a ***Snortal*** to make this technology widely available. The snortal is the scent portal that will carry information on scent development, samples, and access to all the latest in the scent-related hardware and software.

Though the technology holds a lot of promise, there may have teething problems, first, in the accuracy with which natural smells can be created artificially and used universally and second, in implementation. Smell is a very powerful sense to exploit at the conscious and subconscious level. In order to create a consumer appeal, the intensity, accuracy, and duration of the smell has to be carefully controlled.

Another problem is how a database of smells can be created that would be independent of both input and output devices, which would help in widespread adoption of this technology. As of now, each company is working on its own database, so that the smell of 'chocolate' created by the output device of one company can be different from the smell created by that of another for the same product. However, it's difficult to build such a standard, because of the large number of permutations and combinations possible in scents.

Even though this technology is on the threshold of becoming "the in-thing" in the very near future, yet it remains to be seen how it will be available in the market for the ready use of consumer.

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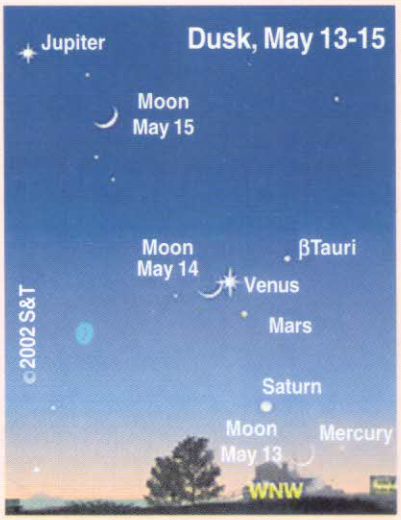
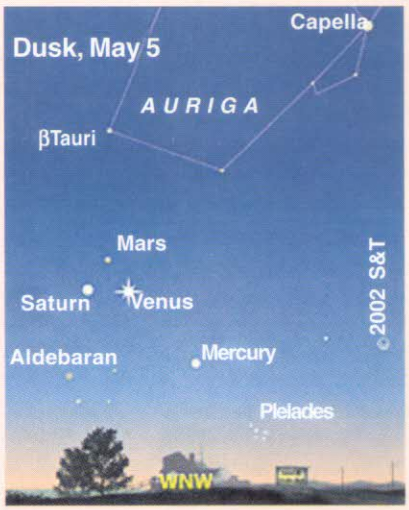
Dance of the Planets



A grand and beautiful lineup of all the bright naked-eye planets — Mercury, Venus, Mars, Jupiter, and Saturn — is taking shape in the western sky at dusk. Throughout April and May these five worlds will form and reform new patterns as they move against the background stars. There is no single date of a "great planetary alignment," though all five of them (plus the Moon) will be clustered within 33° of sky on the evening of May 14th.

Such gatherings of the naked-eye planets are relatively rare, occurring roughly every 20 years when slow-moving Jupiter and Saturn appear close together from Earth's perspective. A similar grouping occurred in May 2000, though it was hidden in the Sun's glare. The last compact and widely visible five-planet array was in February 1940, and astronomers calculate that another good one won't take place until September 8, 2040. So sky-gazers of all levels should take the time to enjoy this one while it lasts.



During May 2-6, five planets shine in the western sky during evening twilight. Start with bright Jupiter high up; you can't miss it. The rest are bunched together down to Jupiter's lower right. By far the most brilliant of these is Venus. Forming a small triangle with Venus are fainter Saturn and much fainter Mars. Below the triangle is the star Aldebaran, and to its right is Mercury. During May 7-11, all five naked-eye planets continue to be visible. Highest in the sky is brilliant Jupiter. Well to its lower right is even-brighter Venus. Note how the spacing between Venus and dim, orange Mars has shrunk — on May 09, the two appear closest together (just 1/3°, much less than a finger's-width at arm's length). Look below Venus for Saturn. Down to Venus's lower right is Mercury. Binoculars give a great view! The accompanying diagrams (May 5 and May 13-15) are good for viewers in the USA and the Western Europe. In India, we will see specific arrangement one day earlier than given there.

(source : "A rare dance of the planets" by Alan M. MacRobert available at the Sky and Telescope website http://skyandtelescope.com/observing/objects/planets/article_572_1.asp)

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