bia Car Corporation". The management staff had ambitious plans to build a high quality golf car. Changes in the vehicle were made, but the projected durability did not show. Problems related to production cropped up and these were very disappointing. All of their troubles were compounded by a serious fire in the plant in 1983. It was in April of the next year that W.R. Sauey initiated negotiations to purchase the company. He modified the name to "Columbia ParCar Corporation".

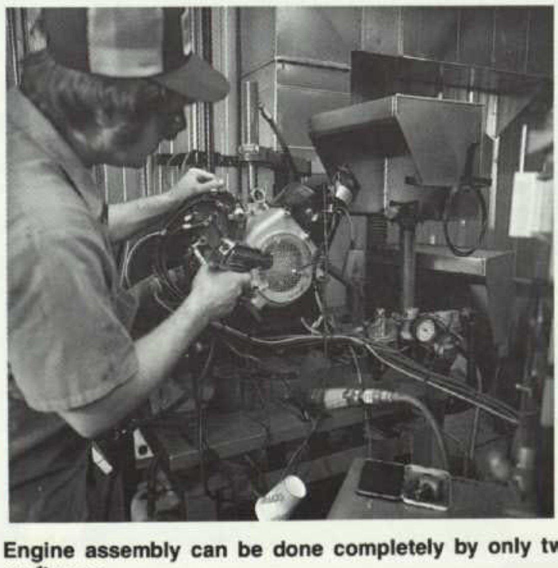
Eric Sauey divided the work he had to do as president into several broad categories. He knew that immediately he had to offer a newly designed vehicle with many unique yet solid features that would stand out among all other golf cars. They

Jigs for frame fabrication.

needed to be differences that appealed to owners of the cars and to golfers operating them. That has been done, with great success. The plant has been reorganized for optimum productivity. They now build lower product numbers on a daily basis, but do it consistently all year long. The result has been significant gains in parts and vehicle quality, and has provided the company with a steady workforce with minimal amounts of training and retraining. They have stabilized their financial position. The final step is now underway - sharing what they feel is the best kept secret in the golf and utility car industry. The Columbia ParCar now embodies the features and quality and cost the industry wants. Marketing and sales are now receiving more emphasis and attention. John English

A welding operation in the fabrication bay.

An aerial view of the Columbia facility in Deerfield. Notice the test track in the upper right quadrant.



Engine assembly can be done completely by only two craftsmen.

COLUMBIA PARCAR

brings his vast experience to them as the new Marketing and Sales Director. He has over eight years of successful experience in the golf and golf care business with two of Columbia's major competitors. All of those years were served as a Regional Manager for E-Z Go and for Club Car. John feels his job is going to be selling Columbia's ParCar's unique and exclusive features. Programs for dealers and distributors will be upgraded. More personal contact will be made. Overseas markets will be explored, opened and expanded.

The Columbia ParCar manufacturing facility is in an industrial park in Deerfield. As with several other turf equipment manufacturers, the site seems an unlikely one. Deerfield is a small agricultural village about 25 miles east of Madison, just south of Interstate 94. The company really likes their location, primarily because of the workforce. Their rural work ethic is strong and they really do care about the product they are literally building by hand. A common thread through all of the visits I've made for the "Made in Wisconsin" feature has been the Wisconsin craftsmen (and women), a great source of pride for all of us who live and work here. The 120,000 square feet of the plant houses 85 employees, which makes Columbia one of Dane County's largest manufacturing employers. They have an estimated $40 million impact on the Wisconsin economy each year. It is a non-union workforce with no job classifications other than experience. The cross-training they experience offers the company great flexibility in the manufacturing and assembly areas. Absenteeism rates are extremely low, as you might expect.

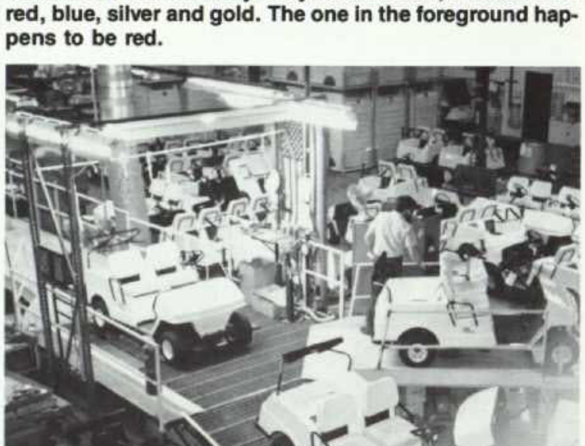
The large plant is divided into four general areas: shipping/receiving, storage, assembly and fabrication. The fabrication bay is a place with a tremendous amount of activity. Primary processes of this area are cutting, bending, welding, boring and final machining. Columbia makes most of the parts for their vehicles in-house. When they are unable to do that economically, parts are sourced from American suppliers, if at all possible. "Build

America, Buy American" is an attitude that the Sauey family not only preaches, but practices. You do not see stacks and aisles of parts and pieces from Korea, Taiwan or Japan. In fact, whenever they can they purchase from Wisconsin companies (aluminum engine castings, for example, come from Manitowoc and (obviously!) the seats come from Reedsburg).

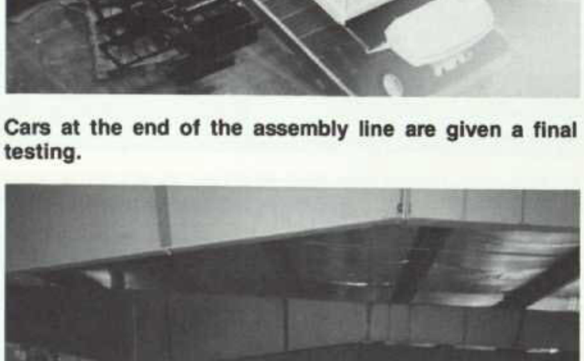
Peter Kooiman, a manufacturing engineer for ParCar, spent time explaining and emphasizing the "just-in-time" philosophy of manufacturing. It is a procedure that is finding more use in American plants where it is feasible. What it is, basically, is making pieces and parts for assembly just as they are needed. You do not see large crates of parts sitting around the factory. What may be raw steel and tubing in the morning is cut, welded, painted and on a finished golf car at the end of the day. Management has found that this is essential for economic production. Also, they do not have to store thousands and thousands of pieces until they are needed. Further, if there is a fit problem or a rework required on a particular part, the number of parts needing attention is greatly reduced. Just-in-time manufacturing offers this as a good quality check and allows a lot more flexibility in scheduling and use of labor.

Columbia takes a lot of pride in the fact that they manufacture their own engine - the only American golf car company to do so. Competitors use will-fit engines, always imported and usually designed for other applications. The Columbia engine is used only in the Columbia ParCar and they have full control over all parts and manufacturing. These engines are made in one area of the fabrication bay and are built by the "cell concept." This is an idea where one man performs several of the operations necessary in the product manufacturing. Two men can, in fact, machine all of the engine parts by themselves and another two men can do the assembly. Engine testing is done on each and every engine on a dynomometer twice - first after the engine has been assembled and a second time after the car is completely built. They also have a testing laboratory where engines are routinely taken for horsepower and performance checks.

Columbia offers not only ivory colored cars, but standard red, blue, silver and gold. The one in the foreground happens to be red.



Cars at the end of the assembly line are given a final testing.



Car inventory ready for shipment in the approaching busy season.

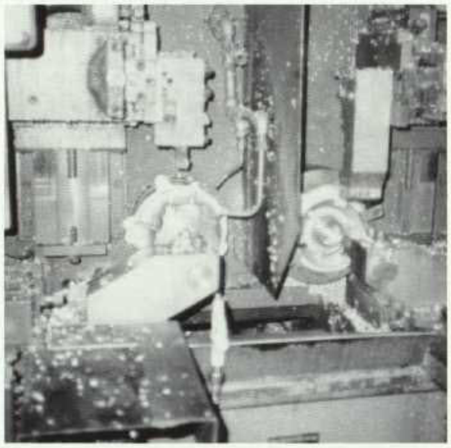
COLUMBIA PARCAR

The overwhelming impression after a walk through the assembly area of the plant is that the Columbia ParCars are assembled with great care. They are meticulously crafted. The line moves slowly and each employee performs several of the assembly tasks. As mentioned, cars are built at a steady rate all year long, but the busy time for shipping is the upcoming March and April period. All manufactured cars are stored inside until they are loaded for shipping. Columbia ParCar builds their car numbers to an educated forecast of sales, not on pure speculation. Because of lead times needed for raw materials and other supplies, they generally work on a 120 day projection.

When the cars reach the end of the assembly line, their last step is an inspection. The engine is tested again. Each car is checked on a chassis dynomometer. The front end is aligned. Axles and drive trains are gone over. After each car leaves the test ramp, an experienced employee goes over the vehicle, reviewing it for every last detail. When the cars leave the building, Columbia is confident of their quality construction.

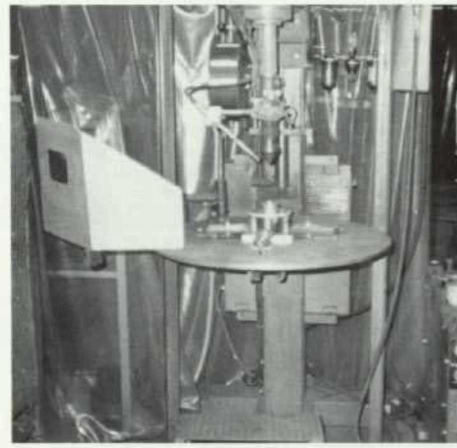
When we think of the auto industry we also think of test tracks. Often they are included on television ads, showing a new model car screaming around tight turns at high rates of speed and coming to screaching halts. Well, Columbia ParCar has a test track for their vehicles! It is part of their broad in-house testing program. As you near the Columbia plant you see a large and steep grassed hill rising abruptly and dramatically from the surrounding level ground. An asphalt cart path disects it. This is the most visible feature of the outdoor test facility. They are able to run cars through sand, up and down these severe paved and unpaved slopes. Rock has been deposited and cars are driven around and through them. Straightaways are paved with asphalt, gravel and other materials. There are sharp turns, posts, stop-and-go's. In a phrase, they can duplicate almost any golf course condition these cars might encounter. In addition to the outdoor track and indoor testing lab, automatic operation equipment can put hours on machines by either steady or by intermittent operation. The extensive testing is all part of building a durable, dependable and low maintenance product.

My impression of the attitude of the leadership at Columbia Par-Car is that hard work and smart decisions will lead to an ever increasing share of the golf car market. They are pressing on with the adaptation of these vehicles for industrial and commercial use. The energy, perserverance and competitive nature of W.R. Sauey is obvious and on the surface at Columbia, even if he is not there every working day. We shouldn't be surprised, I guess. It is this chip off the old block that makes the future bright for this family affair.



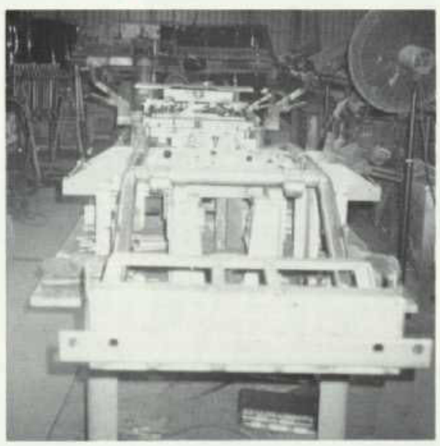
Engine parts machining area - the "cell concept".

Because of "just in time" manufacturing, this aluminum tubing will be part of a sun roof by day's end.



An automataic welding setup for wheel hubs.

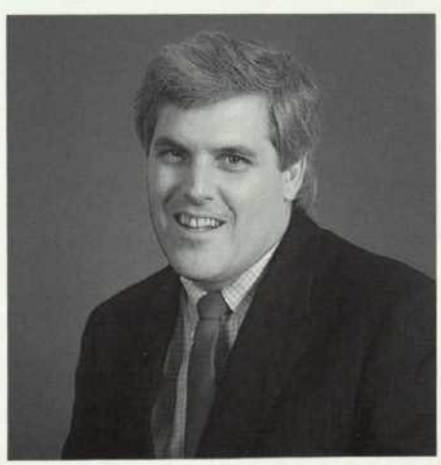
Golf car bodies ready for the paint booth.



Frame fabrication area of Columbia's plant.

Cars move slowly along the assembly line.

Chassis assembly.



John English, Director of Marketing and Sales.

Wiring harness subassembly area.

COLUMBIA PARCAR

Car bodies waiting for the paint booth.

Cars waiting for approval at the last inspection.

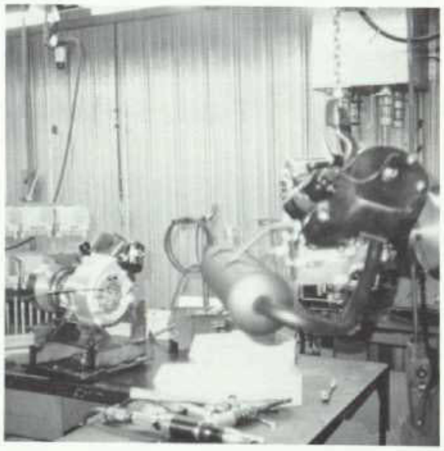
Vehicle controls are being installed here.

A completed car is readied for dynomometer testing.

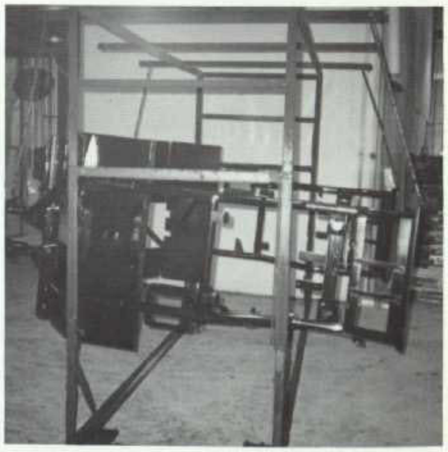
The front end of every car is aligned.

Engine subassembly area.

A car body comes from a subassembly area and is married to a chassis on the primary assembly line.



Engines are hoisted from subassembly area to primary assembly line.



Pieces just out of the paint booth. Parts are cleaned in a phosphate material before they are electrostatically painted.

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The Cell Components: Back to the Basics

By Michael Semler

In the seventeenth century, Robert Hooke, using a microscope of his own construction, noted that cork and plant tissues are made of small cavities. He was the first to call these cavities "cells", meaning "little rooms". Three hundred years later, we still subscribe to Hookes' foundation.

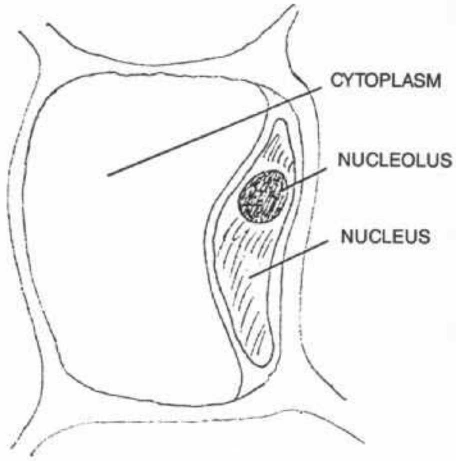
Much of the current education philosophy revolves around getting back to the basics in teaching. Hand held calculators are great, but we still need to know the principles of multiplication and division. Such is the case for us. In order to manage turfgrass properly, we must have a basic understanding of the plant and its cells. This is the basis for this article. It is intended as a review of plant cell structure and a "back to the basics" opportunity.

The plant cell consists of protoplasm and the cell wall. The protoplasm consists of the cytoplasm and the nucleus. The cytoplasm contains certain distinct organelles (such as: ribosomes, plastids, and mitochondria) and membrane systems (endoplasmic reticulum and golgie bodies) which can be seen in detail only with an electron microscope. In addition, the cytoplasm consists of a ground substance, which suspends the organelles and mem—branes. In contrast to most animal cells, plant cells develop liquid filled vacuoles within the cytoplasm.

The ground substance is frequently in motion and compounds can be seen being swept along in an orderly fashion. This motion is known as cyclosis and may help exchange materials between cells and within the cell.

In the cytoplasm, the most distinct structure is the nucleus. The nucleus serves two important functions: first, it controls the ongoing functions of the cell, determining which protein molecules are produced and when; second, it stores the genetic information and passes it along to daughter cells in cell division.

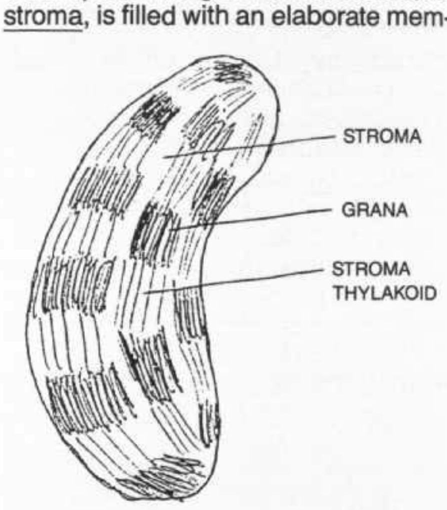
Inside the nucleus, chromatin, visible with certain strains, are thin strands of DNA and protein molecules and are distinguishable from the nucleoplasm, or nuclear ground substance. During cell division, the chromatin become progressively more condensed until they take the form of chromosomes. The hereditary information passed along during cell division is carried in the molecules of DNA.



More often, the only structures visible in the nucleus with a light microscope are the nucleoli (singular - nucleolus). Nucleoli are present in nondividing nuclei and are responsible for ribosome formation. The number of nucleoli present in the nucleus is variable and often they fuse together to form one large nucleoli.

One characteristic which distinguishes plant cells from animal cells is the presence of plastids. Mature plastids are classified on the basis of the pigments they contain. The first type are the chloroplasts, which are the primary site of photosynthesis and contain the chlorophyl and carotenoid pigments.

The internal structure of chloroplasts is complex. The ground substance, or stroma, is filled with an elaborate mem-

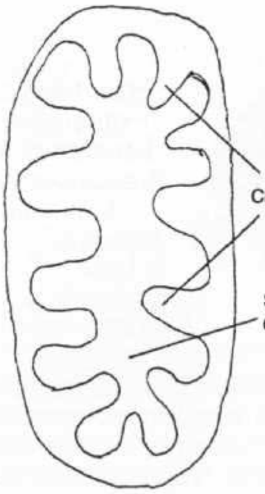


brane system in the form of flattened sacks called thylakoids. Characteristic of chloroplasts is the presence of grana, which are stacks of thylakoids. The thylakoids of various grana are connected to each other by singular thylakoids called stroma thylakoids. The thylakoids are thought to form a single, interconnected system. The pigments chlorophyl and carotenoid are found in the thylakoid membranes.

A second type of plastid are the chromoplasts. They are also pigmented and synthesize and retain the yellow, orange and red carotenoid pigments. Chromoplasts may develop from previously existing green chloroplasts by which the chlorophyl and existing membranes disappear and masses of carotenoids accumulate, as occurs during the ripening of many fruits.

A third type of plastid are the luecoplasts. These are nonpigmented and are believed to synthesize starch. Others may form a variety of substances including oils and proteins. Luecoplasts may develop into chloroplasts if exposed to light.

Mitochondria are another important structure in the cell. The mitochondria are the so-called "powerhouses" of the cell because they are the site of respiration - the means by which energy of carbohydrates (sucrose and its building block glucose) is transferred to ATP. ATP is the universal energy carrier molecule and is made available for the energy requirements of the cell. The Krebs cycle and the Electron Transport Chain, the two aerobic respiration pathways yielding complete oxidation of the glucose molecule, occur in the mitochondria.



The mitochondria are double membraned, like the plastids, with the inner membrane folded inward into pleats called cristae. The cristae serve to increase the surface area available to the enzymes and the reactions associated with respiration. The compartments around the cristae contain a solution with the enzymes, water, phosphates and molecules involved with respiration.

Mitochondria move and twist within the cell and tend to congregate where energy is required. The amount of cristae in the mitochondria depends on the energy requirements of the cell. The greater the energy needs, the more cristae they contain.

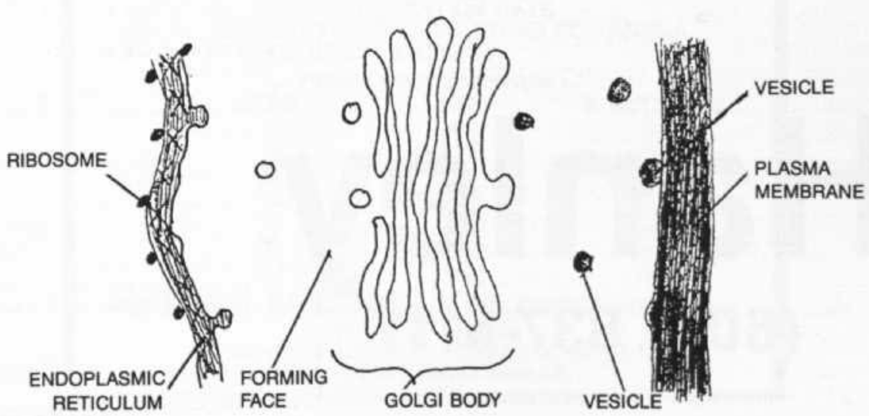
Unlike plastids and mitochondria, the microbodies are single membraned, spherical organelles. They are associated with one or two segments of the endoplasmic reticulum. Some microbodies, called peroxisomes, play a role in glycolic acid metabolism, associated with photorespiration. Like the respiratory processes that take place in the mitochondria, photorespiration involves the oxidation of carbohydrates. However, unlike other respiration processes, it yields no usable energy and may actually cause a loss of energy. Others, called glyoxisomes, are important in the conversion of fats into carbohydrates in germinating seeds.

Ribosomes are the site at which amino acids are linked to form proteins. Like microbodies, some may be attached to the endoplasmic reticulum, or they may be freely occurring in the cytoplasm. Ribosomes are usually abundant in metabolically active cells.

The endoplasmic reticulum is a 3-dimensional membrane system of infinite extent within the cell. It appears to function as a communicative system and is involved with channeling materials, fats and lipids to different cell parts. Also, the endoplasmic reticulum of adjacent cells is interconnected by way of the plasmodesmata. The plasmodesmata are minute canals in the cell wall with a small portion of the endoplasmic reticulum running through it called the desmotubule. As mentioned before, ribosomes are commonly attached to the endoplasmic reticulum. This endoplasmic reticulum is called rough endoplasmic reticulum: that lacking ribosomes is called smooth endoplasmic reticulum.

The golgi bodies are groups of flat, disk shaped sacs, called cistrenae, which function as secretory organelles. They are often branched into a complex series of tubules at their margins. Numerous vesicles are formed and pinched off at the edges, which then migrate and fuse with the plasma membrane of the cell wall. The vesicle contents are discharged outside the cell and the polysaccharide contents become part of the cell wall.

The contents secreted by the golgi bodies are not necessarily produced by them. Most of the secretions may be synthesized by other components, such as the endoplasmic reticulum,



then transferred to the golgi bodies.

The immature plant cell contains many small, fluid filled bodies called vacuoles. Vacuoles increase in size as the cell matures and may take up to 90% of a mature cell volume. Vacuoles are surrounded by the tonoplast, or vacular membrane.

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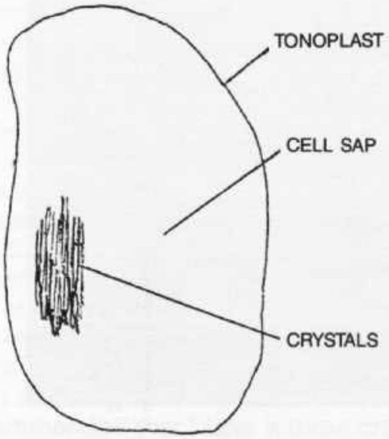


vacular membrane.

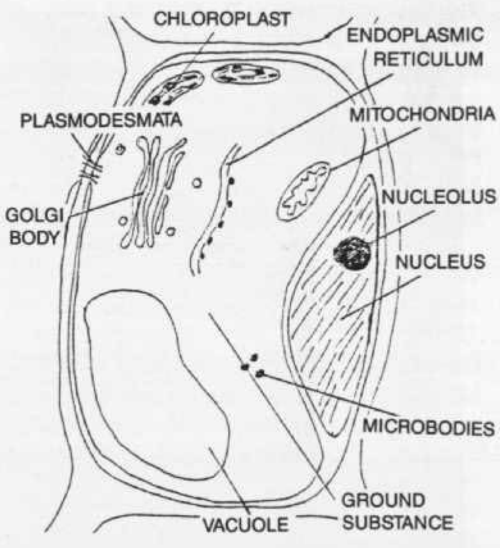
The principal component of the fluid, called the cell sap, is water, with other components varying in concentration according to the type of plant and its physiological state. Vacuoles typically contain salts, sugars and some dissolved proteins. The tonoplast plays an important role in the active transport of ions into the vacuole. Thus, ions may accumulate inside in concentrations far in excess of those in the cytoplasm. At times, crystals may form, depending on the material, in response to the increased concentration. The vacuole may also be the site of the water soluble anthocyanin pigments. Anthocyanins are responsible for the blue, violet, purple and dark red coloration, usually masked by the more abundant chlorophyl pigments.

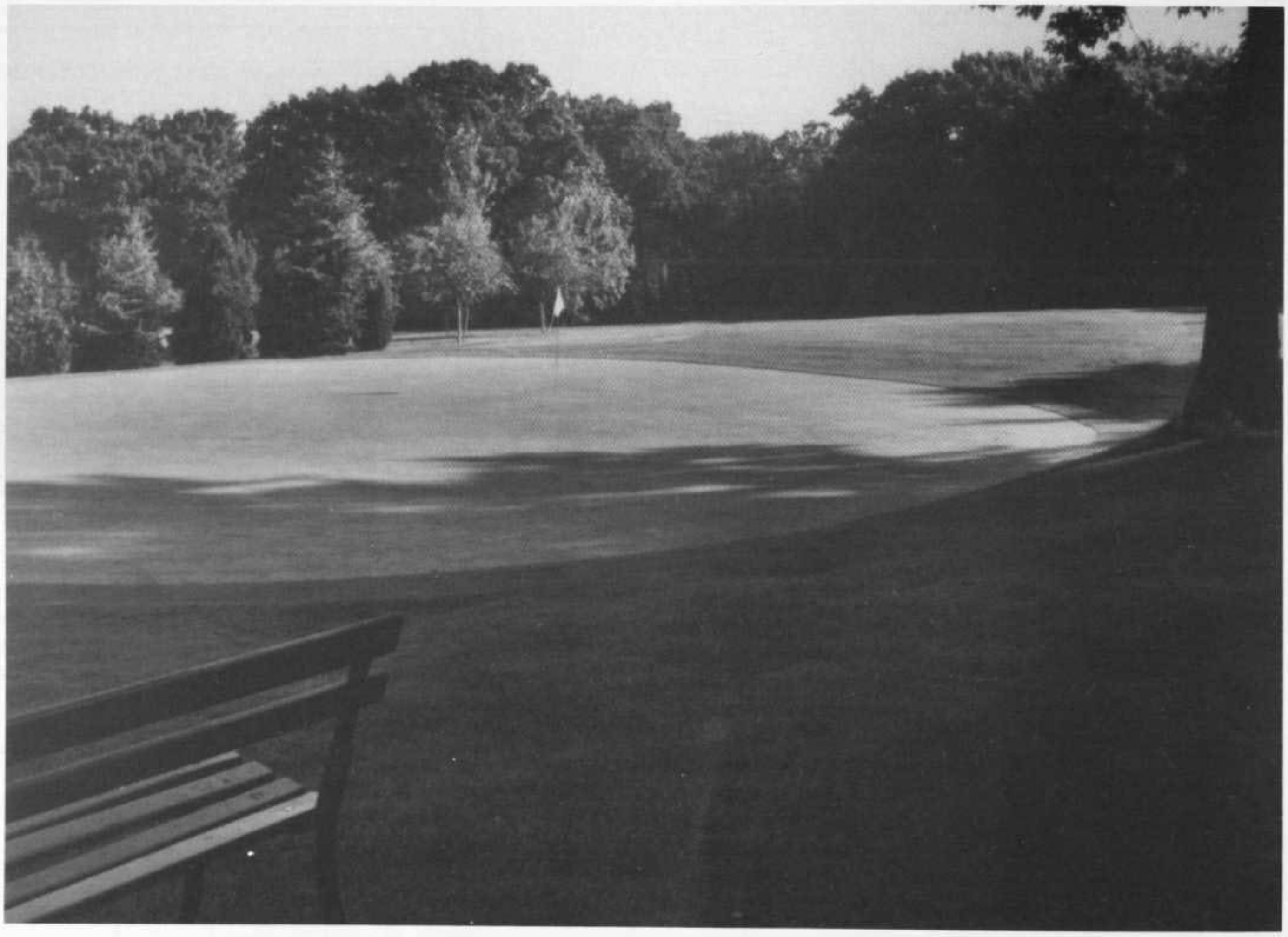
In addition to being involved with ion accumulation and the water balance of the cell, the vacuole may be involved with the breakdown of molecules and entire components of the cell. After being digested by the vacuole, the components are then recycled and used within the cell.

The talk so far concerning the membranes and membrane structures may have given the idea that they are static in nature. This is by no means the case. The cell membranes are in fact dynamic structures, constantly changing their shape and surface area. Internal cytoplasmic membranes represent a continum, with the endoplasmic reticulum being the initial source of membranes. New cisternae are added to golgi bodies from the endoplasmic reticulum. Golgi vesicles then pinch off, migrate and fuse with the plasma membrane, contributing to its growth. Even in tissues undergoing little growth or cell division, the membranes are constantly being replaced. Even though the membranes persist, the molecules are continuously replaced.

By themselves, the cell components constitute but a small portion of the complex system of the plant. The components' complexity is indicative of the importance they play and the need to understand what they are and how they function. Understanding the basics is critical if we are to understand the overall picture. They go hand in hand. It is hoped this article will inspire all of us to "get back to the basics".

The Typical Plant Cell
(not to scale)





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