ENCYCLOPEDIA OF FOOD SCIENCE AND TECHNOLOGY pdf

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Description Now in a thoroughly-updated and expanded second edition, Wiley Encyclopedia of Food Science and Technology covers fundamental concepts and practical requirements in food science, as well as cutting-edge technological and industry information.

Frederick J Francis, editor. Encyclopedia of Food Science and Technology, 2nd edition. Gelatin is a substantially pure protein food ingredient, obtained by the thermal denaturation of collagen 1 , which is the structural mainstay and most common protein in the animal kingdom. Today gelatin is usually available in granular powder form, although in Europe, sheet gelatin is still available. There are two main types of gelatin. Type A, with isoionic point of 7 to 9, is derived from collagen with exclusively acid pretreatment. Type B, with isoionic point of 4. However, gelatin is sold with a wide range of special properties, like gel strength, to suit particular applications. The disadvantage of gelatin is that it is derived from animal hide and bone not from trotters as is a common perception , hence there are problems with regard to kosher and Halal status and vegetarians also have objections to its use. Competitive gelling agents like starch, alginate, pectin, agar, carrageenan etc. Gelatin is an amphoteric protein with isoionic point between 5 and 9 depending on raw material and method of manufacture. The only other animal product containing hydroxyproline is elastin and then at a very much lower concentration, so hydroxyproline is used to determine the collagen or gelatin content of foods. In brief, the protein is made up of peptide triplets, glycine - X - Y, where X and Y can be any one of the amino acids but proline has a preference for the X position and hydroxyproline the Y position 3. Approximately amino acids produce an alpha-chain with the left-handed proline helix conformation. Collagen exists in many different forms but gelatin is only derived from sources rich in Type I collagen which contains no cystine, however, hide or skin contains some Type III collagen which can be the source of traces of the traces of cystine found in some gelatins. Although Type I collagen contains no cystine, the alpha procollagen chains excreted by the cell do contain cystine at the C terminal end of the protein which is thought to be the site of assembly of 3 alpha-chains. The three chains then spontaneously 4 coil together, zipper fashion, to form a right-handed helix. After spontaneous helix formation, cross links between chains are formed in the region of the N terminal telopeptides globular tail portion of the chains and then the telopeptides containing the cystine and tyrosine of pro-collagen are shed leaving the rod-like ca. These collagen rods assemble together with a quarter-stagger to form the collagen fibre and the fibres are stabilised by further cross-links. Gelatin is the product of denaturation or disintegration of collagen. Initially the alpha-chains of collagen are held together with several different but easily reducible cross-links. As the collagen matures, so the cross-links become stabilised 3. Then as time progresses the eta-amino groups of lysine become linked to arginine by glucose molecules Maillard reaction to form the pentosidine type cross-links which are extremely stable 5. Hence when the alkaline processing is used on young animal skin the alkali breaks one of the initial pyridinoline cross-links and as a result, on heating, the collagen releases, mainly, denatured alpha-chains into solution 5. Once the pentosidine cross-links of the mature animal have formed in the collagen, the main process of denaturation has to be thermal hydrolysis of peptide bonds resulting in protein fragments of various molecular weights i. With the "acid process", the collagen denaturation is limited to the thermal hydrolysis of peptide bonds with a small amount of alpha-chain material from acid soluble collagen in evidence 6. Nutritionally, gelatin is not a complete protein food because the essential amino acid tryptophan is missing and methionine is only present at a low level. Type A gelatin dry and ash free contains Gelatin is abnormally stable and a special catalyst has to be used to obtain the correct Kjeldahl nitrogen content. The amino acid analysis of gelatin 8 is variable, particularly for the minor constituents, depending on raw material and process used, but proximate values by weight are: It should be remembered that the peptide bond has considerable aromatic character, hence gelatin shows an absorption maximum at ca. Collagen is resistant to most proteases and requires special collagenases for its enzymic hydrolysis. Gelatin, however, is susceptible to most proteases, but they do not break gelatin down into peptides containing much less than 20 amino acids. The cross-linking of gelatin with aldehydes is being used to extend the uses of gelatin. In particular, treatment of gelatin films with glutaraldehyde is receiving considerable study in order to improve their thermal resistance, decrease their solubility in water as well as to improve their mechanical properties. In Japan and Brazil the cross-linking of gelatin using the enzyme trans-glutaminase and its use in joining gelatin to other proteins, is approved for food use. An occasional phenomenon is the loss of gelatin solubility after storage in a new kitchen cupboard where the residual formaldehyde vapour from the adhesives used, causes cross-linking of the gelatin. This reaction has been used to make gelatin adhesives water-resistant. Furthermore, the "smokes" used in food preservation are rich in aldehydes and thus can have unwanted reactions with gelatin. There are a large number of unit processes used in the manufacture of gelatin and the raw materials from which it is derived are demineralised bone called ossein , pigskin, cow hide, fish skin and in China, donkey hide is also used quite extensively. In theory there is no reason for excluding any collagen source from the manufacture of gelatin, but the ones above are the currently commercially available raw materials. Interestingly, in countries where pork is sold with its skin intact, there is no pigskin available for gelatin manufacture. There are basically two processes by which collagen is processed to gelatin: The acid process studied in detail by Reich 9 is mainly used with pigskin and fish skin and sometimes bone raw materials. Thereafter the denatured collagen or gelatin solution has to be defatted, filtered to high clarity, concentrated by vacuum evaporation or membrane ultra-filtration treatment, to a reasonably high concentration for gelation and then drying by passing dry air over the gel. The final process is one of grinding and blending to customer requirements and packaging. The resulting gelatin has an isoionic point of 7 to 9 based on the severity and duration of the acid processing of the collagen which causes limited hydrolysis of the asparagine and glutamine amino acid side chains. The alkali process studied in detail by Cole and Roberts 10 is used on bovine hide and collagen sources where the animals are relatively old at slaughter. The process is one in which collagen is submitted to a caustic soda or lengthy liming process prior to extraction. The alkali hydrolyses the asparagine and glutamine side chains to glutamic and aspartic acid relatively quickly 11 , with the result that the gelatin has a traditional isoionic point of 4. After the alkali processing, the collagen is washed free of alkali and treated with acid to the desired extraction pH which has a marked effect on the gel strength to viscosity ratio of the final product. The collagen is then denatured and converted to gelatin by heating, as with the acid process. Because of the alkali treatment, it is often necessary to demineralise the gelatin solution to remove excessive amounts of salts using ion-exchange or ultrafiltration. Thereafter the process is the same as for the acid process - vacuum evaporation, filtration, gelation, drying, grinding and blending. Although gelatin is often considered a commodity like sugar, the descriptions of the processes and raw materials above, should indicates that gelatin has the potential for being a variable product and it behoves users to ensure that they are using the best product for each particular application. In the past, little emphasis has been placed on the animal age of the raw material, particularly in the case of gelatins from bovines, however it is now known that this factor plays a significant role in the molecular structure of the derived gelatin. The role of liming in the alkali process used to be considered one of progressive alkali hydrolysis of the collagen, which made it possible to denature the collagen at lower temperatures and thus maximise the yield of top quality gelatin. The result is that alkali treatment times have been greatly reduced. One of the less well recognised effects of alkali treatment is the "opening up" of the hide collagen, as it is termed in leather manufacture, or the destruction of the proteoglycans associated with the collagen fibrils and this probably results in a more pure gelatin via the alkali process as is indicated by electrophoresis of the gelatin proteins At present, enormous developments are being made in the understanding of the structure of collagen and the changes occurring with senescence, and these developments are bound to have an impact on the appreciation of the variables in gelatin, particularly at the molecular level. In the FDA reiterated the GRAS status of gelatin and stated that there was no objection to the use of gelatin from any source and any country provided that the hide from animals showing signs of neurological disease were excluded and also Specified Raw Materials were excluded from the manufacturing process. Although, at the beginning of the Bovine Spongiform Encephalopathy BSE scare in Europe the popular media brought suspicion on all products of bovine origin as being possible transmitters of the disease to humans as CJD, this was a thoroughly unscientific assessment of the dangers of spreading infection. It is now recognised that BSE is a neurological and brain problem and not associated with the hide of the animal. It is also recognised that the processes of manufacturing gelatin make it virtually impossible for the survival of a defective prion, if it were present in the first place. Hence, today, gelatin retains its GRAS status. Gelatin is an excellent growth medium for most bacteria, hence considerable care needs to be taken, during manufacture, to avoid contamination. In the same way to ensure product reproducibility, most companies are implementing ISO quality management systems. Gelatin is only partially soluble in cold water, however dry gelatin swells or hydrates when stirred into water. Alternatively, dry gelatin can be dissolved by stirring into hot water, but stirring must be continued until solution is complete. This method is normally only used for dilute solutions of gelatin. If gelatin solutions are spray dried or drum dried from the sol state, the resulting gelatin is "cold water soluble" and such gelatins gel quickly when stirred into cold water. These gels are generally not clear, so the use of this form of gelatin is limited to milk puddings and other products where solution clarity is not required. The compatibility of gelatin in aqueous solution with polyhydric alcohols like glycerol, propylene glycol, sorbitol etc. In products with limited moisture availability, as in confectionery, and where there is another polymer, as in glucose syrup, competing for the available water, then gelatin can be precipitated resulting in loss of gelation and cloudiness. In these cases the gelatin solubility is very dependent on the charge on the protein molecule or the pH of the product. Hence, the further the product pH is from the isoionic pH the better will be the solubility and performance of the gelatin. Possibly the oldest use of gelatin was as animal glue. For adhesion to take place a warm gelatin solution must be used and the gelatin must not have gelled before the surfaces to be glued are brought together. An example of this use of gelatin is in pharmaceutical or confectionery tableting and in liquorice all-sorts where it can be used to join the layers. The most common use of gelatin is for its thermally reversible gelling properties with water, for example, the production of table jellies. Gelatin is also used in aspic to add flavour to meat products while on gelling it also provides a pleasing shiny appearance to the product. In some cases gelling is known as its "water absorbing property": For example, in canned hams, gelatin can be added to the can before cooking. On cooking the exudate from the meat is absorbed by the gelatin and appears as a gel when the can is opened. In confectionery, gelatin is used as the gelling binder in gummy products, wine gums etc. In the manufacture of these products gelatin is combined with sugar and glucose syrups. Incompatibility between gelatin and glucose syrup can occur 13 and is a function of the concentration of glucose polymers containing more than 2 glucose units, contained in the syrup. Competition between gelatin and glucose polymers for water in low water content products can result in, at worst, precipitation of the gelatin and at best a marked loss in gelling properties or hardness of the product. It is also known that different gelatins with similar properties in water, can have very different properties in confectionery formulations. Some raw fruits like pineapple and papaya contain proteolytic enzymes like bromelin which hydrolyse gelatin and destroy its gelling ability. In such cases it is essential that the fruit is cooked to destroy the protease before the fruit is added to gelatin solutions. Gelatin is a very efficient foam stabiliser and this property is exploited in the manufacture of marshmallows. Different gelatins have different foam stabilising properties and gelatin for this use needs to be carefully selected. However, the foaming properties can be standardised by the use of sodium lauryl sulphate 15 , if this is permitted by local food additive regulations. If a gelled jelly is frozen, the product will suffer from syneresis and on thawing the clear jelly will disintegrate with much exuded water. However, if water containing 0. This effect is most desirable in "ice lollies" and is also used in ice cream manufacture to obtain a smooth product with small ice crystals and also to ensure that any lactose precipitates as fine crystals avoiding the development of graininess with time. Gelatin films shrink with great force on drying, hence such uses usually involve the addition of polyhydric alcohols to modify the adhesion and flexibility of the dry film. Also, for film forming, a gelatin with a high viscosity is preferred to one with a low viscosity, hence for hard capsules and in photography, ossein gelatin is preferred and commands a premium price.

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Preface to the First Edition. Although this encyclopedia is designed for food scientists and technologists, it also contains information useful to food engineers, chemists, biologists, ingredient suppliers, and other professionals involved in the food chain.

Food science examines everything that can happen to food between harvest and consumption. Food technology is used to develop and manage the processes by which food is transformed from raw harvest to edible goods purchased by individual consumers. Almost all foods are modified before consumption. Only some fruits, nuts, vegetables, meats, milk, and eggs may be eaten raw. About three-quarters of all the calories consumed by humans worldwide are derived from rice, wheat, and corn maize â€”truly the staff of life in almost all societiesâ€"all of which must be processed to make their delivery of nutrients feasible. Food science and technology draw on chemistry, microbiology, engineering, physiology, toxicology, nutrition, dietetics, economics, marketing, and law; therefore, food science and food technology are inherently interdisciplinary subjects rather than narrow disciplines. Background Along with the making of shelter and clothing, the securing and preparing of food constitute one of the oldest technical activities, being coeval with the emergence of Homo sapiens. Because of its importance, from the beginning of human society food appears to have been associated with a number of ethical judgments in the form of rituals and taboos. Gender differences in regard to food procurement evolved for natural reasons: Males were the hunters, and females were the gatherers and subsequently the crop cultivators. Anthropologists also focus on cultural aspects such as food as a means of asserting identity or group membership; the reciprocal effects of class or caste systems on foodways; communal eating and food as a means of bonding and hospitality; ritual aspects of food, for example, at funerals and weddings; and food taboos and food eaten for religious reasonsâ€"these so-called ceremonial foods include bread, wine, and oil, the first manufactured foodstuffs. Two major changes allowed human populations to shift from nomadic hunting and gathering, which they had engaged in for hundreds of thousands of years, to living in settled communities. The first was the domestication of animals, probably beginning with that of the Asiatic wolf as an aid in hunting, around 13, years ago after the end of the last ice age. More significant was the keeping of lactating animals such as goats and sheep to guarantee a regular supply of milk, meat, and nonfood products. By approximately 10, years ago sheep had been domesticated in the area that is now Iraq, as were goats. Pigs were domesticated a thousand years later, and it took another thousand years before the wild aurochs had been transformed into cattle in the Balkan area. The second achievement was the recognition of the relationship between plants and their seeds. This allowed a previously nomadic clan to settle in an appropriate landscape. With the receding ice, fields of wild grain or grasses with edible seeds appeared, and eventually women began to plant seeds in cleared areas. Those two achievements were the key elements in what has come to be known as the Agricultural or Neolithic Revolution, which occurred during the New Stone Age , a period that began 11, years ago in southern Asia and 9, years ago in the Tigris and Euphrates river valleys, from where the new techniques began to spread. The agricultural revolution provided more and better food, promoting improved human fertility and longevity, and therefore increased human population numbers. Differentiating between life-sustaining and harmful foods is probably an instinctive human behavior. People are drawn to carbohydrate-rich foods, which are generally sweet, and usually are repelled by alkaloidal products, which contain bitter toxic chemicals. An important discovery was that heat, such as that provided in cooking by fire or hot water, can alter the characteristics of food. The transformation of food materials by heat to make them consistently and predictably edible, flavorful, and spoilage-resistant developed into a practice that preceded techniques for deliberately changing inorganic materials, as in the making of pottery from clay some 30, years ago and then the use of metallurgy about 6, years ago, both of which contributed to cookery. According to Harold McGee , chemistry began with the "food chemistry" of ancestral cooks. The molecules those cooks transformed and manipulated were food molecules. Each time contemporary people prepare food for eating, whether in a large food-processing plant or in a kitchen, they replicate the origins of an art practiced since the harnessing of fire , years ago. It was not until the Enlightenment and well into the Industrial Revolution that food became a focus of scientific study. It was the modern period as well that witnessed the related developments in public health , medical nutrition, and mechanization in food processing, especially for mass production. The adaptation of mass production technologies to agricultural production and food processing radically transformed human-food relations. Those processes made it possible for smaller numbers of food workers to support larger numbers of food consumers, thus promoting urbanization on an unprecedented scale. That urbanization led to new technologies of preservation, transportation, and marketing; inspired scientific studies of nutrition because in many instances the new technologies altered the balances in traditional diets ; and raised ethical issues about the treatment of food processing workers as well as equity in access and distribution which previously had been subject to the negotiations characteristic of traditional cultures. Nevertheless, the basic objectives of assuring a satisfactory supply of food did not change. Those objectives only become more visible, controllable, and subject to management. Indeed, only new insights and improved techniques can assure a continuing stream of food products for the growing human population. The Perennial Vital Objectives All functioning modern societies attempt to provide people with foods that are readily available, abundant, affordable, appealing, appetizing, nutritious, and safe. Agriculture including fisheries , along with food science and food technology, is essential in meeting those goals. Since prehistoric times the objectives related to feeding a clan or a larger community have been optimization of harvest yields, prevention of losses, achievement of edibility, and protection of food integrity factors such as flavor, texture, color, and nutrition. The food systemâ€”the path from soil to mouth or from farm to forkâ€”is a precarious one. Numerous technologies are involved in the modern effort to bring food to consumers. Much can go wrong, and much depends on climate and other natural forces. However, human ingenuity, a multitude of tools, and technological interventions are the critical factors in seizing life-sustaining products from nature. Then all foods must be protected during the transfer from their production habitats to their final destination. The notion of a carefree dependence on the abundance of nature is far removed from reality. About half of all dollars spent on food consumption in the United States at the beginning of the twenty-first century was expended in eating away from home. Other animals compete with humans for the products of nature. The biblical scourges of locusts are a familiar example, but it is mainly invisible competitors that take the most. Bacteria, molds, yeasts, and even viruses consistently make foods unavailable, inedible, or the cause of disease. Only a few microorganisms have been put to positive use, mainly in fermentation. Because eradication is impossible, pest control is a major activity and expenditure for farmers and food processors and even for the food service industry and some householders. This war against microscopic competitors is waged most effectively with chemical weapons and must be affordable and properly done. Current agricultural pesticides are largely products of the s. As with all technological interventions, it soon was realized that there was a side effect in that pesticide residues on and in foods could be harmful to human health and to the environment. A typical quandary is the war against food pests. This battle involves powerful weaponry to assure an abundance of crops and may do damage to people as a side effect. In addition to rodent, insect, and microbiological losses numerous chemical changes occur in foods that have unpleasant results. Soured milk, bitter rice, rancid fatty food, and other unpalatable edibles are thrown away. Not even animals are fed with them because their owners suspect the presence of toxic substances. The losses to the "food system" and to society are obvious. Equally obvious is the fact that such losses, along with food deterioration overall, can be avoided to a large extent through the judicious application of food technologies. That constitutes the major preoccupation of modern food processors and handlers, the custodians who take possession of food after harvesting and deliver it to end users in the expected qualities and quantities. Food losses and food waste are enormous, although no accurate data exist. Ironically, in places where food crops are usually scarce, often because of a lack of technological intervention but also as a result of natural disasters, personal wastage is rare. In the developed parts of the world, where technology assures an abundance of food, there is usually gross disregard for optimal personal food utilization. Examples include tray waste in institutional facilities and careless housekeeping practices. Food protection spans the spectrum from seeds to the moment of consumption. The initial responsibility lies with food producers. Agricultural research began in the nineteenth century. It has always been devoted mainly to production studies that have culminated in the use of chemical, mechanical, computer, and more recently bioengineering technologies. Each technology has had opponents, has sparked heavy discussion, and has been improved as a result. One insight has become clear: Without science and appropriately applied technologies improvement of the human condition would be slow, difficult, and painful. Food Processing From cutting to gamma-irradiation, the subject of food processing involves dozens of operations. Only a few can be mentioned in this brief overview. At the heart of food technology are several processing operations that are used to modify foods primarily to preserve them for later consumption. Water removal is one way to preserve a food: Raisins last longer than grapes, cheese and sausages can be stored for long periods, fruits can be converted to fermented beverages, and grains can be made into beer. In all these cases, the original food disappears but the nutritive value is preserved. Another method of preservation is the use of chemicals, such as acids, that are antagonistic to spoilage microorganisms. During the s about 5, people died every year in the United States from bacterial food poisoning. The human toll from poisoned food was almost unbelievably high until the advent of food technology, along with hygienic measures and medical advances. Vinegar, yogurt, and pickled foods are examples of acid-preserved foods. The pickling of vegetables has a long history, especially in China, and has relied primarily on the use of salt sodium chloride. The history of salt, which is considered the first "food" of commerce, is interwoven with that of food preservation Kurlansky A high sugar content also preserves food, as in the case of candied fruit and confectionery products. The inspiration must have come from honey, the original natural preserved food. Modern food markets provide evidence that almost everything people eat is modified before consumption. The rationale of most processing is to protect a food until it is consumed, and an understanding of food chemistry and microbiology is essential in that endeavor. The simplest way to defeat microorganisms is to remove the water that is vital to them. Most foods that are not dried properly spoil very quickly, but substances antagonistic to microorganisms can be added directly or indirectly, as in lactic and alcoholic fermentations. The result is not only protection but also better nutrient availability and palatability. Lactic acid fermentation utilizes the destructive and digestive ability of certain microorganisms for human advantage, as in the cases of fermented cabbage and yogurt. The production of vinegar, beer, and wine provides examples of acetic and alcoholic fermentation. Other preservatives are microbial inhibitors such as spices, herbs, and salts. Inhibition of oxidation is achieved mainly by means of the addition of antioxidants. Foods that are rancid or have lost flavor or color are considered spoiled. The mechanism is driven largely by enzymes native to foods but also by oxygen in the air. Consequently, air exclusion is a preservative technique.

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The Encyclopedia of Food Sciences and Nutrition, Second Edition is an extensively revised, expanded and updated version of the successful eight-volume Encyclopedia of Food Science, Food Technology and Nutrition ().

Was also added to some margarine. The current law was enacted in and is amended regularly by the Congress. Purpose is to end hunger and improve nutrition and health. It helps low-income households buy food for a nutritionally adequate diet. The purpose was to ensure that all children have access to a healthy breakfast at school to promote learning readiness and healthy eating behaviors. It provides nutritionally balanced, low-cost, or free breakfasts to 7. Implications for Reducing Chronic Disease Risk Thorough review of the evidence on which dietary guidelines are based. Specific evidence provided on intake of fat, fruit and vegetables, protein, salt, alcohol, calcium, fluoride, and physical activity FNB. There are now 11 health-related claims that are approved to be used in advertising on food packages FDA. This report included recommendations for calcium, phosphorus, magnesium, vitamin D, and fluoride. Program initiated in United States, Mexico, and Canada. Scientists first recognized human zinc deficiency in the mids. Severely growth-retarded, young Middle Eastern men were anemic, extremely lethargic, and hypogonadal. Their diet consisted mainly of wheat bread with little animal protein. When their diets were supplemented with zinc, their lethargy, growth, and genital development improved. Nutrition for optimal health â€”present. In the understanding of nutrition, the American public experienced yet another paradigm shift in the s. They wondered if all nutrients that provided a health benefit needed to fit the traditional definition of "essential nutrient. In the U. The explosion of this market is likely due to the increase in social acceptance, changes in regulations, the booming economy of the s, and the targeting of products to particular populations. The scientific validation of some therapies also is of increasing interest. Pharmacological uses larger amounts than required to prevent deficiencies of essential nutrients are being explored. Although much of the current interest in megavitamin supplementation began in the s, the work of Dr. Linus Pauling in the s initiated the movement. Pauling was the only individual to be awarded two unshared Nobel prizes for his work in chemistry and peace In the field of nutrition, however, he is noted most for his unproven theories regarding the potential protective role of vitamin C on the common cold , cancer, and heart disease. Pauling himself reportedly took up to six hundred times the recommended daily amount of vitamin C. Given that many individuals also practice a "more must be better" approach, the national recommendations for nutrient intake now include guidelines for safe upper limits for individual nutrient intakes. Nutrition in Research Experimental nutrition research is one aspect of the science of nutrition. Nutrition research is conducted to answer questions raised both in clinical practice and policy. Research in nutrition can focus on individual cells, whole animals or humans, or entire populations, and often overlaps with research in genetics, biochemistry, molecular biology , toxicology, immunology, physiology, and pharmacology. Nutritional biochemistry is the backbone to the understanding of the structure and function of nutrients within food and the body. Though required in small amounts, nutrients are essential for body growth, sexual development and reproduction, psychological well-being, energy level, and the normal functioning of most organ systems in the body. Nutritional biochemists study the functional roles of vitamins and minerals in the body, metabolic blocks that occur from deficiencies, the effects of hormones on nutrient metabolism, and interactions among nutrients within the body. In the s a whole new area of research emerged that focuses on relationships between nutrition and genetics. Food science is the study of the composition of food materials and the reaction of food to processing, cooking, packaging, and storage. Food science integrates knowledge of the chemical composition of food materials; their physical, biological, and biochemical behavior; the interaction of food components with each other and their environment; pharmacology and toxicology of food materials, additives, and contaminants; and the effects of manufacturing operations, processes, and storage conditions. The potential beneficial role of functional foods in the American diet has gained attention and recent food science research focuses on the development of such foods. Functional foods are generally defined as those that provide health benefits beyond basic nutrition, and include fortified, enriched, or enhanced foods, and whole foods, which have high levels of protective nutrient components. Examples of these foods include orange juice with added calcium or echinacea, or snack foods with antioxidants, fruit-flavored candy with vitamin C, various soy products, and margarine with added plant sterols. Factors that drive the market for such foods include a growing general public interest in nutrition and its impact on health, an aging population that is more concerned with health, research findings receiving media attention, and an increasingly unregulated consumer food market. Human nutrition, or clinical nutrition, research is that which focuses on the study of nutrients within the living human body. Although biochemical studies are extremely informative, until the nutrient is added to or depleted from the diet, the effects on individuals can only be hypothesized. Human nutrition research includes the study of individual nutrient requirements e. In the s one important human nutrition study found that increasing folic acid intake in young women reduces the incidence of neural tube defects spina bifida in their babies. Nutritional epidemiology is the science of systematically studying the relationships between food choices and health status. Epidemiological studies are particularly valuable in understanding complex relationships between food intake dietary exposure and determinants of diseases with multiple etiologies and long latent periods. Examples of such studies include the relationships between low folic acid intake and increased incidence of spina bifida, and elevated saturated fat intake and elevated risk of arteriosclerosis. There are, however, limitations to these studies in that they describe relationships rather than prove cause and effect. Frequently, clinical trials and intervention studies are used as follow-up studies to evaluate more fully the questions raised by epidemiological evidence. Nutrition in Clinical Practice Scientific evidence continues to mount regarding the key roles that nutrients and their metabolism play in the prevention of the most common chronic diseases. Half of the leading causes of death in the United States heart disease , cancer, stroke, and diabetes are associated strongly with unhealthy eating habits. Clinical nutrition is the practice of applying research evidence to aid in the care of individuals with or at risk for diet-related diseases. These principles are used to develop individualized nutrition care plans. Generally, diseases may affect nutritional status by a decreasing the intake of nutrients, b altering the metabolism of nutrients or unusual losses , or c altering energy expenditure. Alternatively, as mentioned briefly above, poor nutritional status can lead to disease. For example, zinc deficiency can decrease the function of the immune system that in turn leads to increased risk for diarrhea and infectious diseases. Assessment of nutritional status is essential for identifying undernourished and overnourished states obesity is now a major health problem and estimating the optimum intake to promote normal growth and well-being. Nutritional assessment has several components, including the evaluation of dietary intake, growth status, body composition, energy expenditure, and biochemical measures of nutritional status in the context of a medical history, diagnoses, and current therapy. These data are used to develop individualized nutritional care plans, which may include recommendations for total energy intake, adjustments in the diet to increase or decrease the consumption of certain foods, and possibly the inclusion of nutrient supplements. For patients who cannot be fed orally, more technology-based nutritional support is used to maintain or improve nutrient intakes and nutritional status. This involves either feeding the patient through a tube directly into the stomach or intestine enteral or through an intravenous line directly into the bloodstream parenteral. Because malnutrition will add to complications of illness and prolong the illnesses and hospitalization, appropriate assessment of the patient is extremely important. In the complex and rapidly changing context of critical illness, individualized nutrition assessments are crucial and require the sequential monitoring of all patients to maintain appropriate nutritional care plans. It is unlikely that individuals who have not been seriously ill have had the opportunity to seek the counsel of a trained nutritional professional for developing an individualized diet plan. The average American displays a keen interest in how nutrition affects his or her health, and is disappointed with the information physicians are able to provide because traditional medical training has limited nutrition content. Therefore, greater numbers of individuals are seeking nutrition information for themselves, and using the information to self-diagnose and self-prescribe. The advances in communications technology, particularly the explosion of information on the World Wide Web , allow the ready accessibility of sound nutritional advice, and substantial amounts of quackery. Without training and a significant amount of time dedicated to the task, it is difficult to decipher truth from fraud. Future directions in nutritional education likely will include tools to aid Americans in deciphering information, particularly from the Internet , in order to make educated choices to optimize their diets and live healthier lives see Table 2. Nutrition in Public Policy: Monitoring and Education Nutrition in public health or nutrition policy generally is regarded as the combined efforts taken toward improving Credible sources of nutrition information on the World Wide Web Professional Organizations American Society for Clinical Nutrition: With increasing emphasis on health promotion and disease prevention, there is a proliferation of nutrition-related disease prevention, screening, and education programs targeted at increasing fiber, fruit, and vegetable intake, and reducing saturated fat intake. Additionally, a number of food assistance programs and mandated food fortification programs have been instituted, all promoting a healthy diet and lifestyle. Nutrition research, public policy programs, and nutrition surveillance systems work synergistically like spokes on a wheel. Evidence obtained from scientific research is used to set nutritional recommendations such as the Dietary Reference Intakes and the Dietary Guidelines for Americans. These standards are used to judge the adequacy of the American diet, provide the basis for nutrition labeling of foods, formulate special diets, and guide the development of food fortification and nutrition policy developed to assist those who are at nutritional risk. Specific food assistance programs such as, food stamps, Special Supplementary Nutrition Program for Women, Infants, and Children are targeted at specific economically disadvantaged and nutritionally at-risk populations. Fortification programs generally are less specific, but some target at-risk populations through specific foods, for example, vitamin Dâ€”fortified milk to prevent rickets in young children. Finally, the wheel is completed by nutrition monitoring programs that are used to evaluate the effectiveness of instituted policies. Perhaps most important, public health nutrition includes the dissemination of scientific findings, the explanation of dietary recommendations, and outreach of federal assistance programs. The responsibility of communicating experimental findings in an understandable form falls on nutrition scientists, journalists, educators, and the public. The scientists are responsible for interpreting the research findings into a form that is understandable to the general public. Journalists are responsible for communicating the scientific message in an objective way, and the public is responsible for pursuing an accurate understanding of the issues. Various government agencies have the responsibility to organize and administrate the myriad of nutritional policies and programs, and to communicate information regarding these programs to the public. The Future of Nutrition and Food Science In the twentieth century nutrition research, practice, and public policy shifted from a focus on the quantitative aspectsâ€”to ensure food security and eradicate nutritional deficienciesâ€”to a greater attention on the qualitative aspectsâ€—to achieve optimal, balanced, dietary intakes. In the twenty-first century nutrition research, practice, and policy will likely explore the following areas: Relationships between food intake and human health will continue to be of great public interest, and nutrition and food scientists will face new challenges in a fasterchanging environment. Domestic Food and Nutrition Security. American Dietetic Association, Implications for Reducing Chronic Disease Risk. National Academy Press, Food and Nutrition Board. National Research Council, Food and Nutrition Board, Institute of Medicine. Studies on calcium, phosphorus, magnesium, vitamin D, and fluoride. Studies on thiamin, riboflavin, niacin, vitamin B 6, folate, vitamin B 12, pantothenic acid, biotin, and choline. Studies on vitamins A and K, arsenic, boron, chromium, copper, iodine, iron, manganese, molybdemum, nickel, silicon, vanadium, and zinc. Evolution of the Concept.

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FOOD SCIENCE AND TECHNOLOGY. Among the concerns of food science and technology are postharvest changes in substances that nourish human beings. Food science examines everything that can happen to food between harvest and consumption.

Fruits and Vegetables Water Activity: Food Texture Water Activity: Good Manufacturing Practice Water Activity: This breadth is maintained in the Second Edition and enlarged to include more of the associated areas of food science. A number of these areas are of current prime importance, including food safety, functional foods, and neutraceuticals. Seventy years ago, when the discipline of food science and technology was first introduced, the accepted definition was the science concerned with food "from the farm gate to the consumer. The above definition of food science and technology was appropriate for food production techniques in the early part of the twentieth century. We were primarily dependent on fresh fruits and vegetables in season and meats, augmented by commodities which could be easily stored such as grains, root crops, dried fruits and fermented foods, and beverages. The "New England boiled dinner," composed of corned beef, potatoes, carrots, cabbage,turnips, onions, and parsnips, was a good example. A major change from a seasonal concept of food supply to a processed system occurred in the s with the development of food preservation techniques such as conning, freezing, dehydration, and chemical preservation. When this was combined with developments in packaging, storage, transportation, and consumer marketing, the rate of change to a processed-food society was speeded up. Today we have the advantages of a stable processed food supply combined with fresh fruits and vegetables produced locally and also shipped in from other countries. This has produced the best of both systems, but it has some problems. The concentration of production, packaging, storage, and transportation into large units has increased the possibility of contamination with chemicals and microorganisms, a major concern of regulatory official; it may also be a source of concern for readers of this encyclopedia. Hopefully, the sections on food safety, estimation of risk, interpretation of risk, and management of risk will allay the fears for the safety of the global food supply. Another change in the concept of food science and technology occurred in the s with increased concern over adequate nutrition in food and the nutrition delivery system. The science of nutrition at that point had developed to the point where meaningful predictions could be made on the effect of components in the food supply on the health and well-being of the populace. This led to increased emphasis on food processors to maintain the nutritive value of their products in order to supply the "Acceptable Daily Intake" recommended by governmental and other agencies. However, maintenance of nutrients already present in food was not enough, and the science of fortification was developed primarily to prevent the development of conditions which could lead to a deterioration in the overall health of the individual. This concept was enlarged to encompass components of the diet which were not necessarily related to deficiencies and disease but were related to overall well-being. This led to the concept of "Neutraceuticals," components which combine nutritive and pharmaceutical properties. The term "functional foods" was also introduces to describe components which have a technological function in foods as well as a nutritive or health benefit. Both areas are rapidly expanding and may be of interest to readers of this encyclopedia. The members of the Editorial Board were chosen for their understanding of particular areas of food science and technology that I thought should be given more consideration in the Second Edition. I believed that the First Edition had an excellent set of papers, primarily in technology, and I wanted to build on that base. All of the editors enjoy a superb reputation in their respective fields and I am grateful to them for their willingness to share opinions and expertise. The contributors supplied the real foundation for the encyclopedia and I am most grateful for their willingness to contribute their time and energy to write the papers. This expression of professionalism is reassuring for the future of the discipline. Finally, I would like to thank the group of professionals at Wiley for their administrative support in what otherwise would be an overwhelming assignment.

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8: Food science - Wikipedia

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9: Encyclopedia of Food Science and Technology 2nd edition 4 Volume Set

The Encyclopedia provides a platform for experts from the field of food safety and related fields, such as nutrition, food science and technology and environment to share and learn from state-of-the art expertise with the rest of the food safety community.

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