

Food Science: A Primer

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How to cite this paper: Matthew N. O. Sadiku | Tolulope J. Ashaolu | Sarhan M. Musa "Food Science: A Primer" Published in International Journal of Trend in Scientific Research and Development (ijtsrd), ISSN: 2456-6470, Volume-3 | Issue-4, June 2019, pp.839-841, URL: <https://www.ijtsrd.com/papers/ijtsrd23952.pdf>



IJTSRD23952

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Food science has a hand in every product that is consumed. It provides us with frozen foods, canned foods, microwave meals, snacks, and variety of diets. Food science helps in feeding our ever growing population which is nearly 7 billion! It has evolved to make food the basis of a healthy civilization, help society overcome hunger and disease, and improve safety, affordability, and availability of foods.

COMPONENTS OF FOOD SCIENCE

Food science is multidisciplinary field, drawing from both pure and applied sciences. It combines chemistry, microbiology, physics, nutrition, and engineering. Other areas that food science embraces include agricultural science, sensory science, molecular thermodynamics, nanotechnology, and economics. Some of these areas are illustrated in Figure 1 [2]. Food science explores the nature of foods and focuses on the technical aspects of food. It covers all areas of food. Hence, food science covers several sub disciplines including the following [3,4]:

- Food chemistry is the study of chemical processes and interactions of all biological and non-biological components of foods. It examines food molecules in chemical reactions.
- Food engineering is the industrial processes used to manufacture food. It uses engineering concepts to solve problems in food manufacturing systems design and operations.

ABSTRACT

Food science is the discipline that applies basic sciences and engineering to study the nature of foods and their harvesting, processing, distribution, storage, and preparation. It is essential to meeting the needs of a growing global population. A major goal of food science is to understand the nature and properties of foods at a fundamental level so as to make existing food production processes more efficient. This paper provides a primer on food science.

Keywords: food science

INTRODUCTION

Food is a basic human necessity. The health and well-being of a nation depends on the ready availability of quality food at affordable price. The world population demands a sufficient and stable supply of nutritionally-balanced food. The increased reliance of society on ready-to-eat foods has led to greater responsibility for processors in terms of quality and safety. Tremendous progress has been achieved in recent years in the field of food production, processing, storage, and distribution. Food production have increased in most countries due to better production techniques and the introduction of Green Revolution [1].

Food science is the application of physical science and engineering principles to the creation and maintenance of a safe, abundant, and high quality food supply. It is applied science dedicated to the study of foods and how to transform food into a safe, convenient, nutritious, and healthy products.

- Food technology is the application of food science to the selection, preservation, processing, packaging, distribution, and use of safe food.
- Food microbiology is concerned with the study of the effects microbes or organisms can have on the quality and safety of food products. It also includes the study of the effect of the environment on food spoilage and food manufacturing.
- Food packaging looks at how food is packaged after processing to preserve maximum nutrients.
- Food processing, such as cooking and manufacturing, is concerned with preserving the safety and nutritious properties of food while allowing distribution to consumers.
- Food preservation involves the causes and prevention of food spoilage.
- Molecular gastronomy is a sub discipline of food science that seeks to investigate the physical and chemical transformations of ingredients that occur in cooking. It explore the physical changes that occur as food is prepared for human consumption.
- Food quality is the quality characteristics of food that are acceptable to consumers. When it comes to food, quality is an elusive term. Quality control also ensures that product meets specs to ensure the customer receives what they expect.

Some of these subdisciplines are illustrated in Figure 2 [5].

FOOD SCIENCE TOOLS

Food scientists have many excellent tools at their disposal with which to study foods and beverages (e.g. wine, tea, fruit juices). With the development of modern instruments, more and more tools are used in food science, including the following:

- **Magnetic Resonance Imaging (MRI):** When it comes to analyzing dynamic structural changes in food during processing and storage, no tool can compare with magnetic resonance imaging (MRI). MRI food imaging techniques include gradient-echo imaging, functional imaging, whole plant functional imaging, flow imaging, and rheology [6].
- **Microscopy:** Knowledge of the microstructure of food materials is essential to predict and control their behavior. Light and electron microscopy have been widely applied to study all kinds of raw materials and processed products. The use of non-invasive imaging techniques such as magnetic resonance imaging (MRI) is much restricted due to the elevated cost of the equipment. The atomic force microscope (AFM) is a member of the scanning probe microscopes family. The recent introduction of confocal scanning laser microscopy is a major advance in microscopy. It permits observation of selected levels within thick samples [7,8].
- **Spectroscopy:** There are several spectroscopic techniques depending on the different ways that atoms and molecules interact with electromagnetic waves. Mass spectrometry is used in food science, medicine, pharmacy, and botany. Raman spectroscopy analyzes the light dispersed by food material when it is illuminated by a laser source. It is a valuable tool in food materials science to interpret the mechanical, thermal, and rheological behavior of biomaterial. Researchers may use this tool as a complementary technique in the characterization of food microstructure [9].
- **Expert System:** This is a good instrument for information support of strategical and tactical manager decisions in different scientific and technological knowledge areas[10].

Internet resources and computerized surveys are frequently implemented as a developing tool to reproduce aspects of more sophisticated customer-research techniques.

BENEFITS AND CHALLENGES

Financial support of the food industry by the government is a indication of the significant role food plays in our society. The current availability, abundance, quality, and safety of food in most parts of the world is largely due to technological innovations in food production, supported by the food science discipline. Food science provides the foundation for the current quantity and high quality of foods [11].

Agricultural technology has favored large farmers and is not suitable for small farmers. Small farmers may lack technology that could be incorporated into the cropping system. In some cases, both producers and consumers have lacked knowledge of what constitutes good nutrition. Marketing and distribution of food are inefficient [12].

The needs of developing countries differ from those of the developed countries. Indiscriminate imposition of solutions

from outside to developing countries will not solve their problems.

Consumers are increasingly concerned about the origin of the environmental, societal, and ethical implications of their food choices. Deciding what to eat for dinner each night is hard, as food is connected to social, cultural, and economic circumstances. Overconsumption of affordable food (either at home or at restaurants) with high caloric value leads to obesity [13]. It is a major challenge for food scientists to give consumers guarantees that the food products are not only safe but produce better health.

CONCLUSION

Food science studies the preservation, selection, storage, and distribution of food. It is still a relatively new and growing discipline. In the future, food science will be called upon to address a number of challenges for mankind, including sustainability, nutrition security, longevity and health, and food safety and defense.

Since change is constant in food science, continuous learning should an essential activity of any food scientist who wants to remain current. Conferences, workshops, symposia, webinars, online programs, and short courses can provide a wide range of opportunities for professional development [12]. Cooperation among agencies involved in agriculture, nutrition, and food science is needed. Education on food science should be given emphasis at all levels of society in order to inculcate good eating habits in all age groups [14].

More information on food science can be found in numerous books in [6, 15-30] and the following journals exclusively devoted to it:

- Journal of Food Science
- Journal of Food Science & Technology
- Food Science & Nutrition
- Journal of the Science of Food and Agriculture
- Food Science and Technology International
- Trends in Food Science & Technology
- Journal of Clinical Nutrition and Food Science
- Food Science and Technology International
- Trends in Food Science & Technology

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Figure 1 Food science is a multidisciplinary field [2].

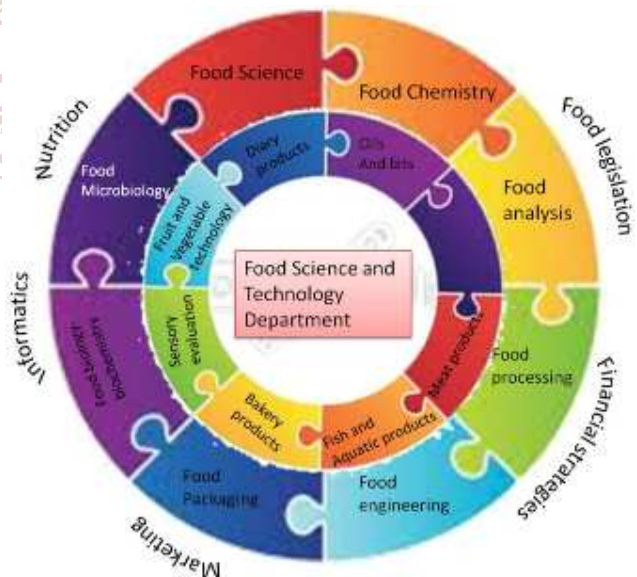


Figure2 Some subdisciplines of food science [5].