

Recent Trends and Applications in Biological Sciences, Zoology, Botany and Agricultural Sciences

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DOI: [10.36348/sjls.2023.v08i11.002](https://doi.org/10.36348/sjls.2023.v08i11.002)

Received: 22.10.2023 | Accepted: 27.11.2023 | Published: 07.12.2023

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Abstract

Most of the molecular targets are genes involved in carbohydrate and sugar metabolism. The jasmonic acid signaling regulation controls a range of plant developmental processes and responses to biotic and abiotic stressors; this regulation most likely involves the photosynthetic apparatus. Proteases and peptidases that are specialized to certain compartments, their number, location, and turnover, protein interactors, and posttranslational modifications (PTMs) including phosphorylation, ubiquitination, nitrosylation, and carbonylation are among these activities. The adding pure natural components and plant extracts to food may help prevent botulism. Furthermore, given the lack of apparent pharmacological treatment, whole foods high in polyphenols and the bioactive substances contain have to be assessed for potential medical benefits. The food chain is seriously endangered by fusarium species and other fungal species that infect food, particularly grain. Mycotoxins' harmful effects on people are limited by the highest amounts that are allowed in food. Several nations have placed restrictions on the number of mycotoxins that can be found in food items.

Keywords: Jasmonic acid, biotic, abiotic stressors, ubiquitination, nitrosylation.

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INTRODUCTION

Photosynthetic activity occurs throughout the plant, or within its superior system. From the perspective of the system, products resulting from photosynthetic assimilation processes are stored in sink tissues i.e., harvestable organs, production and utilization of commodities are connected only when carbon and nitrogen have been absorbed in the source tissue [1, 2]. It has been tried, albeit to varying degrees of success, to increase the capacity of source and sink tissues to increase biomass output. Most of the molecular targets are genes involved in carbohydrate and sugar metabolism. Recently, a prospective technique that simultaneously enhances sink and source capacities was offered, using the potato crop plant as an example [3-5].

The fundamental principle of genotype-based precision oncology is the capacity to use targeted, potent, and perhaps less toxic medications to target genetic abnormalities particular to tumours. Comprehensive preclinical research and the initial identification of somatic, single-gene genetic abnormalities that might be pharmacologically addressed enabled the first steps towards genomic precision oncology [6, 7]. The comprehensive and integrative characterization of many cancers using high-throughput technologies under the efforts has recently ushered in a new era in the genomic or molecular taxonomy of cancer [8, 9].

Emerging aspects and advances in plant sciences

In general, cells that use light energy to convert atmospheric CO₂ into carbohydrates are said to exhibit

photosynthesis. Photosynthesis at an elevated plane is determined by the design of the canopy and leaf activity. Finally, photosynthesis is connected to the capacities of source and sink tissues-mature leaves and heterotrophic organs, respectively. In addition to the SA pathway, jasmonic acid (JA)-signaling (co)-regulation controls a range of plant developmental processes and responses to biotic and abiotic stressors; this regulation most likely involves the photosynthetic apparatus. In actuality, high-throughput gene expression data analysis revealed the presence of heat stress and methyl jasmonate (MeJA) sensitive genes [7, 9].

Proteomics and its variants, including phosphoproteomics, redox proteomics, and peptidomics, are essential tools for comprehending the mechanisms governing protein production and degradation in plants, as the machinery of plant cells is composed of hundreds of distinct proteins. Proteases and peptidases that are specialized to certain compartments, their number, location, and turnover, protein interactors, and posttranslational modifications (PTMs) including phosphorylation, ubiquitination, nitrosylation, and carbonylation are among these activities. By building an integrated understanding of the mechanisms behind changes in protein expression under diverse physiological and developmental circumstances, new targets may be established rationally to tailor photosynthesis for agronomic benefit [10, 11].

CO₂ must enter the substomatal cavity through the stomatal hole from the atmosphere for photosynthetic assimilation to take place. Because they adjust their aperture in response to several internal and external stimuli, stomata function as the initial point of control for gaseous flow because they balance the intake of CO₂ for photosynthesis with the loss of water through transpiration. Not only is oxygenic photosynthesis the source of our food, either directly or indirectly, but it is also a very important process. Antioxidants aid in preventing oxidative damage to tissues and hasten the healing of wounds. Strong antioxidant qualities are possessed by flavonoids, naphthoquinones, and anthraquinones. Shikonin, alkanin, lawsone, emodin, epigallocatechin-3-gallate, ellagic acid, and some herbal extracts have strong antioxidant activity that works by scavenging reactive oxygen species (ROS), stopping lipid peroxidation, and increasing the intracellular activity of antioxidant enzymes like glutathione peroxidase (GSH-Px), catalase (CAT), and superoxide dismutase (SOD). Herbal treatment also promotes angiogenesis, fibroblast cell proliferation, and the production of provisional extracellular matrix (ECM). Herbal extracts and natural products have immunomodulatory and anti-inflammatory qualities that speed up the healing process of wounds. To transform carbon dioxide and water into organic molecules like glucose sugars and starch, which they subsequently release into the atmosphere as molecular oxygen, plants,

algae, and cyanobacteria-which are oxygenic photosynthesizers use light energy [9, 11, 12].

Emerging aspects in biological sciences

Cancer ranks as the second most prevalent cause of mortality worldwide. In general, the incidence of cancer has increased. Thus, in human civilizations, cancer is a serious problem that affects everyone's health. Unfortunately, the disease shows diversity at the tissue level, which creates major obstacles to a precise diagnosis and successful treatment [13–15].

The prostate, lung and bronchus, colon and rectum, and urinary bladder have the largest percentages of cancer types in males, correspondingly. The breast, lung and bronchus, colon and rectum, uterine corpus, and thyroid are the areas in women where cancer incidence is highest. According to these statistics, the majority of cancers in men and women, respectively, are prostate and breast cancers. The malignancies that affect children most frequently are blood cancer and those that affect the brain and lymph nodes, respectively. A sequence of progressively occurring gene mutations that alter cell activities cause cancer [16, 17].

Other carcinogenic causes include radiation, bacteria, and viruses, which together account for 7% of all cancer cases. Cancer generally causes cellular relationships to break down and essential genes to stop working. This disruption causes aberrant cell division and affects the cell cycle. Under normal circumstances, proto-oncogenes are in charge of cell division and expansion, which are particularly hazardous to a cell's ability to survive. Tumour suppressor gene deficiency also results in uncontrolled cell division. Repair genes often encode proteins and/or enzymes with repairing capabilities; around 30 different types of repair proteins have been identified. In essence, repair genes' roles in properly repairing DNA are fulfilled by removing uracil from DNA, which also circumvents UV light-induced DNA damage and lesions [18–20].

It is often referred to as biological treatment or biotherapy, and it works to combat illnesses like cancer by boosting the body's natural defense mechanisms. Immunological checkpoint inhibitors are used in immunotherapy to eliminate the immunological tolerance that certain tumour cells have adopted. Numerous immunotherapies, including cancer vaccines, monoclonal antibodies, and non-specific immunotherapies, have been employed often. Numerous types of monoclonal antibodies, such as nude monoclonal antibodies, are utilized in the therapy of cancer. These antibodies function on their own without the need of drugs or radiolabeled materials. For instance, alemtuzumab is utilised in the treatment of certain individuals with chronic lymphocytic leukaemia. To the CD25 antigen, it binds [18–20].

The immune system is notably capable of recognising a wide range of antigens, including TAAs, that are present on the surfaces of tumour cells. Scientists and researchers have made several forecasts about vaccine treatment, indicating that it is more dependable than conventional remedies. The immune system is

required to establish a long-lasting and efficient immune response against cancer cells by providing a vaccine, from managing the cancer patients to their relapse-free survival. Another potentially effective tactic is the tumour vaccine [22–25].

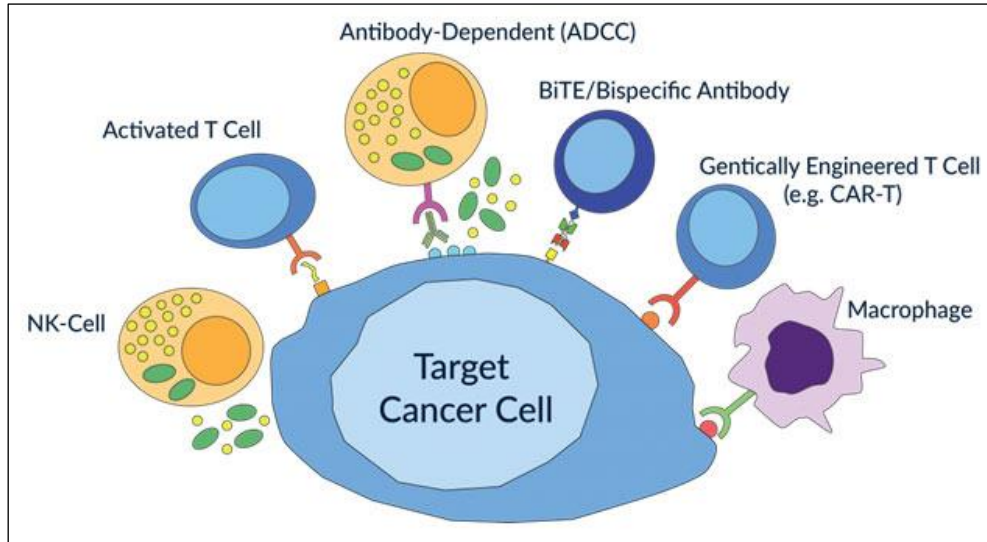


Fig-1: Shows the carcinogenesis by affecting tumor microenvironment

By altering the tumour microenvironment and hence causing epigenetic changes and the production of pro-carcinogenic processes, long-term chemical exposure can accelerate the development of breast cancer. Women who have been exposed to chemicals on a long-term basis have a far higher chance of developing breast cancer, and this risk increases with the length of the exposure. There are several substances that have been linked to the development of breast cancer; however, the most studied in relation to breast cancer to far are polychlorinated biphenyls (PCB) and dichlorodiphenyltrichloroethane (DDT), as early exposure to these compounds impairs the development of the mammary glands. Increased exposure to oil mist, synthetic fibres, organic solvents, polycyclic aromatic hydrocarbons (PAH), and pesticides was also linked to a possible association [19–22].

In patients with the Luminal-molecular subtype of BC, endocrine treatment can be utilised as a neoadjuvant or adjuvant therapy; it is useful in situations of metastasis or recurrence of breast cancer. Since the expression of ERs is a widely seen phenomena in patients with breast cancer, hormone therapy is frequently employed as a potential therapeutic modality. The goal of endocrine treatment is to reduce oestrogen levels or stop oestrogen from stimulating breast cancer cells. Selective oestrogen receptor modulators (SERMs) and selective oestrogen receptor degraders (SERDs) (fulvestrant) are drugs that block ERs, while aromatase inhibitors (AIs) (letrozole, anastrozole, exemestane) are therapies that try to reduce the oestrogen levels. Patients

with breast cancer who get hormonal treatment in addition to chemotherapy had lower death rates [19-21].

Autophagy, specifically macroautophagy, is a process of recycling intracellular components that functions as a quality-control mechanism in the body. It operates at a low basal rate, eliminating damaged organelles and pathologic long-lived or misfolded proteins. Additionally, autophagy may play a role in non-conventional protein secretion. In response to a range of stressors, including pathogenic, metabolic, and genotoxic ones, it is increased as a protective mechanism. The epithelial cells exhibit immotility and exhibit strong adhesion to both the surrounding matrix and one another. Such barriers are associated with adult physiological (e.g., wound healing) and pathological (e.g., organ fibrosis) conditions, as well as the reversible biochemical changes known as epithelial-mesenchymal transition (EMT), which enable a polarised epithelial cell to acquire a mesenchymal phenotype, normally utilised during embryogenesis [11, 12, 15].

It expanded by demonstrating a spectrum of intermediary phases commonly referred to as "partial EMT" that could progress, revert, or exist as a final state, reflecting a more fluid phenomenon. Originally described as transformative between two binary-like states: full-epithelial and full-mesenchymal. Tissue- or tumor-specific context-dependent triggers include a variety of growth factors, signalling pathways, mechanical and metabolic stress, and stiffness of the matrix. The activation of mesenchymal genes and the repression of epithelial genes frequently occur at the

level of one of the master EMT transcription factors. Epigenetic modifiers that exhibit non-linear, finely adjustable control over the process are also known as EMT regulators. There is a lot of evidence to suggest that EMT plays a part in cancer cell invasion and migration. However, new information has cast doubt on this contribution [23-25].

Emerging aspects in agriculture and food technology

Additionally, research on the nutritional value and toxicological analysis of unconventional oil sources was started [26, 27]. The experience with food poisoning and its impact on public health, together with global

developments, led to a change in focus from food poisoning to food safety. The focus was progressively expanded to include concerns about food safety from the standpoint of public health protection and utilising globally recommended risk-based methodologies. Important food safety issues were also addressed from a national standpoint by defining the criteria for developing national policies pertaining to food safety assurance and control on microbiological pathogens, mycotoxin exposure assessment, and pesticide residues in food and water, as well as by identifying food safety problems and infrastructure requirements [27, 28].

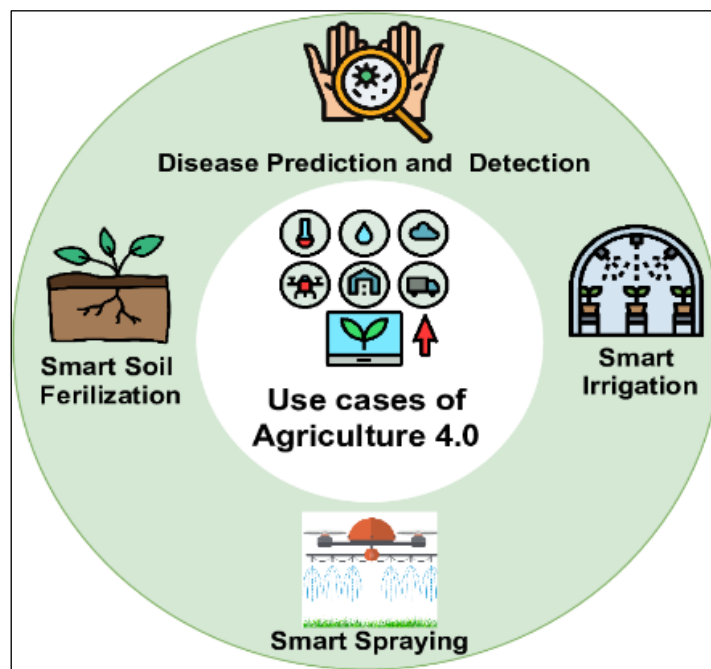


Fig-2: Shows the various applications in agriculture fields

The main component of essential oils extracted from a range of plants, such as sage (*Salvia officinalis*), clary (*Salvia sclarea*), tansy (*Tanacetum vulgare*), wormwood (*Artemisia* spp.), and white cedar (*Thuja occidentalis* L.), is thujone, a monoterpene ketone. Worldwide, essential oils derived from these plants are utilised in herbal remedies, alcoholic beverages, and perfumes. Due to its potential for toxicity, numerous nations have laws governing the amount of alpha- or beta-thujone that may be found in food and drink items. In the United States, thujone can be flavouring added to food as long as the final product is thujone-free. Savoury flavour is added to sausages, meats, sauces, and condiments by using sage oil, which has a 20–30% thujone (alpha- and beta-) content [21-24].

The central nervous system effects of thujone-containing sage, hyssop (*Hyssopus officinalis* L.), and cedar essential oils have been reported to elicit tonic-clonic or simply clonic convulsions. Thujone is thought to be the harmful ingredient in absinthism, a sickness brought on by long-term consumption of absinthe, which

is distilled from wormwood essence. Absinthe has been connected to the crippling diseases due to the toxicity of thujone. It down the restless, confused, and agitated before going into renal failure, according to a published case report [29, 30].

The adding pure natural components and plant extracts to food may help prevent botulism. Customers can choose teas with a high concentration of these anti-toxin components because the amount of catechins and theaflavins in commercial teas varies greatly. Consuming phenolic-rich fruits and vegetables may help prevent botulism, according to the previously described mechanism of natural polyphenolic chemicals inhibiting the botulinum toxin [28-30].

Furthermore, given the lack of apparent pharmacological treatment, whole foods high in polyphenols and the bioactive substances they contain have to be assessed for potential medical benefits. The food chain is seriously endangered by fusarium species and other fungal species that infect food, particularly

grain. For instance, Tanzanian babies' development was slowed when they ate fumonisin-containing maize, while adult celiac patients ingested more fumonisin than non-celiacs [31-34].

Mycotoxins' harmful effects on people are limited by the highest amounts that are allowed in food. Several nations have placed restrictions on the amount of mycotoxins that can be found in food items. Among mycotoxins, AFs have strong immunosuppressive, genotoxic, and carcinogenic effects on humans. Consequently, government organisations have set maximum amounts of aflatoxins, including AFB1, in the majority of food commodities [35-37].

CONCLUSION

The atmospheric concentration of carbon dioxide brought on by the combustion of fossil fuels. The combustion of fossil fuels and climate change are two of the biggest environmental problems. There is a lot of carbon dioxide in the atmosphere and the air we breathe as a result of burning fossil fuels. However, plants become useful to reduce the amount of pollutants in the atmosphere, carbon dioxide from the air is stored by both terrestrial and marine plants on earth.

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