Fuel

Biofuel from sunflower-bagasse

A wide variety of biomass resources such as wood and forest product residues, grasses, agricultural crops and their residues, and animal wastes can be used as energy feedstocks and chemicals. Liquid fuels derived from biomass are expected to contribute significantly to the energy potential from this resource. Pyrolysis is thermal degradation either in the complete absence of an oxidizing agent, or with such a limited supply that gasification does not occur to any considerable extent. Gas, liquid and char are the common products of pyrolysis and the relative proportion of these products depends very much on pyrolysis method and reactor environment.

Dr. Gercel from Department of Chemical Engineering, Anadolu University, Eskisehir, Turkey performed pyrolysis experiments on sunflower (***Helianthus annuus* Linn.**)-pressed bagasse in a fixed-bed tubular reactor. The effects of nitrogen flow rate and final pyrolysis temperature on the pyrolysis product yields and chemical compositions were investigated. The maximum bio-oil yield of 52.10 wt.% was obtained in a nitrogen atmosphere with flow rate of 50 ml min^{-1} and at a pyrolysis temperature of 550°C with a heating rate of 5 °Cs^{-1}. The chemical characterization results showed that the oil obtained from sunflower-pressed bagasse might be a potentially valuable source as fuel or chemical feedstocks (Gercel, *Bioresour Technol*, 2002, **85**, 113-117).

Poultry

Featherless chicken

The first genetically modified featherless chicken has been created. The chicken was produced by crossbreeding a small bareskinned bird with a broiler chicken. It is, according to its creators, environmentally friendly, fast-growing and low in calories. The lack of feathers keeps it cooler and leaner than the feathered variety, according to geneticist Avigdor Cahaner, who created the chicken at Israel's Hebrew University. These hybrids will, he says, revolutionise the chicken business. Feather-free birds direct their energy to growing larger rather than keeping cool. The birds also save money on ventilation and water that would be used in the plucking process. Several dozen featherless birds have already been produced [*Chem Ind*, 2002, **2**(11), 8].

Therapeutics

Resveratrol promote permeability transition pore opening mediated by Ca^{2+}

Chinese scientists investigated the mechanism of anti-cancer effect of resveratrol, its effects in cell apoptosis and role in mitochondrial permeability transition pore (PTP) induction. Results revealed that resveratrol inhibits the respiration and decrease the respiration control rate of mitochondria. Resveratrol can promote the PTP opening mediated by Ca^{2+}. These may be one of the pathways that resveratrol showed anti-cancer action and induce cells apoptosis [Xue-mei & Zhan-xia, *Acta Pharm Sinica*, 2003, **38**(2), 81-84].

Neurite outgrowth activity of *Withania*

Neurodegenerative diseases, such as Alzheimer's disease and Parkinson's disease, have attracted more and more public attention due to their damaging impact upon patients and families as well as society generally. Although their pathogeneses are yet to be fully understood, the disease processes are generally believed to be triggered by a number of genetic, environmental, and metabolic factors. Among them, dysfunction of neuronal networks is one of the causes of irreversible cognition impairment among patients. Therefore, the reconstruction of neuronal network as indexed by neurite outgrowth, provides new insights for drug development to prevent, treat, and cure these diseases.

***Withania somnifera* Dunal.** highly reputed as "Indian ginseng" in Ayurvedic medicine, is noted for its beneficial effects on the nervous system. A MeOH extract of the roots showed appreciable activity in the bioassay using a human neuroblastoma SK-N-SH cell line. Zhao and others from Japan reported five new withanolide derivatives obtained from the MeOH extract, and their neurite outgrowth activities.

From the methanolic extract of the roots several withanolide derivatives were isolated. Of the isolated compounds (20S,22R)-3α,6α-epoxy-4β,5β,27-trihydroxy-1-oxowitha-24-enolide, withanolide A (20S,22R)-4β,5β, 6α,27- tetrahydroxy-1-oxowitha-2,24-dienolide, withanoside IV, withanoside VI and coagulin Q showed significant neurite outgrowth activity at a concentration of 1μM on a human neuroblastoma SH-SY5Y cell line [Zhao *et al, Chem Pharm Bull*, 2002, **50**(6), 760-765].

Antioxidant activity of *Pluchea*

***Pluchea indica* Less** is a shrub widely found in the Indian subcontinent. In traditional medicinal system a decoction of the root has been used as an astringent and antipyretic. It has also been used in lumbago, leucorrhoea, dysentery, in poultices and for the treatment of atonic and gangrenous ulcers. Sen and others from Department of Pharmaceutical Technology, Jadavpur University, Kolkata studied the antioxidant activity of root extract, its effect on lipid peroxidation and H_2O_2-induced stimulation (*in vitro*) of dioxygenase activity of soybean lipoxygenase.

The influence of the methanol fraction of ***Pluchea indica*** root extract (PIRE), the dual inhibitors (BW 755C and phenidone) and vitamin on both *in vivo* and *in vitro* free radical scavenging activities, CCl_4-induced lipid peroxidation and the metabolism of arachidonic acid by lipoxygenase was studied. PIRE produced significant anti-inflammatory activity against glucose oxidase-induced paw oedema (*in vivo*), inhibited hydroxyl radical and superoxide generation, lysis of erythrocytes induced by hydrogen peroxide, CCl_4-induced lipid peroxidation and also dioxygenase activity of lipoxygenase (both in the presence and absence of hydrogen peroxide). Significantly higher free radical-scavenging activity was observed with BW 755 C and phenidone compared with PIRE. However, both BW755C and phenidone stimulated hydroxyl radical generation compared with the observed inhibitory effects of PIRE and vitamin E (Sen *et al, Phytother Res*, 2002, **16**, 331-335).

Psychopharmacological activity of Tragia

***Tragia involucrata* Linn.** is a shrub widely found in India. Different parts of the plant have been advocated in a variety of diseases. The roots have been reported to possess diaphoretic and alterative actions for use in pyrexia-induced cold extremities and for pain in legs and arms. A decoction of the roots has also bend reported to be useful in relieving bronchitis and attendant fever. Analgesic and anti-inflammatory activity of methanol fraction of root have also been reported. Dhara and others from Department of Pharmaceutical Technology, Jadavpur University, Kolkata studied psychopharmacological activity of the methanol fraction of the root extract in rodents. It produced an alteration of behavioural pattern and a reduction in spontaneous motility. A significant potentiation of pentobarbitone-induced sleep, a decrease of body temperature, suppression of the aggressive behaviour pattern and of the conditioned avoidance response was observed with the fraction. This suggests that the methanol fraction of the root extract possesses significant central nervous system depressant action (Dhara *et al, Phytother Res*, 2002, **16**, 326-330).

Cytotoxic triterpenoids from *Ganoderma*

The fruiting bodies of ***Ganoderma lucidum* Karst** are a well-known Chinese crude drug component, which have been used clinically in China, Japan and Korea for a long time as a home remedy. They are considered to promote longevity and maintain the vitality of humans. Nowadays, in China, this mushroom is used for leucopoenia. More than 130 highly oxygenated and pharmacological active triterpenoids have been isolated from the fruiting bodies, mycelia, and spores of *G. lucidum*. Some of them have been shown to have cytotoxicity against hepatoma cells (ganoderic acids U-Y), and hepatoma PLC/PRF/5 and KB cells (ganoderic aldehyde A) *in vitro*, an inhibitory effect on angiotensin converting enzyme (ganoderic acid F), inhibitory activity against farnesyl protein transferase (ganoderic acid A and methyl ganoderate A), β-glucosidase -inhibitory activity and hepatoprotective effect (ganoderic acid A), inhibitory effects on eukaryotic DNA polymerases (lucidenic acid O and lucidenic lactone) and antinociceptive activity (ganoderic acids A, B, G, H and compound C6). The triterpenes ganoderiol F and ganodermanontriol were found to have anti-human immunodeficiency virus (anti-HIV-1) and anticomplement activity; lucidumol A showed cytotoxicity against Lewis lung carcinoma (LLC) cells; ganodermanondiol had a cytotoxic effect on Meth-A (sarcoma, murine) cells; and ganoderic acid B, lucidumol B and ganolucidic acid A exhibited an inhibitory effect on human immunodeficiency virus (HIV)-1 protease.

Gao and others further isolated triterpenoid compounds, named lucialdehydes A-C **(1-3)**, together with ganodermanonol **(4)**, ganodermadiot **(5)**, ganodermanondiol **(6)**, ganodermanontriol **(7)**, ganoderic acid A **(8)**, ganoderic acid B8 **(9)**, and ganoderic acid C1 **(10)** from the fruiting bodies of *G. lucidum* and studied their cytotoxic activity against LLC, Meth-A, Sarcoma-180, and T-47D (human breast cancer) cells. Lucialdehydes B, C **(2, 3)**, ganodermanonol **(4)** and ganodermanondiol **(6)** showed cytotoxic effects on tested tumour cells. Of the compounds, lucialdehyde C **(3)** exhibited the most potent cytotoxicity against LLC, T-47D, Sarcoma 180, and Meth-A tumour cells with ED_{50} values of 10.7, 4.7, 7.1 and 3.8 μg/ml, respectively [Gao *et al*, *Chem Pharm Bull*, 2002, **50**(6), 837-840].

Antidermtophytic agent from *Allamanda*

***Allamanda cathartica* Linn.** is widely cultivated in India and tropical America. The leaves have been reported as a valuable cathartic medicine in moderate doses and the bark has been reported as a hydragogue in ascites. Tiwari and others from Banaras Hindu University, Varanasi studied active principles from the leaves and their dermatophytic property.

Plumieride isolated from the leaves was tested for fungitoxicity against the test dermatophytes, *Epidermatophyton floccosum* and *Microsporum gypseum*. The cytotoxic activity of plumieride was observed against P_{388} mouse leukaemia cells. In antidermatophytic testing against dermatophytes, plumieride exhibited absolute fungitoxicity, inhibiting the growth of both test dermatophytes completely. During cytotoxic testing against the leukaemia cell line the IC_{50} value of plumieride was found to be 85 μg/ml, indicating little cytotoxic activity against the P_{388} leukaemia cell line (Tiwari *et al*, *Phytother Res*, 2002, **16**, 393-394).

Anti-HIV activity of Oleander

Oleander (***Thevetia peruviana* Schum**) is an evergreen flowering shrub growing widely throughout tropical and subtropical regions. The latex is poisonous to man, animals and certain insects. Despite its toxicity, oleander has been used as an abortifacient, to treat congestive heart failure, malaria, leprosy, indigestion, ringworm, venereal disease and even as a suicide instrument. The leaves have been reported to contain iridoid glycosides, flavonoids, triterpenes, monoterpenes and cardiac glycosides.

In preliminary screening the ethanol extract of leaves showed high anti HIV-1 (IC_{50} = 1.56 μg/ml) and HIV-1 IN inhibitory activity (IC_{50} = 12.0 μg/ml). Tewtrakul and others fractionated the ethanol extract further into n-hexane, chloroform, and water soluble fractions and isolated several compounds from the water fraction and studied the inhibitory activities against HIV-1 IN and HIV-1 RT-associated DNA polymerase [RNA-dependent DNA polymerase (RDDP) and DNA-dependent DNA polymerase (DDDP)]

Two new flavanone glucosides, peruvianoside I **(3)**, peruvianoside II **(4)** and a new flavonol glycoside, peruvianoside III **(13)**, were isolated from the leaves, together with nine known flavonol glycosides quercetin 3-O[β-D-glucopyranosyl-(1→2)-β-D-galactopyranoside] **(5)**, kaempferol 3-O-[β-D-glucopyranosyl-(1→2)-β-D-galactopyranoside] **(6)**, quercetin 3-O-[6-O-sinapoyl)- [β-D-glucopyranosyl-(1→2)-β-D-galactopyranoside] **(7)**, kaempferol 3-O[(6-O-sinapoyl)-β-D-glucopyranosyl-(1→2)-β-D-galactopyranoside] **(8)** quercetin 3-O-[(6-O-feruloyl)-β-D-glucopyranosyl-(1→2)-β-D-galactopyranoside] **(9)**, kaempferol 3-O[(6-O-feruloyl)-β-D-glucopyranosyl-(1→2)-β-D-galactopyranoside] **(10)**, quercetin 3-O-[β-D-glucopyranosyl-(1→2)-β-D-galactopyranoside] **(11)**, kaempferol 3-O-[β-D-glucopyranosyl-(1→2)-β-D-galactopyranoside] **(12)**, and kaempferol 3-O-{β-D-glucopyranosyl-(1→2)-[α-L-rhamnopyranosyl-(1→6)]-β-D-galactopyranoside} **(14)** and two known iridoid glucosides, theviridoside **(1)** and thevaside **(2)**.

Of the isolated compounds, the compounds **7, 9, 11, 14** and quercetin showed appreciable HIV-1 RDDP inhibitory activity with IC_{50} values of 33, 20, 41, 38 and 43 μM, respectively, whereas the others showed moderate or no activity. In the case of HIV-1 IN inhibitory activity, compound **9** again showed the highest activity (IC_{50} = 5μM) among the isolated compounds, followed by **7, 8, 10, 14, 11** and **6** with IC_{50} values of 7, 30, 31, 43, 45 and 59 μM, respectively. Moreover, compounds that inhibited HIV-1 IN activity also possessed HIV-1 RDDP inhibitory activity, although they did not appreciably affect DDDP activity. Flavanone glucosides **3, 4** and iridoid glucosides **1, 2** showed no activity at concentrations below 100 μM against either HIV-1 RT or HIV-1 IN [Tewtrakul *et al, Chem Pharm Bull*, 2002, **50**(5), 630-635].

Human platelet aggregation inhibitors from Thyme

Thyme (***Thymus vulgaris* Linn.**) is commonly used as a culinary herb for adding flavour. Platelet aggregation is an important reaction to stop bleeding but it is considered that excessive platelet aggregation causes thrombosis and arterioscleosis. Okazaki and others from Japan studied the aggregation activity of compounds isolated from thyme.

Two compounds thymol **(1)** and 3,4,3´,4´-tetrahydroxy-5,5´-diisopropyl-2,2´-dimethylbiphenyl **(2)** were isolated from the leaves of thyme. Compounds **1** and **2** were assayed for inhibitory effects on platelet aggregation induced by collagen, ADP, arachidonic acid (AA) and thrombin. These compounds inhibited platelet aggregations induced by almost all of these stimulating agents except that compound **2** did not inhibit platelet aggregation induced by thrombin. Compound **1** strongly inhibited platelet aggregation induced by AA. Thromboxane A2 (TXA_2), which strongly induces platelet aggregation, is transformed via the cyclooxygenase pathway from AA, suggesting that **1** is a cycloxygenase inhibitor (Okazaki *et al, Phytother Res*, 2002, **16**, 398-399).

Treatment of animals corneal opacity using latex of *Calotropis*

Corneal opacity in animals is treated by antibiotics and steroids but to avoid this practice and follow traditional methods, veterinary scientists at BAIF Institute for Rural Development , Karnataka did experiment with latex of ***Calotropis procera* Ait.** (Hindi-*Aak*).

The experiment was done on two farm animals, JR-cross heifer and HF-cross cow who were suffering from corneal opacity due to external injuries. For the treatment of each animal 4 drops of latex was mixed thoroughly in 2g of butter taken in a stainless steel cup and applied once in the fossa (not directly to eye) located between eye and base on the ear and then observed for one week for healing. In both the animals after the application, swelling of the eye and severe lachrymation was seen after a day and continued for 3-4 days. By seventh day there was complete clearance of the opacity of cornea.

The results are supported by traditional practices about the use of root of Calotropis to alleviate eye disorders in human. However, there is scope for further studies (Hedge & Nimbalkar, *Indian Vet J*, 2003, **80**, 562-563).

Neuroprotective compounds from Biota

Dried leaves of ***Thuja orientalis* Linn.** are used as a haemostatic, expectorant and hypotensor in Korean folk medicine. Methanolic extract of the leaves shows significant protective activity. Koo and others from Seoul, South Korea isolated and studied neuroprotective compounds from the 90% MeOH fraction of leaves using primary cultures of rat cortical cells injured by excess glutamate as an *in vitro* assay system.

A new pinusolide derivative, 15-methoxypinusolidic acid **(1)**, and other new isopimarane diterpene, *ent*-isopimara-15-en-3α, 8α-diol **(2)** with three known diterpenes, lambertianic acid **(3)**, isopimara-8(9),15-dien-18-oic acid **(4)** and isopimara-7(8),15-dien-3β,18-diol **(5)** were isolated from the 90% MeOH fraction of leaves. Compound **1** showed significant protective activity against glutamate-induced neurotoxicity in primary cultures of rat cortical cells [Koo *et al, Chem Pharm Bull*, 2002, **50**(6), 834-836].

Anticonvulsant and sedative effects of Salvadora

***Salvadora persica* Linn.** is widely known in traditional medicine. Monforte and others from School of Pharmacy, Annuziata, Italy studied its neuropharmacological activity. They evaluated the effects of stem extracts of this plant on the potentiation of pentobarbital-induced hypnosis and on protection against pentylenetetrazol (PTZ)-induced convulsion. The extracts extended sleeping-time and decreased induction-time induced by sodium pentobarbital; in addition it showed protection against PTZ-induced convulsion by increasing the latency period and diminishing the death rate (Monforte *et al, Phytother Res,* 2002, **16**, 395-397).

Antiviral activity of *Melia*

Herpes simplex virus (HSV) causes a wide range of infections, which are usually self-limiting in the immunocompetent host. HSV-1 is generally associated with primary and recurrent mucocutaneous, facial, ophthalmic or genital lesions. The virus establishes a latent ganglionic infection in the neurons that innervate the area of primary infection and it is periodically reactivated causing repeated lesions at or near the site of initial infection.

A number of nucleoside analogues have been developed as antiherpetic agents, i.e. thymidine analogues (idoxuridine, trifluridine), guanosine analogues (acyclovir, gancyclovir, pencyclovir) and arabinonucleosides (vidarabine/Ara-A and Ara-T). The therapeutic limitation of these nucleoside analogues is that drug resistant strains develop readily through mutations in the thymidine kinase and/or polymerase viral genes. For this reason, the search for new types of antiviral compounds that may act against different targets along the herpesvirus replication cycle has been intensified. Such compound is particularly useful because of their relative abundance in nature and, in many cases their low cytotoxicity.

Meliacine (MA), an antiviral principle isolated from leaves of ***Melia azedarach* Linn.** exhibits potent antiviral activity against herpes simplex virus type 1 (HSV-1) by inhibiting specific infected-cell polypeptides (ICPs) produced late in infection. Some of these are involved in DNA synthesis and in the assembly of nucleocapsids. Alche and others from Argentina studied the effect of meliacine on HSV-1 propagation. The report provides additional evidence to elucidate the mode of action of MA against HSV-1. Time-of-addition experiments confirmed that MA affects a late event in the multiplication cycle of HSV-1. MA diminished the synthesis of viral DNA and inhibited the spread of infectious viral particles when HSV-1 that expresses β-galactosidase activity was used. In addition, the lack of a protein with an apparent MW of 55 kD was detected in MA-treated cell extracts. Ultrastructural analysis of infected cells showed that, in the case of MA treatment, a large number of unenveloped nucleocapsids, accumulated in the cytoplasm and a minor proportion of mature virus were found in cytoplasmic vesicles.

These findings suggest that MA exerts an antiviral action on both the synthesis of viral DNA and the maturation and egress of HSV-1 during the infection of Vero cells (Alche *et al, Phytother Res*, 2002, **16**, 348-352).

Effect of *Pongamia pinnata* root extract on gastric ulcers

The seeds, leaves and seed oil of *Karanj*, ***Pongamia pinnata* (Linn.) Pierve** are reported to possess anti-inflammatory activity and ulcerogenic potential. Recently scientists at Department of Pharmacology, Institute of Medical Sciences, BHU, Varanasi found the ulcer protective effect of extracts of both seeds and roots. In continuation of their work these scientists studied the effect of methanolic extract of ***P. pinnata*** roots (PPRM) against various experimental gastric ulcer models and offensive and defensive gastric mucosal factors in rats. An initial dose-response study using 12.5-50mg/kg ***P. pinnata*** root extract, when given orally in two divided dose for 4 days + 5th full dose on the day of experiment 60 min before the experiment, indicated 25mg/kg as an optimal regimen and was used for further study. PPRM showed significant protection against aspirin and 4 hr PL, but not against ethanol-induced gastric ulceration. It showed tendency to decrease acetic acid induced ulcer after 10 days treatment. Ulcer protective effect of PPRM was due to augmentation of mucosal defensive factors like mucin secretion, life span of mucosal cells, mucosal cell glycoproteins, cell proliferation and prevention of lipid per oxidation rather than on the offensive acid-pepsin secretion (Prabha *et al, Indian J Exp Biol*, 2003, **41**, 304-310).

Antiallergic activity of *Bupleurum*

Bupleurum falcatum* Linn.** is one of the most widely used plants in traditional oriental medicines. *B. falcatum*, or its important principle saikosaponins, is known to have numerous pharmacological activities, including anti-inflammatory, antipyretic and antitussive actions. From a preliminary study with a series of plant extracts it was shown that the methylene chloride fraction of ***B. falcatum root possesses antiallergic activity. Using an activity-guided fractionation procedure it was possible to isolate a single triterpenoid glycoside, known as saikosaponin-A, which is responsible for the antiallergic activity. Park and others from South Korea evaluated the inhibitory action of saikosaponin-A on allergic asthma and its mechanism in experimental animals.

The separation and isolation of an extract of ***B. falcatum*** were performed based on antiallergic activities in preliminary studies with higher plants. The final active compound was identified as saikosaponin-A (SSA), a triterpenoid glycoside. SSA at more than 1 mg/kg (i.v.) significantly inhibited the passive cutaneous anaphylaxis reaction in rats in a dose-dependent manner, attaining a maximum inhibition of approximately 60% with 10 mg/kg. SSA at 3 and 10 mg/kg also suppressed asthmatic bronchoconstriction in sensitized guinea-pigs. SSA possesses a weak inhibitory activity on histamine-induced tracheal contraction in guinea-pigs and on histamine release induced by A-23187 in rat mast cells. These results indicate that SSA has an inhibitory activity against allergic asthma. This activity seems to derive from both antagonism of the histamine action and inhibition of allergic mediators (Park *et al*, *Phytother Res*, 2002, **16**, 359-363).

Effect of **betel leaf** on healing of NSAID drug induced experimental ulcer

Betel or *pan*, ***Piper betle* Linn.** possesses medicinal properties including gastrocytoprotective properties on experimentally induced gastric lesions by antioxidative mechanism. In continuation to their findings on oxidative properties of the leaves, Majumdar and his team at University College of Medicine, Kolkata studied its curative action on non steroidal anti-inflammatory drugs (NSAID) induced ulcers as the prolong use of NSAID is considered to be one of the causative factors of peptic ulcer.

Treatment with ethanol extract of leaf of *P. betle* at a dose of 150 mg/kg body weight daily for 10 days, after induction of peptic ulcer by NSAID in albino rats, produced significant healing effect. During healing process, on treatment with the extractive, antioxidative factor, e.g. superoxide dismutase and catalase activity, mucus and total gastric tissue sulfhydryl group were increased. In contrast, oxidized lipid and oxidatively modified proteins were reduced to near normalcy, within 7 to 10 days, however, change in the untreated group was not significant. The extract also showed significant *in vitro* free radical scavenging action. The results suggest that the antioxidant or free radical scavenging activity of the plant extract, may be responsible for its healing action. (Majumdar *et al*, *Indian J Exp Biol*, 2003, **41**, 311-315).

Antidiarrhoeal effect of methanolic root extract of Anantamul

The roots of Indian Sarsaparilla or *Anantamul*, ***Hemidesmus indicus* R. Br.** are extensively used by tribals for diarrhoea and dysentery. To confirm scientifically, scientists at University of Madras, Chennai carried out an *in vitro* and *in vivo* study on male and female wistar rats weighing 150-250g.

Methanolic extract of ***H. indicus*** root (MHI) was screened for its antimicrobial activity against *Salmonella typhimurium, Escherichia coli* and *Shigella flexneri in vitro* and in experimentally induced diarrhoea in albino rats, *in vivo*. MHI had an anti enterobacteriae effect as evident from agar well diffusion method and decrease in CFU/ml in MHI treated LB broth culture. MHI inhibited the castor oil induced diarrhoea in rats as judged by a decrease in the amount of wet faeces in MHI-pretreated rats at a dose of 500-1500 mg/kg. The results indicated that MHI was more active than standard antidiarrhoeal drug, lomotil. Phytochemical tests revealed the main constituents as tannins, steroids, triterpenoids and carbohydrates. Present findings suggested that MHI might elicit an antidiarrhoeal effect by inhibition of intestinal motility and by its bacteriocidal activity (Das *et al, Indian J Exp Biol*, 2003, **41**, 363-366).

Cancer fighting tomatoes

Researchers from Purdue University (West Lafayette) and the U.S. Department of Agriculture (USDA) Vegetable Laboratory (Beltsville) have genetically modified tomato plants to generate high levels of the cancer-fighting antioxidant lycopene. The tomatoes have up to three times the amount of lycopene in conventional tomatoes.

The scientists were initially working to develop tomatoes that would ripen later than existing varieties for food processing. In the process they discovered that the new tomatoes also had more lycopene than conventional tomatoes. "This is one of the first examples of increasing the nutritional value of food through biotechnology," says Avtar Handa, professor of horticulture at Purdue. "We think this approach could be used to increase the phytonutrient content of other fruits and vegetables."

The increase in lycopene occurred naturally in the GM tomatoes, says Autar Mattoo, who heads the USDA Vegetable Laboratory. "The lycopene levels increased by 2.0-3.5 times compared to the nonengineered tomatoes," Mattoo says.

Lycopene has attracted much attention since 1995, when a six-year Harvard University (Cambridge) study found that men who ate at least 10 servings of foods per week containing tomato sauce or tomatoes were 45% less likely to develop prostate cancer. Other research has found that lycopene also reduces the amount of oxidized low-density lipoprotein — the so-called bad cholesterol — and may reduce the risk of heart disease.

A U.S. patent application has been filed on behalf of USDA and the Purdue Research Foundation. The Consortium for Plant Biotechnology Research (St. Simons Island), a USDA program, funded the research [*Chem Week*, 2002, **164**(27), 71].