



## St. ALOYSIUS' COLLEGE

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Dept. of Botany & Microbiology

## Trends in Microbiology

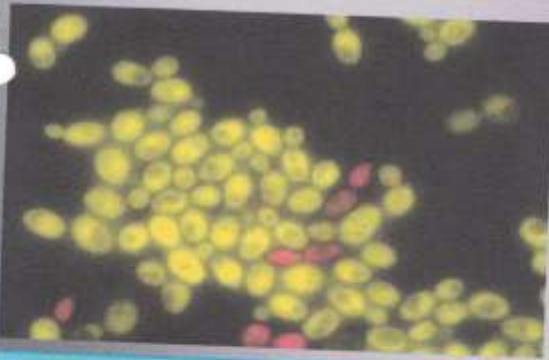


There is No "I" in Team



### Scientists program solitary yeast cells to say 'hello' to one another.

For centuries, human have been playing with yeast. But these simple fungal cells usually do their jobs—making bread rise or converting sugar into alcohol—without having to communicate or work together. UW researchers have produced cell-to-cell communication in baker's yeast, a first step in building multicellular organism from scratch. The red yeast cells produce a plant hormone, which "tells" the green cells to express a gene differently.



### The Microbe

*The microbe is so very small*

*You cannot make him out at all,*

*But many sanguine people hope*

*To see him through a microscope.*

*His jointed tongue that lies beneath*

*A hundred rows of curious teeth;*

*His seven tufted tails with lots*

*Of lovely pink & purple spots,*

*His eyebrows of a tender green;*

*All these have never yet been seen—*

*But Scientists, who ought to know,*

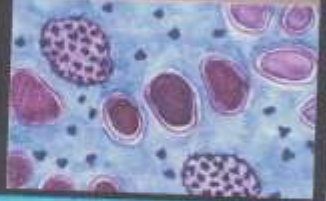
*Assure us that they must be so....*

*Oh! Let us never, never doubt*

*What nobody is sure about!*

### Researches locate promising target for potential vaccine against MALARIA !!

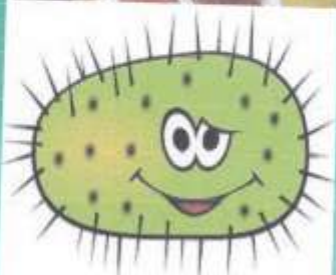
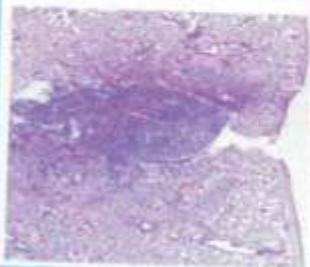
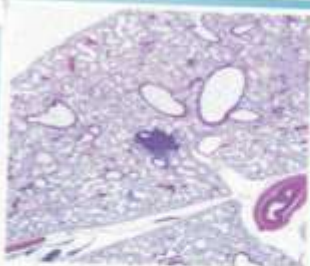
Researchers from Johns Hopkins Bloomberg School of Public Health have located a new- and likely more promising, they say- target for a potential vaccine against malaria, a mosquito-borne illness that kills as many as 750,000 people each year.



How small genetic change in *Yersinia pestis* changed human history-

*From gastrointestinal infection to bubonic plague*

While studying *Yersinia pestis*, the bacteria responsible for epidemic plague such as Black Death, scientists found a small genetic change that fundamentally influenced the evolution of deadly pathogen, and thus the course of human history. They demonstrated how the acquisition of a single gene caused the shift of *Y. pestis* from causing a primarily gastrointestinal infection to a more serious and often fatal respiratory disease and lead to infections associated with bubonic plague.



## Latest discoveries in Microbiology

- Discovery that carcinogenic agents induce genome-wide loss of heterozygosity (LOH).
- Development of genetically-engineered mouse models of lymphocyte deficiencies for studies of microbial and autoimmune diseases.
- Development of a new class of HIV inhibitors.
- Discovery of a new iron transport system in *Staphylococcus aureus*.
- Invention of a new method of intracellular delivery of biologically active peptides and proteins into cells.

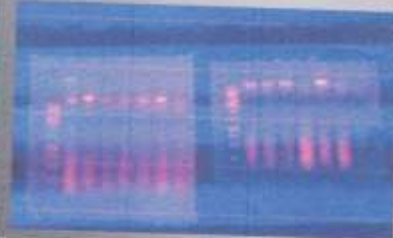
## SUMMER TRAINING PROGRAM

ON

## BASIC MICROBIOLOGICAL TOOLS AND TECHNIQUES

Summer training program was organized by Department of botany & microbiology for the students on basic microbiological tools and techniques.

Techniques like chromatography, DNA isolation, slide culture etc. were demonstrated to students.



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Department of Botany &  
Microbiology





## NATURE

Department of Botany & Microbiology  
St. Aloysius College (Autonomous) Jabalpur

VOLUME: Oct-Dec. 2015



### Plants Release Animal-like Substance When Stressed

Although plants do not have nervous systems, they respond to stress with chemical and electrical signals that are remarkably similar to those of animals; a new study has found. The findings, published in the journal *Nature Communications*, could help to explain why certain plant-derived drugs work so well in humans: the center of it all is the neurotransmitter GABA (gamma-aminobutyric acid), which humans and animals, as well as plants, release when they are stressed out.

According to senior author Matthew Gilliam of the University of Adelaide's School of Agriculture, Food and Wine said in a press release, GABA is produced by plants under stress, for example, when they encounter drought, salinity, viruses, acidic soils or extreme temperatures, but it was not known whether GABA was a signal in plants. He continued, "We've discovered that plants bind GABA in a similar way to animals, resulting in electrical signals that ultimately regulate plant growth when a plant is exposed to a stressful environment."



### DID YOU KNOW?

A TREE CAN ABSORB UP TO 48 LBS OF CARBON DIOXIDE A YEAR.  
PLANT A TREE - REDUCE GLOBAL WARMING.



### Fighting H1N1 -- New Ways to Kill the Flu

**WHAT IS THE FLU:** The flu is caused by the influenza virus, which targets the respiratory tract by binding to the surface of cells. Then the virus releases its genetic information into the cell's nucleus to replicate itself. When the cell dies, those copies are released into the body, infecting other cells. Flu symptoms are unpleasant, but not life threatening by themselves. However, the flu weakens the immune system, making the body vulnerable to more serious infections such as pneumonia. Because the flu is caused by a virus — as opposed to bacteria — antibiotics are not an effective treatment. Both the flu and the common cold are best treated by bed rest, consuming lots of fluids, and taking over-the-counter medication to ease symptoms until the virus runs its course. There are three basic strains of the flu virus: A, B and C. A is the most common strain, and the most severe. The flu vaccine works by triggering the body's immune system response. The body recognizes the vaccine as a foreign invader and produces antibodies to it. However, flu strains differ from year to year. A phenomenon called original antigenic sin occurs when the antibodies produced by the body's immune system to fight exposure to the flu virus become part of the body's "memory" so that it can fight off future exposure to the same flu strain. The problem is that those same antibodies end up suppressing the creation of new antibodies when the body is exposed to a new strain of the flu, making last year's flu vaccine ineffective against the newer strain. The phenomenon has also been observed in dengue fever and HIV, among other viruses.

Broccoli has large amounts of soluble fiber, making it effective at reducing LDL cholesterol and risks for heart disease.



**DURING PHOTOSYNTHESIS, PLANTS EMIT LIGHT, CALLED FLUORESCENCE, THAT HUMANS CAN'T SEE.**



### New species of metal-eating plant discovered

Scientists from the University of the Philippines, Los Baños have discovered a new plant species with an unusual lifestyle — it eats nickel for a living — accumulating up to 18,000 ppm of the metal in its leaves without itself being poisoned, says Professor Edwino Fernando, lead author of the report. Such an amount is a hundred to a thousand times higher than in most other plants. The new species is called *Rinorea niccolifera*, reflecting its ability to absorb nickel in very high amounts.

Nickel hyperaccumulation is such a rare phenomenon with only about 0.5–1% of plant species native to nickel-rich soils having been recorded to exhibit the ability. Throughout the world, only about 450 species are known with this unusual trait, which is still a small proportion of the estimated 300,000 species of vascular plants.



### Fungi may help drought-stressed wheat

Scientists at Aarhus University have discovered that fungi associated with plant roots may improve growth and yield of drought-stressed wheat. A specific group of useful fungi -- the so-called *arbuscular mycorrhizal* fungi (*AM* fungi) -- may be able to help alleviate drought stress in wheat. These fungi live in a symbiotic relationship with plant roots. Recent research from Aarhus University demonstrates that the fungi can improve growth and yield in some wheat varieties under drought stress. Drought stress leads to water deficits in crops, which affects crop growth and development and a number of metabolic processes in the plants, such as photosynthesis and primary metabolism. Previous experiments have demonstrated that this symbiotic relationship involves a mutual exchange of nutrients between the crop and the fungus. The fungus provides inorganic nutrients, in particular phosphorus, to the plant. Furthermore, the fungi help crops fight biotic stress factors such as diseases and pests. Scientists from the Department of Agroecology at Aarhus University have recently examined whether the association with *AM* fungi can alleviate drought stress in wheat.

### Things You Didn't Know About... Carnivorous Plants

1. Sundews get their name from glistening, sticky, hairlike trichomes, which secrete enzymes that digest insects unlucky enough to get stuck.
2. The adaptation of trapping and digesting prey has arisen at least nine times in different plant families in response to soil lacking the nutrients nitrogen, phosphorus and potassium.
3. The 600 or so carnivorous species on the planet today thrive in places where other plants struggle, including bogs and heaths.
4. Aquatic bladderworts are the fastest carnivorous plants. When passing prey trip the bladder's "trigger hairs," the trapdoor opens so quickly that the change in pressure sucks the prey inside.
5. The oldest carnivorous plant leaf fossil, from a relative of *Roridula*, was found in Baltic amber that's 35 million to 47 million years old.



The liquid inside young coconut can be used as substitute for blood plasma.

**A teaspoon of honey is actually the lifework of 12 bees.**

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TRENDS  
IN  
MICROBIOLOGY  
Jan- March, 2015

### THE MICROBIOLOGY OF BIOMINING

Bio-mining, the use of micro-organisms to recover precious and base metals from mineral ores and concentrates, has developed into a successful and expanding area of biotechnology.

Bio-mining processes employ microbial consortia that are dominated by acidophilic, autotrophic iron- or sulfur-oxidizing prokaryotes.

Mineral bio-oxidation takes place in highly aerated, continuous-flow, stirred-tank reactors or in irrigated dump or heap reactors, both of which provide an open, non-sterile environment.

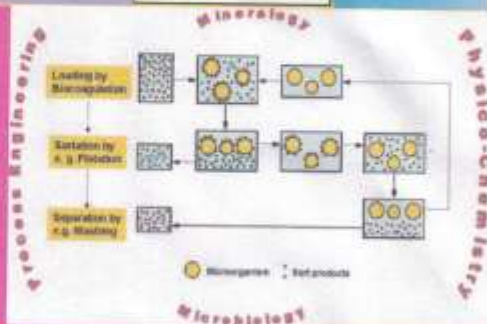
Continuous-flow, stirred tanks are characterized by homogeneous and constant growth conditions where the selection is for rapid growth, and consequently tank consortia tend to be dominated by two or three species of micro-organisms.

### Bio-mining (Mineral Bioleaching, Mineral Bio-oxidation)

Bio-mining is the use of autotrophic, acidophilic, iron- and sulfur-oxidizing microorganisms to produce ferric iron and sulfuric acid. These chemicals are capable of oxidizing a variety of minerals containing insoluble metal sulfides such as  $\text{FeS}$ ,  $\text{CuS}$ ,  $\text{NiS}$ , and  $\text{ZnS}$  into their soluble sulfate forms e.g.,  $\text{FeSO}_4$ ,  $\text{CuSO}_4$ ,  $\text{NiSO}_4$ , and  $\text{ZnSO}_4$ , respectively, resulting in their extraction into water from which they may be more easily recovered. Metal leaching is carried out from mineral waste dumps, or more typically and especially from constructed heap or stirred tank reactors. The metals recovered commercially in the greatest quantities are copper and gold.

Our bet is to export the technology, so that the world can move from just exploiting natural resources to adding a value with the help of biotech.

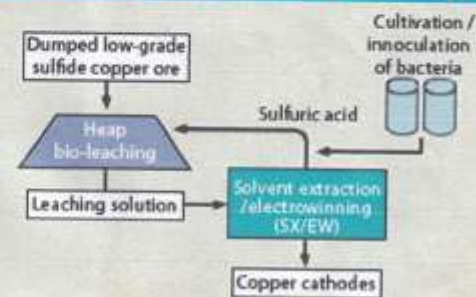
GABRIEL RODRIGUEZ



### BIOMINING – HISTORY

Bio-mining was first envisioned in the 1950s and 1960s, when acid-loving microbes called acidophiles were discovered. Brierley says: In the decades since, researchers have been trying out bio-mining here and there, but large-scale buy-in from the mining industry has been slow to come. Zobrist says: That's because bio-mining requires new infrastructure, making it more economical for companies to do things the traditional way: by crushing and milling rock, separating the valuable metal-containing minerals by flotation, and then smelting the minerals at high pressures and temperatures to get out the metals.

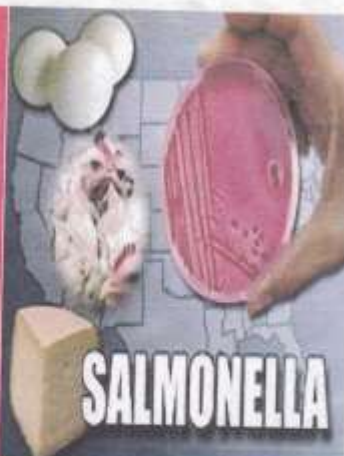
### Copper recovery process using bio-mining technology



## Stopping Salmonella in Eggs

HOW DO *E. coli* AND *Salmonella* GET INTO OUR FOOD?

*E. coli* is a type of bacteria that often resides within the intestinal tracks of animals, including people. Many strains are harmless, but strain O157 causes serious food poisoning. In the intestines, the bacteria help to maintain health by producing vitamin K, and by keeping other species out. When fecal matter, manure, or pieces of the intestines are poorly processed and come into contact with meat or vegetables, the bacteria contained within them can attach themselves to food. *Salmonella* is also a bacteria, capable of causing diarrhea and other potentially severe illnesses. It can be found in water, fecal matter, and the intestines of mammals and birds. The best defense against infection is careful cleaning and cooking of meats and eggs.



## Engineered Tobacco Plants as Biofuel

Finally putting tobacco plants to good use, researchers from the Biotechnology Foundation Laboratories at Thomas Jefferson University have identified a way to increase the oil in tobacco plant leaves, with the aim of using it as biofuel. This is a promising prospect, one, because it offers an alternative to exploiting plants that are used in food production, and two, because tobacco plants generate biofuel more efficiently than other agricultural crops. The challenge researchers faced was that this precious oil is mostly found in tobacco seeds, and tobacco plants only produce about 600 kg of seeds per acre. However, they have now found ways to genetically engineer the plants so that their leaves express more oil.



"While the biological properties of deoxyribose nucleic acid suggest a molecular structure containing great complexity, X-ray diffraction studies described here... show the basic molecular configuration has great simplicity."

Rosalind Franklin

## OBJECTIVE QUESTION

What crucial feature of a penicillin is involved in its mechanism of action?

- Carboxylic acid
- $\beta$ -lactam ring
- Acyl side chain
- Thiazolidine ring

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## TRENDS IN MICROBIOLOGY

Oct-Dec, 2015



### QUIT QUIT QUIT QUIT SAY NO TO ANTIBIOTICS QUIT QUIT QUIT QUIT

An antibiotic might be described as an antibacterial agent that inhibits bacterial growth or kills bacteria. However, colds and many other upper respiratory infections, as well as some ear infections, are caused by viruses, not bacteria. If antibiotics are used too often for things they can't treat—like colds or other viral infections—they can stop working effectively against bacterial infections. This phenomenon is known as antibiotic resistance, and is a direct result of antibiotic overuse.

#### Pros of Antibiotics

**Highly effective:** Antibiotics can treat a wide variety of infections such as strep throat, tonsillitis, and sinusitis.

**Easy to administer:** Most antibiotics are easy to administer since you can take them orally or via injection.

**Few side effects:** Many antibiotics have few side effects, which makes them the perfect option when you feel extremely sick.

**Cost-effective:** Most older antibiotics—especially those with generic alternatives—are very affordable on any budget, even if you lack health insurance.



#### Cons of Antibiotics

**Possibility of an allergic reaction:** Some people are extremely allergic to some types of antibiotics, such as those containing sulfa. Unfortunately, sulfa is present in many common antibiotics, so it may be more difficult to find a suitable medication for your illness.

**Drug-resistant bacteria:** If you do not take the full dose of an antibiotic, it only kills some of the bacteria in your system and can make the rest antibiotic-resistant, which means antibiotics may not work as well for you in the future.

**Potential side effects:** Many antibiotics have side effects, some can trigger nasty problems such as digestion issues, discomfort, nausea, diarrhea, and sensitivity to light.

### ALTERNATIVES TO ANTIBIOTICS

**Antimicrobial peptides:** Peptides produced by the American alligator could add to the arsenal of antibacterials. Peptides with antibacterial activity have been isolated from frogs, alligators and cobras, among others, and some seem to be effective in epithelial cell cultures and at healing wounds in mice. One, called pexiganan, based on a peptide from frog skin, is now in phase III clinical trials to treat diabetic foot ulcers.

**Phages:** Of all the alternatives to antibiotics, phages — viruses that attack bacteria — have been used the longest in the clinic. Phages have several advantages over antibiotics. Each type attacks only one type of bacterium, so treatments leave harmless (or beneficial) bacteria unscathed. The US National Institute of Allergy and Infectious Diseases in Bethesda, Maryland, now lists phages as a research priority for addressing the antibiotic crisis.

**Gene-editing enzymes:** CRISPR, a gene-editing technique that has taken the scientific world by storm, is based on a strategy that many bacteria use to protect themselves against phages. Researchers are turning that system back on itself to make bacteria kill themselves.

**Metals :** Metals such as copper and silver are the oldest antimicrobials. They were favoured by Hippocrates in the fourth century bc as a treatment for wounds. Some groups are exploring the use of metal nanoparticles as antimicrobial treatments. Silver ions are used in an antimicrobial wound dressing.

**Predatory Bacteria:** Bacteria cause infection, but some can also fight it by preying on fellow microbes. Several researchers are beginning to test these predatory bacteria in animal models and cell cultures. The best-known species, *Bdellovibrio bacteriovorus*, is found in soil.

By using antibiotics as a cure-all, the magic bullet has come back to hit us. Every time we take antibiotics, we give harmful bacteria a new opportunity to become resistant. Clearly we need to find other ways to fight infections and to support our immune systems when we get sick. Here are some natural alternatives to prescription antibiotics.

#### Grapefruit Seed Extract

A grapefruit bioflavonoid concentrate works to help knock out a cold. You can take one 100 mg tablet every four to five hours or a few drops of the liquid.

#### Olive Leaves

Olive leaves have been used medicinally for centuries to treat fever, malaria, colds, and fungal infections.

#### EpiCor

EpiCor is a fermented yeast product that enhances natural killer cell activity and helps modulate and strengthen the immune system. It contains a unique blend of vitamins, minerals, amino acids, and antioxidants.

#### Russian Choice Immune

This is a probiotic that originated as a fermented milk product in Eastern Europe. It supports the immune system and the gastrointestinal system.

#### Elderberries

Elderberries contain anti-inflammatory bioflavonoids that have been shown in test tube studies to inhibit viral growth.

Watchful waiting and allowing the infection to resolve naturally--along with children's echinacea, a multivitamin, vitamin C, and a no-sugar, no-refined-carbohydrate diet--may stop the cycle of repeat infections in children.

#### *Electrical stimulation may offer Alternative to antibiotics for wound treatment*

The team from Washington State University (WSU) in Pullman describes their electrochemical scaffold or "e-scaffold" approach for wound healing.

They note that when they used the e-scaffold on a biofilm of the highly multi-drug-resistant *Acinetobacter baumannii*, it killed nearly all of the microbes within 24 hours. The bacterial population was reduced to 1/10,000th of its original size.

#### *UA microbiologists search for antibiotic alternatives in bacteria*

A study found bacteria in manure from antibiotic-free cows helped soil bacteria gain resistant genes against beta-lactams, a class of antibiotics that includes penicillin. A team of microbiologists led by Dr. David Baltrus at the UA are studying if bacteriocins, or bacterial toxins that kill other bacteria, can explain the "killing abilities" between communities of bacteria on different leaves of a single plant. Bacteriocins create an antibiotic-like effect. According to Raiwe, using bacteriocins as an alternative to antibiotics may reduce the cost of producing and storing crops and feed by curtailing antibiotic resistance.

#### *Alternatives to Antibiotics to Keep Food Animals Healthy*

USDA's Agricultural Research Service is developing new technologies to address antibiotic resistance and reduce the use of antibiotics through agricultural management, which includes food, animals, crops and the environment water, soil and climate. Using natural supplements like vitamin D to treat a condition of dairy cows called "mastitis," which affects milk quality and production of cattle.



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#### *Hydrogen peroxide attacks the biofilm*

A discovery reports that applying electrical stimulation to biofilm reduces dissolved oxygen to hydrogen peroxide at the electrode surface. Hydrogen peroxide is a disinfectant that attacks various essential cell components in bacteria and other microbes and lead them into death.





**NATURE**  
(April-June 2015)  
**St. ALOYSIUS' COLLEGE**  
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## Beauty of the Nature: Fascinating Fungal Biodiversity

**Bitter Oyster (*Panellusstipticus*):** It is a species of fungus in the family Mycenaceae. It grows in groups or dense overlapping clusters on the logs, stumps, and trunks of deciduous trees. It is a bioluminescent fungi.

**Golden Jelly Fungus (*Tremellalesenterica*):** Common names include the yellow brain and witches' butter. It belongs to Tremellaceae family. It is most frequently found on dead but attached and on recently fallen branches, especially of angiosperms. Its convoluted or lobed surface is greasy or slimy when damp, it dries into a thin film which revives after subsequent rain. Though bland and flavorless, it is edible.

**The Wrinkled Peach (*Rhodotuspalmarum*):** It is a genus in the Physalaciaceae family. It is a monotypic genus and consists of the single mushroom species. Its declining populations in Europe have led to its appearance in over half of the European fungal Red Lists of threatened species. Typically found growing on the stumps and logs of rotting hardwoods. It has pinkish colour and distinctive ridged and veined, rubbery surface of the caps.

**Rounded Earthstar (*Geastrumsaccatum*):** It belongs to the Geastrum genus. It is found growing on rotting wood. The opening of the outer layer of the fruiting body in the characteristic star shape is thought to be due to a buildup of calcium oxalate crystals.

**Puffball Mushrooms:** There are quite a few varieties of puffball mushroom, all of which belong in the division Basidiomycota. But what they all share in common is that the spores grow internally and the mushroom splits open to release the spore. They are called puffballs because of the clouds of spores that "puff" out when they burst open.

**Bleeding Tooth (*Hydnellumpeckii*):** The younger specimens of the species bleed a bright red juice that has anticoagulant properties, hence its common name.

**Devil's Cigar (*Chorioactisgeaster*):** This is an extremely rare mushroom, and is found only in very select locations in Texas and Japan. Scientists do not know why the fungus mysteriously lives only in Texas and Japan. The fruiting body grows on the roots of dead cedar elms and on dead oak trees.



## Bizarre fungal world



- Moulds and bacteria growing together in sawdust can generate enough heat to make it catch fire.
- Razor Strop Fungus (*Piptoporus betulinus*) are used to sharpen razors.



*Piptoporus betulinus*

A **lichen** is an associated organism: an alga and a fungus, live together in a symbiotic association, producing a new body. Lichens can be used as pollution monitors.

**World's largest known organism:** Honey mushrooms are among the largest living organisms on Earth. One single specimen in an Oregon forest is 110-footlong, 200-ton blue whale, estimated to be somewhere around 2,400 yrs old.



**Lichen as Spices:** black stone flower, *Parmotrema perlatum* (dagadphool/kalpasi), is ingredient in various spice mixes.

**Lichens as Dye:** It is a common source of natural dyes. It is usually extracted by either boiling in water or ammonia fermentation.

**Lichens as pH Indicator:** Litmus, a water soluble pH indicator dye mixture is also extracted from *Rocella* species (lichen).

**Lichens as antibiotics:** Some lichens have antibiotic properties. The genus *Usnea* is used in Europe in ointments and other commercial products and is said to aid healing in superficial wounds.

**Edible Lichen:** *Bryoria*, an edible lichen used in United States and is also fed to pets.

**Lichen & Mummies:** A bizarre use of lichens is as packing material for ancient Egyptian mummies (abdomen was packed with dried lichen).



Black stone flower



Wool dyed with lichens



*Rocella* sp. & the dye Litmus



Litmus paper



*Usnea* sp



*Bryoria* sp

Mushrooms make their own wind

When it's time to eject spores, mushrooms release water vapour which evaporates, cooling the air surrounding mushroom. This cooler air is denser than warm air so it flows away from the mushroom, creating lift, which can carry spores up to 4 inches (10 cm) both horizontally and vertically.

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"The journey of a thousand miles begins with one step." Lao Tzu





## NATURE

Department of Botany & Microbiology  
St. Aloysius College (Autonomous) Jabalpur

July-September, 2014



The Golden Toad (*Bufo perigrinus*) is thought to be the first species to go extinct because of climate change.



- Protect and plant trees.
- Recycle, reduce and re-use items.
- Use public transport.

THINGS YOU  
CAN DO

### Middle Eastern vegetation resistant to climate change: Ecosystems withstand more than seven lean years

Ecosystems in the Middle East are home to a wealth of unique species including the ancestors of many of our staple crops today. The region has a relatively small amount of water available and it is predicted that in the future, there will be even less rain. That could jeopardize Middle Eastern ecosystems and threaten the survival of important species.

Researchers headed by Katja Tielbörger, have carried out long-term experiments in Israel aimed at testing this prognosis. Over nine years, an area rich in plant species was subjected to artificially low rainfall. Their findings are published in the latest *Nature Communications*.

The study revealed that neither nine years of greater aridity nor nine years of extra rain had much effect on the diversity or composition of species, their biomass which is important for grazing pastures. This means we need to revisit the popular theory that arid regions are particularly sensitive to climate change.



### Fish moving poleward at rate of 26 kilometres per decade

Large numbers of fish will disappear from the tropics by 2050, finds a new University of British Columbia study that examined



the impact of climate change on fish stocks. The study identified ocean hotspots for local fish extinction but also found that changing temperatures will drive more fish into the cooler waters of Arctic and Antarctic.



"Global warming must be seen as an economic and security threat."

Kofi Annan



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'Excellence through Perseverance'



## TRENDS IN MICROBIOLOGY



### Versatile antibiotic found with self-immunity gene on plasmid in staph strain

A robust, broad spectrum antibiotic, and a gene that confers immunity to that antibiotic are both found in the bacterium *Staphylococcus epidermidis* Strain 115. The antibiotic, a member of the thiopeptide family of antibiotics, is not in widespread use, partly due to its complex structure, but the investigators, from Brigham Young University, Provo, Utah, now report that the mechanism of synthesis is surprisingly simple. "We hope to come up with innovative processes for large-scale production and derivitization so that new, and possibly more potent versions of the antibiotic can become available, says co-corresponding author Joel S. Griffiths.

### Evolution of extreme parasites explained by scientists

Extreme adaptations of species often cause such significant changes that their evolutionary history is difficult to reconstruct. Zoologists have now discovered a new parasite species that represents the missing link between fungi and an extreme group of parasites. Researchers are now able to understand, for the first time, the evolution of these parasites, causing disease in humans and animals. Parasites use their hosts to simplify their own lives. In order to do so, they evolved features that are so extreme that it is often impossible to compare them to other species. The evolution of these extreme adaptations is often impossible to reconstruct.



### Antibiotic resistance: Bacterial defense policies

High-resolution cryo-electron microscopy has now revealed in unprecedented detail the structural changes in the bacterial ribosome which results in resistance to the antibiotic erythromycin. Multiresistant bacterial pathogens that are insensitive to virtually all available antibiotics are one of the major public-health challenges of our time.





### Potential of autochthonous bacteria for use as biofertilizers

Neiker-Tecnalia, the Basque Institute for Agricultural Research and Development, is working to select autochthonous bacteria with a biofertilizing potential as a result of the stimulating effect they have on the take-up of nutrients by plants, phytohormone production and phytopathogen control. The research is of great interest for farmers because bacteria-based biofertilizers constitute an alternative to conventional chemical fertilizers that are expensive and less sustainable from the environmental point of view. The final goal in selecting autochthonous bacteria with a biofertilizing potential is to create a bacterial strain bank to be subsequently used in biofertilizing formulations. These bacteria have the capacity to increase the bioavailability of nutrients present in the soil so that the crops can thus assimilate them; what is more, they produce hormones that stimulate plant growth and encourage root development. Another of their advantages is that they even combat other micro-organisms in the soil that cause plant diseases.



### Mineralization of sand particles boosts microbial water filtration

Mineral coatings on sand particles actually encourage microbial activity in the rapid sand filters that are used to treat groundwater for drinking, according to a paper. These findings resoundingly refute, for the first time, the conventional wisdom that the mineral deposits interfere with microbial colonization of the sand particles.



Always trust a microbiologist because they have the best chance of predicting when the world will end"

— Teddie O. Rahube

"In microbiology the roles of mutation and selection in evolution are coming to be better understood through the use of bacterial cultures of mutant strains."

— Edward Tatum



### List of Selman A. Waksman Award in Microbiology winners

Jeffrey Gordon (2013)

For his pioneering interdisciplinary studies on the human microbiome and for defining the genomic and metabolic foundations of its contributions to health and disease.

Carol A. Gross (2011)

For her pioneering studies on mechanisms of gene transcription and its control, and for defining the roles of sigma factors during homeostasis and under stress.

Jonathan Beckwith (2009)

For fundamental contributions to gene regulation, protein targeting and secretion, and disulfide biochemistry, and also for the development of gene fusions as an experimental tool.

Richard M. Losick (2007)

For discovering alternative bacterial sigma factors and his fundamental contributions to understanding the mechanism of bacterial sporulation.



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**Trends  
In  
Microbiology**  
Jan-March, 2016

### APPROACH OF BIOREMEDIATION

"**Biosimulation**" involves a group of organisms in order to shift the microbial ecology towards desired process. This can be achieved through changes in pH, moisture, aeration, or nutrient additions.

"**Bioaugmentation**" where organism selected for high degradation abilities are used to inoculate the contaminated site. These two approaches are not mutually exclusive- they can be used simultaneously.

### The Stream Where I Played

*I played in this stream as a child,  
When the river seemed so endless  
and wild.  
The water was clear and smelled so  
clean,  
It was so long ago that it seems  
like a dream.*

*Now this stream is too dirty for my  
child.  
The water is scummy and smells  
vile.  
The place where I played seems so  
foul and decayed,  
And I shed the first tear as the  
dream starts to fade.*

**"Water and air, the two essential fluids on  
which all life depends, have become global  
garbage cans."**  
— Jacques-Yves Cousteau

### BIOREMEDIATION

Bio-Remediate = to use biological organisms to solve an environmental problem.

The collective range of cleanup methods by using natural microorganism (such as bacteria, plant, fungi, etc.) to degrade hazardous organic contaminants or convert hazardous inorganic contaminants to

environmentally less toxic or nontoxic compounds of safe levels in soils, subsurface materials, water, sludges, and residues.

### CURRENT RESEARCH

*Pseudomonas putida* has been found to be useful in the detection of certain chemicals, such as land mines. On the grand scale, a linkage between the bacteria's ability to degrade TNT and the explosive compound found in land mines has inspired research to utilize *P. putida* as a way of detecting land mines from soil content.

TSCA Experimental Release Application Approved for *Pseudomonas putida* Strains



As the population and land prices rise, housing rises higher and higher. But the amount of garbage is increasing at an even pace.

### List of Bacterial genera important in Bioremediation

**Bacteria:** - *Arthrobacter albus*  
*Brachybacterium*  
*Distzia*  
*Nocardioidea*  
*Gordonia*  
*Pseudomonas putida*  
*Dechloromonas*  
*Aromatic*  
*Nitrosomonas europaea*  
*Nitrobacter hamburgensis*

**Yeast:** - *Saccharomyces cerevisiae*  
*C. boidinii*  
*C. lipolytica*





"Process of bioremediation before the treatment and after the treatment"



#### Check your knowledge

Q1 What is Bioremediation?

1. To use biological organisms to solve an environmental problem.
2. The variety of species in an area
3. A variety of health foods
4. None of the above

Q 2 Which species of *Arthrobacter* use in bioremediation ?

- 1) *biodini*
- 2) *lipolytica*
- 3) *cerevisiae*
- 4) *albus*

#### Research journal of Environmental Toxicology, 2015

Bioremediation on Detoxification of Pulp and Paper Mill Effluent

Presently, 50-60 m<sup>3</sup> of water needed to produce a ton of paper and around 240-250 chemicals have been identified in effluents, which are produced at different stages of paper making in pulp and paper industry. This industry is typically associated with pollution problems related to high BOD, COD, toxicity, AOX, color and chlorinated compounds.

Although numerous studies have looked ways to remove COD, BOD etc, of pulp and paper effluents, the problem still presents. Number of microorganism including bacteria fungi and actinomycetes has been implicated to degrade the xenobiotic compounds present in pulp and paper mill effluent. This article review the origins' and effect of major pollutants present in pulp and paper mill effluents and the progress made in their reduction through fungi, bacteria, algae and enzyme as well as further scope is also discussed.

#### *Dinococcus radidurans*

It is a radiation-resistant extremophile bacterium that is genetically engineered strain of *D. radidurans* has been shown to degrade ionic mercury and toluene in radioactive mixed waste environment.

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## Trends in Microbiology

July - October 2018

### APPROACHES FOR BIO-CONTROL

#### THERE ARE 3 GENERAL APPROACHES TO BIOLOGICAL PEST CONTROL.

**Importation:** It is a classical or biological control that involves the introduction of pest's natural enemies to a new locale where they do not occur naturally.

**Augmentation:** It involves the supplemental release of natural enemies, boosting the naturally occurring population.

**Conservation:** It is the third approach to biological control. In this the natural existing enemies are conserved & it is simple & cost effective.

### BIO-CONTROL

*'Biological control'* or biological pest control is the reduction of pest population by using natural enemies.

It is important because crop pests become resistant to chemical pesticides.

### CURRENT RESEARCH

In 2014 our researchers released French and Spanish spring active *Onthophagus vacca* & *Bubus bububalus* dung beetles in Australia's latest effort to improve dung burial. Burying dung improves pasture productivity, sequesters carbon and controls buffaloes and bush flies.



#### List of Biological pests important in Biocontrol.

**Fungi:** - *Uromyces penicillatus*

*Prospodium tuberculatum*

*Puccinia aspergiae*

*Kortyana sp*

**Beetle:** - *Onthophagus vacca*

*Bubus bububalus*

*Noctua opiblini*

*Leuca boicostata*

**Moth:** - *Cochylis atrisquata*

*Platyphila isodactyla*

*Agonopterix zinnella*

*Toxix sp*

*"The greatest threat to our planet is the belief that someone else will save it" - Robert Swan*





## BIOLOGICAL CONTROL

Before

After



### Bio control cycle



### Check your knowledge

Q1 what is Bio-control?

1. Reduction of pests using natural enemies
2. Supplemental release of natural enemies
3. A variety of insect species
4. None of the above

Q2 which species of beetle used as dung beetle?

- 1) Onthophagus
- 2) Cassida
- 3) Oleria
- 4) Colaspis

### Crustacean that act like super bug:

**Daphnia** is a genus of small planktonic crustaceans they are 0.2-3 millimeters in length. They are the members of the order cladocera, commonly called as water fleas. Daphnia live in various aquatic environments ranging from acidic swamps to freshwater lakes, ponds, streams and rivers. Two most common species are *D. pulex* (small and most common) and *D. magna* (large). Daphnia are typically filter feeders, ingesting mainly unicellular algae and various sorts of organic detritus including protists and bacteria. As it can feed on algae and protists so it can be used for reducing the problem of Eutrophication (excessive accumulation of nutrients in a lake or other body of water, frequently due to run off from the land, which causes a dense growth of plant life).

### ***Rodolia cardinalis***

*Rodolia cardinalis* is a species of ladybird beetle that is sometimes described as endemic to Australia. It was introduced in California to control cottony cushion scale.

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