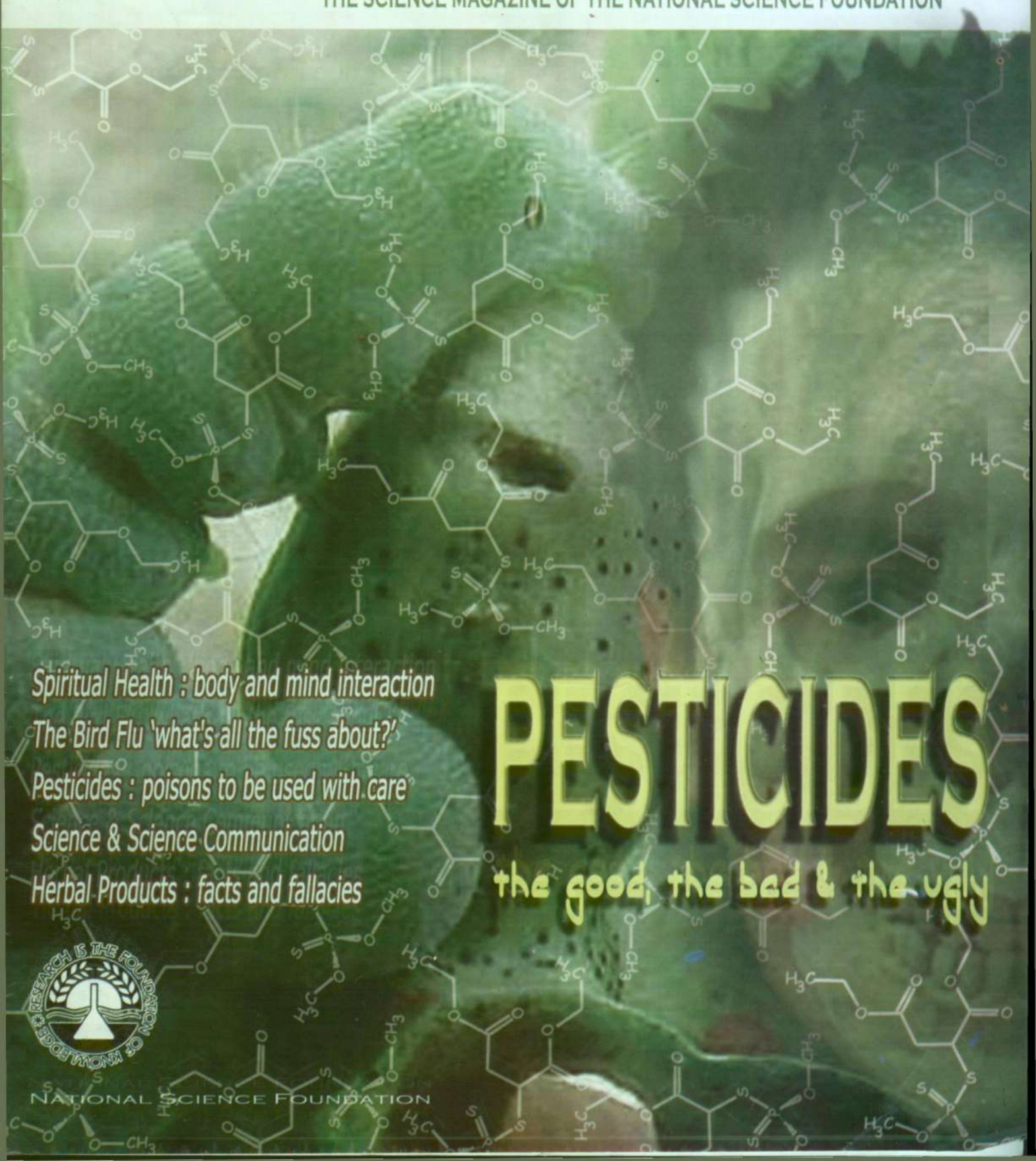
VOLUME 22 NUMBER 02

ISSN 1391 - 0299

VIDURAVA

THE SCIENCE MAGAZINE OF THE NATIONAL SCIENCE FOUNDATION



Spiritual Health : body and mind interaction

The Bird Flu 'what's all the fuss about?'

Pesticides : poisons to be used with care

Science & Science Communication

Herbal Products : facts and fallacies

PESTICIDES

the good, the bad & the ugly

RESEARCH IS THE FOUNDATION OF KNOWLEDGE

NATIONAL SCIENCE FOUNDATION

VIDU-22C25



VIDURAVA

Volume 22 No. 02

December 2005

Contents

Medicine

Spiritual Health: Body & Mind Interaction 3
Seneviratne Epa

Medicine

The Bird Flu - What's all the fuss about? 7
Panduka Karunanayke

Agriculture

Pesticides: Poisons to be used with care 11
Jeevani Marasinghe

Scientists

Arthur C Clarke - Great Contributor to Global Communication 16
Chinthana Wijewardena

Science Communication

Science and Science Communication 18
Jayantha Wattavidanage

Chemistry

Herbal Products: Facts and Fallacies 21
Upali M. Senanayake

Editors

Dr Kumara Hirimburegama
Mr Thusitha Malalasekera
Dr S.R. Krishnarajah

Assistant Editor

Mr K.G. Janaka Karunasena

Typesetting & Page Designing

Shyama Vithanage

Published by

National Science Foundation
47/5, Maitland Place
Colombo 07.

Tel: 2696771-3
Fax: 2694754
E-mail: janak@nsf.ac.lk

Pesticides and dangerous side-effects of Green Revolution!

The "Green Revolution" started in 1950's spread all over the world, and hunger of the rapidly increasing world population was alleviated by increased food production. This revolution was driven by improved scientific knowledge and technological contribution. Scientists developed high yielding genetically improved crop varieties, and the most widely used major weapons in the green revolution were artificially synthesized chemical fertilizers and synthetic-pesticides.

With the use of these chemicals weapons, crop yield was increased 2-3 times, while forest-lands coming under plow got reduced. Several millions of lives, especially in developing countries were saved, and living conditions of many communities were improved. In addition, multinational agrochemical and fertilizer companies made huge profits. At the same time, governments and scientists were satisfied about their great success in achieving the supply of food for rapidly increasing world population.

But, no one noticed the disasters which were following after these remarkable achievements. Highly diversified plant kingdom in tropical countries like Sri Lanka was affected and some plant types disappeared since modern agricultural practices with above chemicals crept in to traditional nature based farming culture. Poisonous pesticides and concentrated synthetic fertilizers killed colorful small fish and some indigenous small animals moving freely in small clean-water streams flowing through natural landscapes where people grow food crops. Chemical based revolutionized agriculture poisoned the nature and natural-balance was seriously disturbed. In addition, the poisons chemical pesticides were easily used by some weak-minded individuals those who were not able to face the challenging situations in their life to terminate their own existence in the world.

Those who were responsible for introducing the green revolution with poisonous chemicals never expected such disastrous side-effects and after-effects. Especially, misuse of pesticides has produced dangerous results to the man as the nature maintains its balanced status. But, our question is, can the ever-increasing world population be fed without food produced through chemical based modern agrotechnologies. What are the available alternatives? Can 100% organic agriculture feed the world? How to use poisonous pesticide-chemicals safely, and minimum amounts only if unavoidable? What can we do about this chemical pollution and poisoning? Read the theme article and join to take correct action!

Spiritual Health: Body and Mind Interaction

Unfortunately, medical science of West failed to grasp the reality that body and mind too can have such an interaction as with matter and energy and that they too can simultaneously exist together. Therefore, even when there was obvious evidence of mind influencing the body we continued to ignore the interaction. For example, consider the Placebo effect *ie.* mere thought of taking a medicine can produce the same effect of the medicine in a patient. This is an example where mind can have a healing power. It is unfortunate that we use the term "Dummy Pill Effect" just to discard this effect.



"A woman who conquered her cancer through meditation" -a newspaper report



This is a story of a woman who conquered her cancer through meditation. I wrote this story nearly 20 years ago, based on a case report published in a Western medical journal at that time, to a Sinhala language newspaper in Sri Lanka.

Changing Western Health Model

What is your reaction when you see a story like this? It is one of scepticism , because we don't have an explanation to such a phenomenon in the Western health model we practice today. This health model we follow has no provision for phenomena based on body mind interaction. The Western system we follow today is what is called Biomedical or Mechanistic Health model, and Rene Descartes of 17th century was the architect of this model. He proposed the philosophical separation of body and mind which lead to the concept of Body Mind Dualism. For him, body and mind were two separate entities with no interaction. Those who follow the Western system in 21st century still believe the same model.

What happened to us as a result of following this model so faithfully? Western medicine closed off the entire domain of body mind interaction from legitimate scientific inquiry. The result is what we see today. When we see a story mentioned above in the news paper, we have no explanation. So we have to dismiss such stories only as anecdotes.

A similar situation existed in Physics in seventeenth century. At that time subatomic particles like protons neutrons and electrons were thought to be solid particles. But, in the last century scientists found that these particles can exist either in solid form or in wave or energy form simultaneously. They saw an interaction between matter and energy. This seemed impossible at the beginning. Two contradictory physical states seemingly existing together. But, scientists ultimately had to come to terms with this reality. This was the basis of quantum theory. Quantum Theory explains the dual nature of matter.

Mind Heals or Causes Illness

Unfortunately, medical science failed to grasp the reality that body and mind too can have such an interaction as with matter and energy and that they too can simultaneously exist together. Therefore, even when there was obvious evidence of mind influencing the body we continued to ignore the interaction. For example, the Placebo effect-*ie.* mere thought of taking a medicine can produce the same effect of the medicine in a patient. This is an example where mind can have a healing power. It is unfortunate that we use the term "Dummy Pill Effect" just to discard this effect. Mind can also produce the opposite effect of

healing – *i.e* causing illness. A woman is more likely to develop a breast cancer after her husband's death. This brings us to the question of how mind influences the body. One clear mechanism is through immune modulation. Depression produces immune suppression through its effects on Natural Killer (NK) cells of the immune system. These NK cells are responsible for host defence protection mechanisms. This is how widows become more vulnerable to cancer.



Interesting thing is that as much as mind can have an effect on the body, body or bodily activities too can influence the mind because this interaction is two way. We know that if we take a walk when we are angry, the anger subsides. So this shows that a bodily or a physical activity can influence the mind. You may have experienced it yourself though you may not have thought of such an interaction. People who take regular physical exercise have better concentration of mind and have better output of work. Research has established this fact. This brings us to an interesting point. Jogging and meditation have the same effect on mind - the concentration of mind. How strange? This proves the interaction between body and mind again.

Physical Exercises, Meditation & Immune System

This brings us to subject of immune enhancement and cancer prevention through physical activity. Earlier we saw how immune suppression caused cancer. Physical activity produces immune enhancement by increasing the activity of NK cells. This is the mechanism through which physical activity prevents cancer. Those who take regular physical exercise are less prone to cancer. Meditation too enhances immunity, again through increased activity of NK cells. This is interesting – both meditation and physical exercise produce same effect on immune system, indicating the interaction between body and mind. So it appears that the concentration of mind is at least one common mechanism of immune enhancement during meditation and physical activity.

Immune modulation is not the only link showing interaction between body and mind. Neuro endocrine systems too can be involved. Sinus arrhythmia on an ECG is a normal phenomenon of beat to beat variation of heart rate, especially found in healthy adults. This is a function mainly dependent on vagal tone. Enhanced heart rate variability indicates an optimum autonomic balance in the body and is considered to be a sign of good health. This is impaired or lost in cardiovascular diseases. A study published in the British Medical Journal showed that meditation and Ave Maria recitation, both in fact enhance the heart rate variability. This indicates the health promoting effects of meditation and other religious practices through their effects on autonomic nervous system. These practices restore what is called inherent cardiovascular rhythm described by Mayer over hundred years ago. So the nervous system too seems to be a link between body and mind.

Power and Biology of Belief

This brings us to a totally new area of neuroscience – the Psychoneuroimmunoendocrine system (PNIE), also called Psychoneuroimmune (PNI) system. This is a functional system that provides a scientific explanation to body mind interaction. This system came into recognition only during the last two decades. If the interaction between body and mind is so close and so obvious why did we take such a long time to recognize this? It is because we haven't had a plausible objective mechanism to explain the connection between body and mind. As a result, we continued to follow the body mind dualism of 17th century preached by Descartes. However, during last few decades medical scientists searched for a possible link between body and mind. Discovery of this system was not therefore an accident but the result of an intense search. In this system, Immune, Endocrine and Nervous systems act as the link between body and mind. PNIE or PNI system is now well established. Recognition of this system allows us to accept the body mind interaction on a scientific basis. What we don't know yet is the exact mechanism or the neuroimmunochemistry of how this system works. But, now we know for sure that the system exists. It is interesting in this context to read a review which came up few years ago, in the International Journal of Dermatology titled "Can the brain inhibit inflammation generated in the skin?". This describes how alpha Melanocyte Stimulating Hormone (MSH) which is a centrally acting hormone, produces an anti inflammatory effect on the skin. Alpha MSH which is produced in brain, acts centrally via the nervous system and produces an anti inflammatory response in the skin. The state of mind influences the level of MSH in the brain and this explains the link between mind and skin.

Recognition of PNIE system has resulted in greater interest in body mind research. There are now mind body centers in some US medical schools, Body Mind Institute at Harvard medical school is one such example. Herbert Benson at Harvard is the pioneer in this field. He is the one who demonstrated what is called Relaxation response during meditation. During this response there is lowering of blood pressure and reduction of oxygen consumption among many other physiological changes during this response. What is important is that it is he who first demonstrated that this response can be voluntarily elicited and that it has the opposite effect of stress response which is involuntary. He in fact said many religious activities can elicit this response. He wrote a book titled "Power and Biology of Belief" and suggested a wisdom in prayer and meditation.

Spiritual Health



There is now a lot of interest on the subject of meditation. This seems to be a way to manipulate body mind interaction in a favourable direction to achieve better health. This brings us to a whole new dimension in health – "Spiritual Health". Spirit is something difficult to define, yet all of us can perceive it. Faith, beliefs, emotions, aspirations all constitute the spirit of an individual. Some people believe that it is the spirit that distinguishes humans from other animals. Research has now established that people with deep religious commitments have better health and live longer. A study done in California showed that church goers live longer independent of other confounding factors.

Evidence Based Medicine Journal in Dec 2000 published a systematic review of trials on what is called distant healing practices such as prayer and religious activities. Conclusion was that such practices are effective in improving patient outcomes.

Inner Resources of Healing

More and more physical diseases are now becoming amenable to cure through interventions on mind. Effect of mind on skin diseases is one good example. Viral Warts can be made to disappear through mere suggestion during hypnosis. How does this happen? Probably via the process called immune modulation or effects on blood supply. Eczema is another good example. It is common knowledge that stress worsens eczema. Similarly relaxation and meditation improve this condition. You have already read of the role of alpha MSH hormone which has anti inflammatory activity on the skin. Psychological interventions are being increasingly tried out with success in conditions which were not thought to be amenable to such treatments earlier. Infertility and diabetes are only two such examples which are now being helped through psychological intervention. Diabetic patients who meditate have been able to reduce their medication. Relief of pain through meditation is another good example. The author of the book titled "Full Catastrophe Living", Dr Kabat Sing describes how he uses Buddhist meditation technique to relieve intractable cancer pain at Massachusetts Hospital's Pain clinic in the USA.

What we now need is to acknowledge the fact that patients have what is called inner resources of healings or inner healing capacity. This is the power of mind in healing. No physician will be able to practice medicine if not for this inner healing capacity of their patients. A surgeon who operates on his patient would only bring the skin and other cut tissues together during the operation. Surgeon has no power to make the wound heal and the healing power is there only within the patient. Unfortunately, very few Western medical doctors realize this fact and as a result show no gratitude to their patients for healing the wound they create during the surgery. The challenge we face in the 21st century is to find ways and means of enhancing the healing powers of mind. As the evidence point out, spiritual practices certainly seem to be one way of promoting such powers of mind. Such an assumption would not be unscientific any more in view of the mounting evidence in this direction now.

Chemical Dependant Western Model

A theme issue of the BMJ few years ago was titled "Too much medicine?" In the opening editorial, the editor himself addressed the subject called medicalization of life. This editorial rightly predicts a future generation of Western medical doctors who would demedicalize life and hand back powers of healing to the patients. Though he does not elaborate on how we could hand back these healing powers, it is obvious that it has to be through empowering the minds of our patients. Empowering the mind should not be looked upon as an alternative to the orthodox medicine, rather a complement to it. This will help shift

the patients from their total dependence on doctors and medicine. So there is some truth in what Ivan Illich says. He is an extreme critique of modern medicine and he says modern medicine has destroyed the human capacity to deal with pain, sickness and death. Isn't this true to some extent? I leave it to you to ponder. Can we hand back the lost inner healing powers to the patients in the present Western health model we practice? Answer definitely is "No", because there is no recognition of body mind interaction or a spiritual dimension in health in the present model.

So we now have virtually come to the end of the road with this model and certainly need to go in a new direction in health if we are to progress in medicine. In the US, people now spend more out of pocket, on complementary therapies than on orthodox medicine, showing their frustration probably. Age adjusted cancer mortality has remained unchanged over last decade or so despite all the advances and the investments made in the diagnosis and treatment of cancer.

Biophychosocial Health Model

The new direction should be one that recognizes the 21st century understanding of body mind interaction. Two decades ago Dr George Angel from the USA proposed "Biopsychosocial health model" to replace the present "Bio medical health model" which has no provision for a spiritual dimension. He probably acted on intuition, as there was not as much scientific evidence at that time as we have today. Around the same time there was a similar thinking in the East and Dr Bisht in India proposed to the WHO to include a spiritual dimension in the definition of health. He called this the fourth dimension of health. So the proposed a new WHO definition which should read as follows:

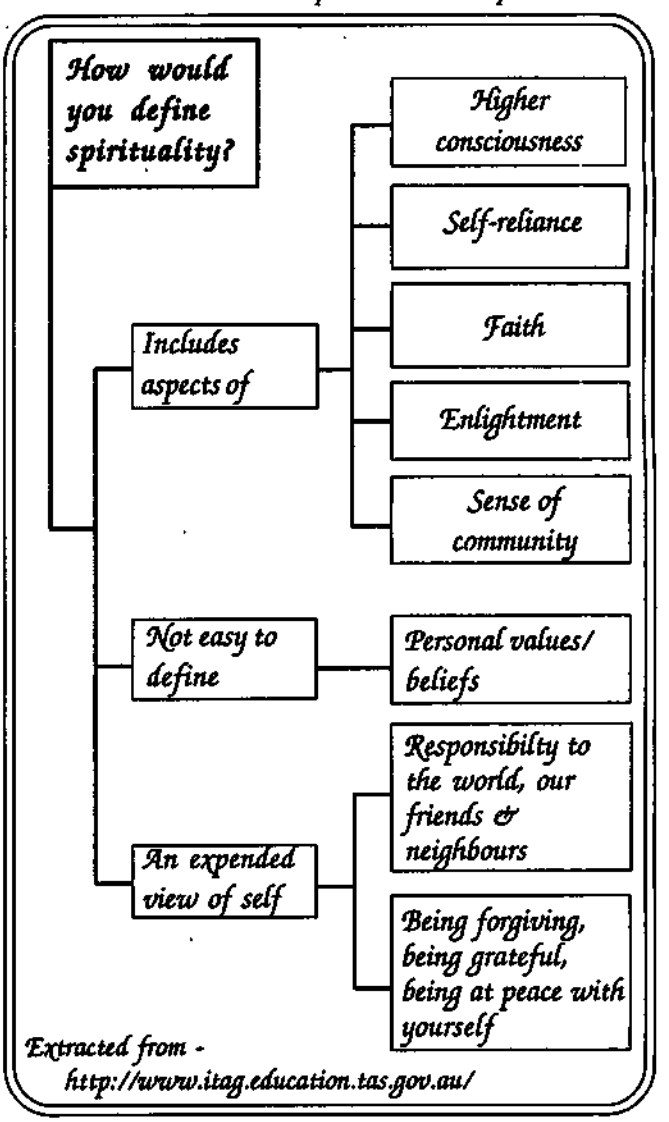
"Health: A state of complete physical, mental, SPIRITUAL and social well being and not merely absence of disease or infirmity".

Mind Power and Pharmaceuticals

This in fact marked a significant milestone in the recognition of body mind interaction in health. What we need today is a health model which recognizes this new dimension – the Spiritual dimension of health. So we need to replace the seventeenth century Bio Medical health model with a "Medico Spiritual" health model. Such a model would allow us to recognize body mind interaction on a legitimate scientific basis and would help reduce patients' total dependence on doctors and their medicine when they fall ill. Patients will be able to understand that they too can play a role in healing by enhancing their own inner power of healing.

Such an approach would also open up totally new area of research for the medical profession not hitherto explored. Race for discovering new drugs based on the emotional peptides released from the brain and nervous system during mindfulness and concentration of mind seems to have already begun in the West. We in the East can teach our patients how they can train their own brains to release the chemical which will be marketed as costly drugs when synthesized. Therefore, Mind Body Counseling would soon constitute an essential part of therapeutic armamentarium of western medical practitioners.

Dr Seneviratna Epa
who works as a Specialist in the Non-State Sector, Matara, is one of the former Presidents of Sri Lanka Medical Association. He has a special interest on Spiritual Health.



The Bird Flu – What's all the fuss about?



A health topic that has aroused considerable public interest in recent times is "the bird flu". Virtually every newspaper and magazine has carried an article on it. What is it all about? Is it really something so important, and if so, why? This article seeks to clarify some of these issues: it will explain what "flu" is, how they come about as epidemics and pandemics, connection to other animals including birds, what we can do to prevent such calamities, and where we stood with regard to the recent outbreak of Bird Flu.

The Flu: Spreads amongst man

The word *flu* is an abbreviation connected to the term *influenza*. Influenza is a disease caused due to an infection by a group of viruses called *influenza viruses*, which are transmitted from patients to others usually by spread through air borne particles of respiratory secretions (which are called *droplets*). Thus, patients who have the flu will, when coughing or sneezing, spread the virus particles with droplets into the environment around them.

People who are within about 2 meters from the patient may then get infected by the virus, because the droplets will enter through the nose, land on the eyes and mouth, and from there it will enter their respiratory tracts. This is called ***droplet spread***. Alternatively, the virus may settle upon nearby surfaces, such as door handles or railings, which others touch frequently. The virus may remain viable for several hours on such surfaces while some viruses get easily destroyed by exposure to natural sunlight and dry environments. A person who touches such a surface may then get the virus onto his own hands – and if he then touches his own eyes or mouth, the virus will enter the body (even though he had never even met the original patient!). This is called ***contact spread***. These facts are important because this knowledge is useful to prevent the spread of infection. Hence, steps that health care workers take to prevent the spread of infection within hospitals are called ***droplet precautions*** and ***contact precautions***, respectively.

It is interesting to note that the most effective techniques of preventing such spread, even in this "high-tech" 21st century, are still good old **basic hygiene measures** – such as hand washing and avoidance of touching one's eyes, nose and mouth with unwashed hands. A basic hygienic measure is the most important barrier for preventing almost all health problems caused by pathogens and other chemical agents that can enter in to the body. But not all types of influenza viruses can cause infections in humans. The virus needs special ***surface proteins*** to help them adhere to human cells, from whence they can then enter the cell. Influenza viruses that have the necessary 'tools' to infect human beings are termed ***human influenza viruses***. **The vast majority of influenza viruses cannot infect humans and, in fact, they are mostly seen in nature amongst various species of water birds.** This is known as their ***natural reservoir***, and it is from this reservoir that other species of animal will get various different influenza viruses.

Our defences against the flu

We have our own natural defence against such infections. One of the most important defences is that our own cells are immune to infection unless the virus happened to have the necessary 'tools' for entering into cells, the relevant surface proteins. If it does, then it can infect human cells and cause human disease. But each infected human will then go on to develop his own cellular and molecular weapons against the virus: ***antibodies***. We form antibodies against various surface structural proteins on the virus, and these antibodies then go on to make the virus incapable of surviving in our body – such specific antibodies are called ***neutralizing antibodies***.

Of course, there is one problem: we can form antibodies only after we have been exposed to the specific protein (which is called the *antigen*) of the virus, which happens in nature by becoming infected with the whole virus itself. In other words, we must first get the infection (and the disease) before we start producing effective specific neutralizing antibodies. And that is not very good news – because the flu is a very severe illness, and some of us actually die from it! But once we have survived, we will be all right – until a new influenza virus with fever specific proteins (against which the earlier specific neutralizing antibodies have no effect) comes along, when the cycle is repeated.

There is, of course, a way we can fortunately get a particular type of specific and effective neutralizing antibody without getting the disease: this is ***vaccination***. During vaccination, the surface protein of the virus that gives rise to the formation of the specific neutralizing antibody (the antigen) is given to humans who have never been infected by the virus. Since the whole virus particle is not given to the person, there will not be viral replication in his body, hence there is no illness. But the antigens will stimulate the formation of the relevant specific neutralizing antibody. When the person now comes across the relevant influenza virus in nature, he has already got the specific weapon against it: the specific neutralizing antibody. By this way, he will be ***immune*** from illness due to that particular virus.

There is, of course, a way we can fortunately get a particular type of specific and effective neutralizing antibody without getting the disease: this is *vaccination*. During vaccination, the surface protein of the virus that gives rise to the formation of the specific neutralizing antibody (the antigen) is given to humans who have never been infected by the virus. Since the whole virus particle is not given to the person, there will not be viral replication in his body, hence there is no illness.

But there is one problem: there are so many different types of influenza viruses with different antigen proteins prevailing amongst us, that it is practically not possible to have a single vaccine against all of them.

To make matters worse, the influenza viruses are also capable of changing their genetic material so that new antigenic proteins are produced. This is because their genetic material (called the ***genome***) is stored in 8 separate segments. This makes it easy for it to exchange genetic material with other influenza viruses that it comes across (this is called ***re-assortment*** of genetic material), so that the virus then goes on to acquire new material from other influenza viruses. Also, it can form genetic codes for new proteins on its own, like any other organism, by the process called *mutation*, which is the process where its genetic material undergoes slight changes during replication of deoxyribonucleic acid (DNA), so that slightly new codes of genetic material is then manufactured. Whether by re-assortment or by mutation, when an influenza virus gets a new codes in the genome, it gets new surface proteins - and this means that we, as human beings, may not have a specific neutralizing antibody against it, so that this virus then has the ability to infect us multiply and cause disease.

Epidemics and pandemics

Our battle with the human influenza viruses and other pathogenic viruses also is, therefore, a never ending one. New human influenza viruses keep appearing form time to time, and when we come across a virus that we have not been exposed to earlier (or been vaccinated against earlier), we will get the illness. We will then either survive (with development of immunity to that particular virus type thereafter) or die.

Influenza viruses are classified into 3 major groups according to their surface proteins, called groups A,B and C. It is group A that causes most of the deadly disease in humans.

Two of the most important surface proteins on influenza viruses are called the ***haemagglutinins*** and the ***neuraminidases***. In fact, influenza viruses are classified according to these proteins. Hence, for example, the influenza virus of the group A that possess the haemagglutinin protein type 1 and the neuraminidase protein type 1 is called the influenza virus A/H1N1. Altogether there are about 15 haemagglutinins and 9 neuraminidases that help classify the influenza S virus in this way; most human epidemics in the past have been due to the subtypes, H1, H2 and H3. The haemagglutinin helps the virus to adhere new human cells before entering them, and the neuraminidase helps virus particles that have replication inside human cells to get released from the cell.

The influenza viruses keep changing their haemagglutinins and neuraminidases slightly, from year to year. When a slightly different type appears, it will come across a few persons in the community, who are not immune to it, and

therefore cause a small ***epidemic.*** The majority of the population would usually be immune to it (due to previous exposure), and hence the epidemic will involve only a minority of persons in the community. The genetic mechanism by which the virus achieves this small, continuous change is called ***antigenic drift.***

Some countries monitor the types of viruses that are in circulation, and are then able to predict the virus types that are likely to cause problems later on during the year (this usually happens during the winter season). They can therefore anticipate the problem and make a vaccine several months before the epidemic starts, so that the epidemic is curtailed in that country. This vaccine, which will have to be made anew every year, is called the ***annual influenza vaccine*** (or the flu vaccine).

But once in every few decades, the influenza virus gets modified in to something quite different and dangerous: it comes up with a new human influenza virus that has an antigenic make up that is entirely different to what is in circulation. This major shift is bad news to all of humanity, and not just to a country or two – because the whole human population is vulnerable to it, and everyone exposed to it will get the illness. This major natural modification in genetic make-up is said to occur by ***antigenic shift,*** and it gives rise to ***pandemics,*** which are massive epidemics involving several countries or continents.

The influenza virus caused several such pandemics in the past. It has probably caused them since Hellenic times (323 to 30 BC), and well-characterised pandemics have been recorded in history since the 15th century. In the 20th century itself, there have been 3 proven pandemics: in 1918, 1957 and 1968.

The 1918 pandemic itself was the largest ever recorded outbreak of an infectious disease: it affected one-third of the world's population and killed 2-3% of it and, according to German war historians, contributed to ending World War I than any other single reason!

From animal to man: The giant leap

Where do these new, deadly viruses come from? The most likely explanation is that they are viruses that have already existed in animals (especially the natural reservoir, the wild waterfowl), and they have recently succeeded in acquiring the surface proteins required to infect human cells. How these viruses acquire these proteins is itself not very clear: it would be either by re-assortment or by mutation of genetic material.



The process of a wild animal's virus becoming a human virus is a step-wise and gradual process, rather than a sudden one. In the first stages, human coming into close contact with animals (such as those working in the poultry industry) will be victims, because the virus is transmitted from those animals to man during close contact, The infected humans themselves may suffer or even die, but the virus has not yet 'learnt' how to 'jump' from one man to another – the infected human is therefore a 'dead-end' host, and each new human patient is the result of animal-to-man transmission through close animal-human contact. Such animal-to-man contact where the man is a dead-end host is known as ***zoonotic transmission,*** and the illness is called a ***zoonosis*** (meaning that it is essentially an animal disease that man has got 'accidentally'). Later on, the virus will learn how to 'jump' from one human to another- and this is when the virus becomes a truly 'human' virus. This marks the beginning of a new pandemic!

This is probably how it happened just before 1918, 1957 and 1968. The difference between then and now is simply that, now, we know all this – we are able to monitor the changes that are taking place, warn ourselves and be prepared.

All three of the 20th century pandemics started in Asia, then spread across Russia to Europe as they became pandemics. Each new virus would have initially caused a few zoonotic infections in people coming in close contact with animals, and suddenly, once the virus had become human, it would have flared up as a pandemic.

Current situation

What is the situation now? The World Health Organization (WHO) has been keeping a close eye on the emergence of new influenza viruses for several years now, knowing that another influenza pandemic is only a matter of time. It

appears that the most likely virus to cause the next pandemic is the type called influenza virus A/H5N1.

Influenza virus A/H5N1 first came to the world's notice in 1997, when it caused illness in 18 humans (killing 6 of them) in Hong Kong. The WHO immediately went into action, and within 2 years it had prepared a very comprehensive assessment of the risks involved, and came out with the ***Pandemic Preparedness Plan,*** which spells out in detail how we should prepare ourselves to face the threat and what to do at various stages of the outbreak. According to this plan, 6 phases are identified: stages 1 and 2 are the ***inter-pandemic periods*** where only animal cases are seen, phases 3 to 5 are the ***pandemic alert phases*** with cases and an increasing risk of the breakout of a pandemic, and phase 6 is when the pandemic is officially declared. It is already causing large outbreaks amongst birds, especially in the poultry industry. Over 100 humans coming in close contact with these birds have become infected, and nearly half have died. We are currently probably in phase 4 (defined as the occurrence of small clusters of human-to human transmission, each cluster involving less than 25 cases and lasting less than 2 weeks).

In other words, it is still a ***zoonosis,*** but it will only be a matter of time before it becomes a human virus. What we do not know yet is when, and where, it would turn into a human virus.

Are we prepared?

We are, as a world, better prepared than before. For instance, we are able to use modern scientific technology to monitor the situation and warn ourselves. We have tests to detect the disease in humans, some of them very rapidly. We also have effective medications, which can be used to treat patients as well as to prevent illness in those who have been recently exposed. It is even possible that we could make a vaccine to give protection to millions of people before they become infected.

But all this required international monitoring, surveillance and cooperation. The WHO is trying its best to achieve this cooperation so that the technology that humanity currently possesses is put to good use in good time – saving millions of lives, hopefully. Its recent success in controlling the spread of SARS (another respiratory illness due to a new, but unrelated virus) has given the health authorities much needed confidence that this task is achievable.

In Sri Lanka too, much work has already been done in this regard. Sri Lanka has stopped importing poultry (killed or alive) for several months now. Our state veterinary services are maintaining a close eye on our poultry. There is a small risk of the virus being brought in by migratory birds, and if this happens it will be noticed firstly amongst our poultry.

Of course, once the virus becomes a human virus and the pandemic starts, it will be very easy for the illness to come to Sri Lanka – as indeed to all countries of the world. All it takes then is for a person to travel to a country where the virus occurs, become infected with it (which is very easy!), and come back to Sri Lanka within a day or two... We have a small chance of escaping because we are an island – provided travel between our country and affected countries become severely restricted (as happened during the period when we talked about SARS). But in today's world of globalisation and air travel, this would be a very difficulty feat to achieve.

And even if it did arrive, there is still quite a lot we can do to limit the spread of the epidemic. Basic public health measures coupled with judicious use of medications may help us, and it is possible that a vaccine may also become available eventually. What the public must do is to keep confidence in the country's public health system, be aware of their latest advice, and follow it meticulously. The experts can only advice: its practice is in the hands of the people. A pandemic influenza virus will not have the mood to forgive a people who don't take good advice.

It is important to realise that an influenza epidemic going out of control is a disastrous experience for all of us. The patients who catch the disease will suffer badly, and some will die. Economic, educational and social activities will come to a standstill, greatly upsetting the lives of even those who are well. The hospital services (which in Sri Lanka are already overburdened, understaffed and under-equipped) will easily become overwhelmed. A full scale flu outbreak in Sri Lanka is not something that we can afford.

Perhaps more than ever before, **"prevention is better than cure!"**

Dr Panduka Senanayake
who serves as a Senior Lecturer,
Faculty of Medicine, University of Colombo,
is a Consultant Physician.

Pesticides: Poisons to be used with care!

Introduction

Pest by means is a nuisance to man. In general any animal plant or microorganism which harms or causes damage to man, his animals, crops or crop products can be considered as pests. In terms of agricultural pests, if the harm exceeds economic injury level (EIL) the causative agent is considered as a pest. Therefore, the control measures should be taken at the economic threshold level which is below the EIL. Pest control is often practiced in agriculture, public health, ware houses, wood and food storage and in many other sectors. The chemicals used to control pests are known as pesticides.

Classification of pesticides

Pesticides can be considered as the most toxic group of chemicals for the target pest having a versatile nature in use. Pesticides are categorized as insecticides, fungicides, herbicides, nematicides, acaricides, biocides, rodenticides, molluscicides and so on. Pesticides used to kill insects are called as insecticides and similarly the other terms are derived according to the target organism to be controlled. Over 90% of the Global use of pesticides are insecticides, herbicides and fungicides. This is true for Sri Lanka as well.

History in brief

Use of chemicals to control pest dates back to thousands of years. Sulphur has been burned in Greek houses to control pest over 3000 years ago. Subsequently, petrol and tar oils, *Derris* derivatives (rotenone), nicotine extracted from tobacco leaves, Hydrogen cyanide, mercury based compounds have also been used to control pests. It is recorded that in the 2nd half of the 19th century Arsenic was used as "Paris Green" to control potato beetle in U.S.A. Mass scale poisoning due to use of highly toxic inorganic chemicals later compelled for the scientists to develop organic chemicals as pesticides perceived them as safer alternatives.

Then with the increase of world population 'green revolution' occurred. During the Green revolution use of agrochemicals was a necessity to obtain higher yields. Paul Muller, a Swiss postgraduate student produced the first organochlorine insecticide derivative dichloro diphenyl trichloro ethane popularly known as DDT in 1939. It was used at the 2nd world war to control head lice in soldiers and to prevent typhus fever. Later DDT was used in controlling malaria vector mosquitoes. During the early days the inherent nature of persistence of organochlorines was considered advantageous due to its ability of long residual action on the pest. They are nerve poisons, which work on nerve axons to pass signals and to make the insect dead by continuous muscular contractions. Organochlorines build up along the food chains and accumulate in animal fat tissues.

Long term sub lethal exposure of animal to organochlorine mostly exhibits adverse effect on their hormone production system (endocrine system). Studies on environmental impacts of DDT have frequently reported of chronic effects of the chemical on number of animal species. As this was revealed later most of the organochlorines including DDT were banned in many countries.

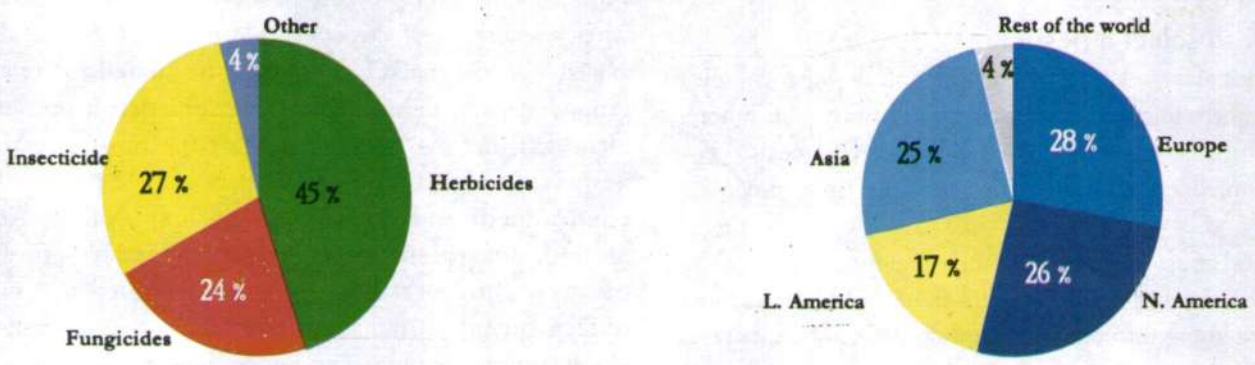


Fig 1. Agrochemical world market in 2004 by categories and region (Total market USD 35.4 bn, crop 30.7 bn, and non crop 4.7 bn)

Present Status

Organophosphates and carbamates were succeeding generation of pesticides to appear. They were nerve poisons as well, which inhibits the enzyme acetyl choline esterase, at the nerve ends. The death of insect brings by the continuous excitation of muscles. These two categories of pesticides are readily degraded in nature (less persistent) but of higher mammalian toxicity.

Then came synthetic pyrethroids, a group of chemicals derived from a naturally occurring insecticide found in *Chrysantamum cinerarifolium.* They were relatively less toxic to mammals but the biological action on pest is similar to that of organochlorines. However, they tend to build up resistance in pests easily. Because of the impressive safety profile of most of the synthetic pyrethroids and effective control of commonly found domestic pests, such as mosquitoes and cockroaches, this group of chemicals easily acquired the domestic chemical pest control sector worldwide. Many formulations of these compounds are used in Sri Lanka, especially in public health programmes. However, these have limited use in agriculture due to possible build up of pest resistance.

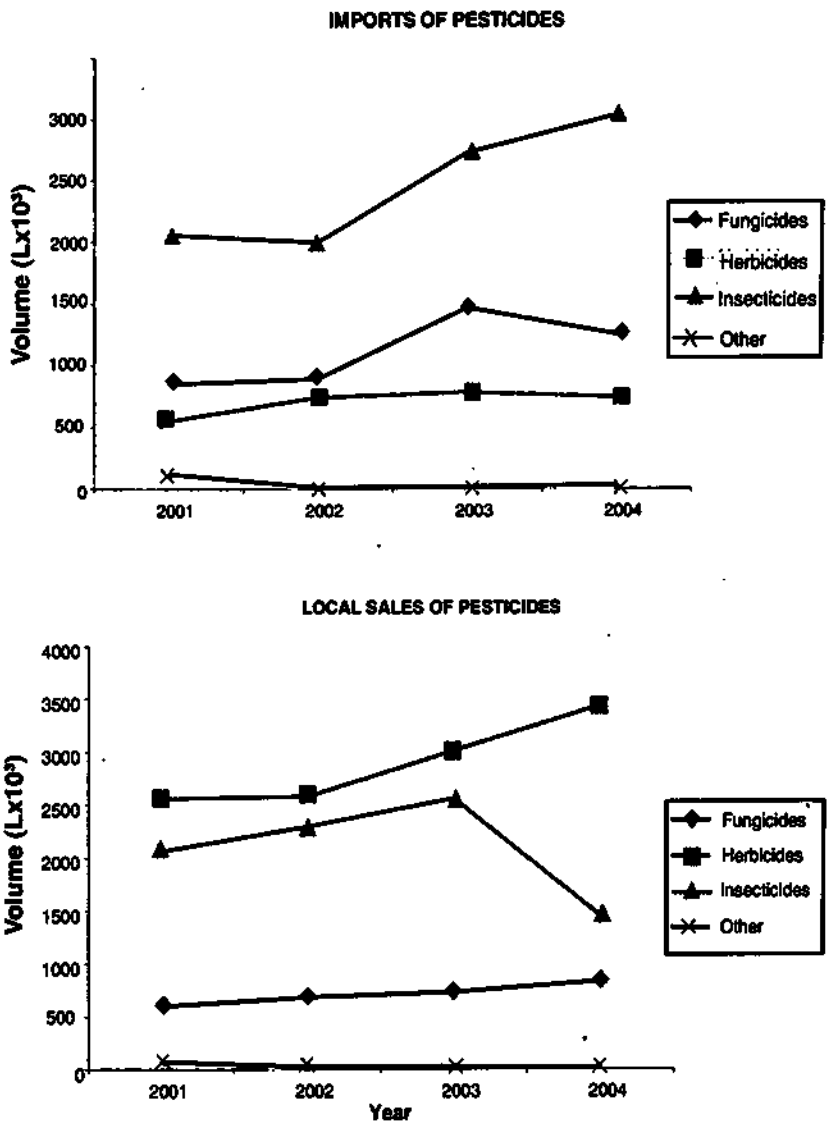


Fig 2. Imports and local sales of pesticides

Other than organophosphates, carbamates and pyrethroids now there are number of new chemical groups emerging with the latest trends in research for more environmental friendly chemicals. Some of them are bio pesticides including botanicals, encapsulated microbial products, pheromones, insect growth regulators, and target specific products.

How to select a pesticide

It is not always desirable to use chemicals/agro-chemicals for controlling pests anywhere because of the inherent toxicities associated with this group of chemicals. Pests are controlled by variety of ways in the environment.

Natural control by parasites and predators, in particular, is one of the important aspects that should be explored before going into chemical pest control. These parasites and predators are also in the same environment where the pest is, which maintain a natural balance among their population. Chemicals affect other useful organisms in the nature, and we have to be very careful on the practice of using pesticides.

Proper identification of the pest is extremely important when selecting an effective pesticide, because the pesticides available in the market are specific or limited to certain groups of pests in most cases. Once the pest is properly identified then we should look for the most effective pesticides which cause least destruction or risk to the environment and the animals get exposed. Before recommending pesticides to the country, local bio-efficacy trials are carried out at the respective crop research institutes of Department of Agriculture and other agencies such as Tea Research Institute. The Researchers carefully design the trials in evaluation of the product to ensure that the pest is effectively controlled at the dosage recommended

Table 1. Insecticide types imported in 2004 to Sri Lanka

Chemical family		Imported Volume (Lx 10^3)
Organo Phosphate	OP	515.56
Organo Chlorine	OC	0.00
Carbamates	CAB	546.45
Botanical	BOT	0.00
Insect Growth Regulator	IGR	122.83
Synthetic Pyrethroid	SP	13.40
Phenyl Pyrozole	PP	6.60
Nitro Guanidine	NG	21.90
Inorganic	IN	3.50
Total		1230.24



(a) (b)

Fig 3. Field application of liquid pesticides: (a) Safe application while wind direction is away from the user, (b) Incorrect and dangerous handling.

with least effect on beneficial organisms, to the crop or related environment. Therefore, it is extremely important that the product recommended for the particular pest is used according to the dosage and dilution rate as prescribed for obtained results. This vital information is available in the label which is approved by the authorities at the time of registering the product after considering all research data.

Farmers are heavily dependent on pesticides due to increasing labour cost to adopt alternative pest control methods. Moreover, chemical pest control is practiced over other options mostly because pesticides have a quick knock down action on pests compared to other control measures. Judicious and correct use of pesticides avoids crop losses and it has become very useful to meet the growing food demand. Integrated pest management (IPM) practices are available and used to minimize the use of these poisonous chemicals in crop production.

Toxicity

World Health Organization (WHO) has established a classification in which all the pesticides are grouped into different hazard classes considering their acute toxicity (toxicity of single or multiple exposures over a relatively short period of time) that might be encountered while any person handling that product. This classification distinguishes between the more and less hazardous forms of each pesticide in liquid and solid forms.

In Sri Lanka, WHO hazard class 1a &1b are prohibited. Pesticides belong to Hazard class II, III are being currently used while focusing on replacing class II pesticides with safer improved alternatives.

Environmental aspects and hazards to farmers and users

Improper and excessive use of pesticides leads to environmental problems such as contamination of ground water, soil and food, pest resistance development, outbreak of secondary pests, loss of diversity of beneficial flora and fauna species. Depending on the nature of toxicity their impact on human health varies. Occupational exposure through dermal and ingestion are the commonest causes for possible health impacts due to pesticides under farming conditions.

While most of these conditions can be significantly minimized by using proper

Table 2. WHO classification of pesticides

Class	LD_{50} for the rat (mg/kg body weight)			
	Oral		Dermal	
	Solids	Liquids	Solids	Liquids
Ia (Extremely hazardous)	5 or less	20 or less	10 or less	40 or less
Ib (Highly hazardous)	5-50	20-200	10-100	40-400
II (Moderately hazardous)	50-500	200-2000	100-1000	400-4000
III (Slightly hazardous)	over 500	over 2000	over 1000	over 4000

Note- LD_{50} the unit to measure acute toxicity, amount of substance required to kill 50% of a population of test animals, expressed in mg/kg. LD – Lethal Dose.

protective measures such as protective clothing (long sleeved shirts, gloves, trousers and face masks etc). Some of the handling practices also improve the safety while application. Avoiding the spray drift from the wind by choosing proper direction of application and use of proper equipment including right nozzle type according to the situation are other important features.

Acute exposure effects or the effects seen within short period of exposure to pesticides, could include headache, dizziness, nausea, vomiting, suffocation, burning sensation in chest etc. If the applicant experiences any of the above symptoms he should immediately stop application of pesticides and wash himself thoroughly before seeking medical advice, if the condition persists.

Apart from immediate toxic response to the exposure of pesticides, medium and long term exposure to lower levels of pesticides also result in numerous other health effects. They are generally classified as sub chronic and chronic effects which include destruction of the reproductive system, damages to certain organs such as kidneys, liver, and physiological system in the body including carcinogenic and other serious health effects. During exposure the person may not recognize easily of the situation in case of chronic exposure because it takes long time to appear the symptoms of some of these health effects. Therefore, taking all necessary precautions at the time of handling pesticides, even if it may not be the preferred choice is extremely important from health point of view. Avoidance of direct contact with pesticides is important in this respect. For example, using necessary personal protective equipment such as gloves etc., thorough wash of contaminated parts of the body using soap and water as quickly as possible are few options generally recommended. It is always important to remember that children and pregnant women are not associated with any pesticide related activity under any circumstance because the health consequences would be greater compared to men and adults. General precautions to be observed in handling and the level of hazards of the formulation are given in the label of the pesticide bottle or container as guidance for the user which should be strictly adhered to by the user.

Label of pesticides sold in Sri Lanka

Pesticide label should conform to the Section 8 of the Control of Pesticides Act which prescribes the information that should contain the label including how the information is presented. Each product has its own trade name decided by the marketing agency but there is a common name accepted internationally for the chemical should appear directly below the trade name in the label with character size of 50% that of the trade name. This avoids undue marketing advantages and possible confusions by the consumer. Along with the common name the label consists information on pests, crops etc. for which the product is officially recommended by Sri Lanka. Dosage which should be applied on the crop or other environment along with such information as dilution is also included. Handling precautions, first aid and in case of emergency, and information for physician are also mandatory on an approved label. The colour band appearing at the bottom of the label provides the vital information of its hazard class as classified by the WHO. **Red** band refers to extremely hazards group, while **yellow**, and **blue** refers to moderately, and slightly hazardous groups. The **green** colour band refers to the group unlikely to cause any hazard. The label contains number of other information along with product related aspects such as registration number. batch number., expiry date, date of manufacture etc, which are very useful for the consumer to get required information at the time of purchase.

Storage of pesticides by the user

Once a product is chosen and purchased another vital aspect is the storage of product or the left over which is intended to be used later. Under any circumstances pesticide should not be just kept in the house for a long period of time which would allow ready access to unwarranted persons and children. ***Specially, children should be given the idea that all pesticides are dangerous poisons that can kill. Adults should develop the idea that pesticides are poisons, and need to be used with care, only if its use become unavoidable.***

Easy accessibility at household environment would result in serious consequences some of which may lead to unfortunate situations such as death of loved ones. Deliberate attempts to terminate the life using pesticide have become a serious social issue in farming community. Therefore, it is extremely important that we should avoid unnecessary and prolong storage of pesticides at household environment. The amount required for immediate use should be brought in and disposes of as early as possible. However, in an instance where a small amount of left over of pesticides or a product to be used in immediate future (in couple of days) can be stored in a safe storage box located outside the house at a place which is not reachable by children and kept always under lock and key. Special precautionary measures are needed to be observed in case of storage of bulk quantities of pesticides.

Legal control in Sri Lanka

The government has the overall responsibility of assuring proper management of pesticide use in the country, and should take specific powers to regulate the distribution and use of them within the country. In Sri Lanka, legal provisions are established under Act No. 33 of 1980 on imports, formulation, packing, labeling, storage, transport, sale and use of pesticides. The Registrar of Pesticides is the licensing Authority who is advised on policy and technical matters by the Pesticide Technical Advisory Committee (PeTAC).

Office of the Registrar of Pesticides implement the regulatory process while conducting programmes, surveys, studies of environmental impacts and training of various target groups including school children etc. For example one ongoing programme is collaborated with the Health Ministry to assess the impact of banning two most potent agents connected with majority of suicides in Anuradhapura and Polonnaruwa districts. The use of them is prohibited in Polonnaruwa areas since 2003 and the trend in pesticide related deaths are monitored in which results show a tendency in declining the death rate. Another possible relationship with these agents in Anuradhapura area is pesticides and Chronic Renal (Kidney) Failure. Samples were analyzed to quantify the residues of possible contaminations in drinking water and the findings were below the levels internationally accepted for potential adverse health effects.

Gas chromatograph for residual analysis

In Nuwara-Eliya area where heavy use of pesticides is practicing, random water samples were analyzed in connected water bodies by gas chromatography. Profenofos and Chlorpyrifos residues were detected in Lake Gregory and Castlereigh reservoirs whereas no residues were detected in Kothmale and Ambewela reservoirs.

Another study is in progress to detect the residue levels in vegetables offered at the market for awareness, educational and regulatory control on possible contamination of food. It would make the seller understand the consumer demand of pesticide free foods and the farmer aware of the proper use of pesticides. These analytical processes are expensive with the need of experienced technical staff, and scares resources are wisely used for preventive and educational purposes.



Fig 4. Gas chromatograph used for the detection of pesticide residues in water and food samples

Sri Lanka has just become a party to the Rotterdam Convention on the Prior Informed Consent (PIC) procedure for certain hazardous chemicals in international trade. Rotterdam Convention entered into force in February 2004. It helps participating countries make informed decisions about the potentially hazardous chemicals that might be shipped to them, and to facilitate the dissemination of these decisions to other countries.

Future controls

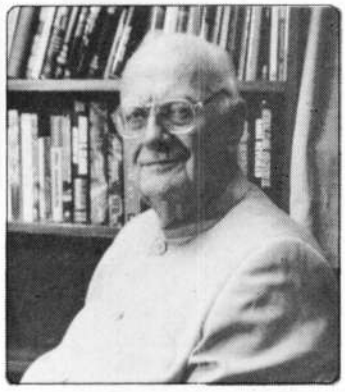
Sri Lanka has already phased out all highly hazardous pesticides including Persistent Organic Pollutants (POPs) under the Stockholm convention. POPs are persistent and last for a very long period of time in the environment. They are potent carcinogens and show teratogenic, oncogenic effects or are highly toxic to humans in other ways. They bioaccumulate along the food chains. Aldrin, Dieldrin, DDT, Chlordane, Endrin, Heptachlor, Hexachlorobenzene, Mirex and Toxaphene were identified as POP pesticides.

Pesticides or pest killers have become essential poisons especially for agri-production, but we should learn to use these poisons with care. Also, we should use the minimum required amount as recommended, while avoiding harmful effects on humans and other organisms in the nature.

Ms Jeevani Marasinghe
is a graudate in Zoology and Environemtnal Sciences. She joined the Department of Agriculture in year 2000 and now serves at the Office of the Registrar of Pesticides, Getambe, Peradeniya.

Arthur C Clarke – Great Contributor to Global Communication

Arthur C Clarke, as we all know, is a scientist who made scientific predictions which have become true affecting the whole world. This world famous science fiction writer selected Sri Lanka to spend his latter half of his life as a honorary citizen. Because of him, Sri Lanka got a world-wide publicity. He celebrated his 88th birthday recently in Colombo. This article briefly reviews retrospective of his journey through his life.



Arthur C Clarke was born to a farm family on December 16th Sunday 1917 at Mindhead, a little hamlet at Summerset in England. His father was Charles Wright Clarke, and the mother was Nora Mary Wills. Clarke was born at his grand mother's house. At the time of his birth his father was in action at battlefield in France.

Little Arthur received his early education Huisis Grammer School in Mindhead. While at school, often he used to read science fictions. Later he wrote articles to school science magazines. The teacher highly valued his articles and gave sweets to encourage small Arthur. To-day, Arthur C Clarke mentions these stories with gratitude. His father faced untimely death when Clarke was just thirteen. The untimely death of his father left Clarke very lonely and helpless. Therefore, he spent most of his time observing sea and night sky. At the age of seventeen Clarke observed the sky using a telescope made by him.

Clarke's father had served as an engineer in the Postal Department before the Second World War. As a result, Clarke got a job to be a minor employee in the same department. It was his first job. One day during the night duty he watched how telex messages were received. As a result, his attention was drawn to this method of communication. The end result of this attention was that Clarke became the father of communication. At the age of 17, he created the communication method with a beam of light and that was written in golden letters in his life. One specialty of this invention was that, using a light beam, to transmit signals ultimately converted to sound at the receiving end.

Clarke's mind was strongly drawn to the "Atomic Energy and Rocket Technology" that was begun at the beginning of World War II. Out of the two, his attention was drawn especially to rocket technology. In 1934, Clarke was busy with rocket design and he carried out experiments with one of his friends Jim Aulborough at his mother's farm. At that time Clarke was nicknamed as 'Scientific Sid', and even today whenever he presents a book to his colleagues he signs as 'Sid'.

Clarke joined The British Civil Service in 1936 and served until 1941. During 1941 to 1945 Clarke served in British Royal Air Force as a Technical Engineer. There he was involved in radar experiments.

He saw that the very rocket technology invented to destroy man could be used for the benefit of man. While he was employed as an Air Force Officer, he carried out experiments involved with rocket and satellite technology. There he was able to develop a sound foundation for the use of satellite technology for communication. His concept was published in 'Wireless World' a leading journal in Electronics in 1945 October issue, and this concept was made known to the public.

After Second World War, Clarke studied in Kings College in London University and obtained a Degree in Bachelor of science with a first class honors in 1948. Thereafter, he joined the British Interplanetary Society, and carried out further investigations. He served as the President of the Inter Planetary Society from 1947 to 1950 and then again in 1953. To day he is a member of both British and American Interplanetary Societies.

Arthur C Clarke is recognized today as the foremost scientific fiction writer. He started his writing career in 1949-50, solely as a way of earning some money. Many of the prediction in his books came true. At the age of 35 (1952) Arthur C Clarke won the International Fantasy Award for fiction writing. This encouraged him to write more books on the subject. 'Childhood End' was written in 1953. Two of his predictions made in this book have come true. That is by analyzing DNA in the cells could give scientific evidence for identification of unknowns. The second prediction leads to the discovery of Birth Control Pill. Since 1956, in every International Science Fiction Writers Conference, Clarke's creations were appreciated. In 1960, The International Academy of Space Travelers admitted him as an honorary member. In 1962, Clarke won The

Kalinga Award; the highest award that could be won by a writer.

The first visit to Sri Lanka by Arthur C Clarke was by accident. In 1954 December he was traveling to Australia to take part in a diving programme. The ship was anchored in Colombo for four hours. After visiting Colombo city, his mind was strongly attracted to its beauty. In 1956, he again came to Sri Lanka, and visited ancient places such as Sigiriya, Polonnaruwa, Anuradhapura and Adam's Peak. Later he traveled to South West sea coast, places like Unawatuna, Ravana Great Base and other similar places. After this experience he decided to adopt Sri Lanka as his place of abode. It was a great honour to Sri Lanka by the announcement of a world famous science author of his decision. In return he enjoys a great satisfaction of living in one of the most beautiful islands of the world, and getting respect of its people. In 1957, the Government of Sri Lanka offered him the 'Resident Guest' award of honorary citizenship.

Arthur C Clarke has written around 100 science fictions. Out of them "2001: A Space Odyssey", "2010: Odyssey Two", "2061: Odyssey Three" and "3001" have been translated into Sinhala. Highly popular Science Fiction Films from books of 2001, 2010 based Space Odyssey one and two were produced.

Even though, Arthur C Clarke today lives as a bachelor, he was married in 1953 to Harylin Mayfield, and was divorced in 1964.

In 1962 February while in a shopping spree in Colombo, accidentally his head was hit hard against a low lying door way. As a result, his physical health was seriously affected and to day he uses a wheel chair for his indoor activities of daily work.

Clarke involved not only in scientific matters, but also artistic activities. He had great liking to watch traditional country dancing and fire walking. Together with some Sri Lankan scientists like Carlo Fonseka, Clarke was involved in scientific investigations on the religious ceremony of fire walking. The first colour film produced in Sri Lanka was "Ran Muthu Dûwa" (The Pearl Island), and producers were Clarke, Wilson and Johnclas. In 1978, he acted as an English Judge in the film "Beddegama" (Village in the Jungle) produced by Lester James Pieris, and thereby becoming an actor. He has written a number of scripts for Radio and Television programmes. Out of them "Mysterious World of Arthur C Clarke" and Arthur C Clarke's "World of Strange Powers" produced by Yorkshire Television in England became very popular.

For the wellbeing of Sri Lanka, Arthur C Clarke has predicted a number of prophesies. In 1995 he called that cricket is a game that wastes time, the time such spends for watching cricket in most inactive time spend by a man. In his book "Deep Range", Clarke has stated that by 2050, the only religion that blossoms man's mind in Buddhism. He advised the Government that Sri Lanka's time should be advance by ½ an hour, but it was implemented in 1995.

Arthur C Clarke has received a number of awards and honours from a number of institutes in Sri Lanka. He was the Chancellor for Moratuwa University from 1979 to 2002, almost for two decades.

He was the Chancellor of International Space Academy from 1989 to 2002. In 1989 he received 'CBE' an award made by the Queen of Great Britain. In 1986 he received "Vidya Jyoti" award offered by the President of Sri Lanka. Accordingly, titles "Sir" and "Vidya Jyoti" are used in front of his name.

For his scientific hypothesis made in 1945 that world can be a communication village using an Earth Stationary Satellite System, he received a cash prize of US$ 50,000. He donated the entire prize money for the establishment of Arthur C Clarke Centre at Moratuwa. This institute is a magnificent gift given to Sri Lanka by him. The institute to day functions under Ministry of Science and Technology, in developing Electronic communication Information Technology and transfers knowledge on astronomy related technologies. In 1996, Japan gifted Sri Lanka a 45 cm computer operated Cassergrain type telescope and it was installed at Arthur C Clarke Centre at Moratuwa.

Arthur C Clarke has received various awards from the world at large for the services he has rendered. In 1992, February 2nd two first covers with two stamps were issued for the service he rendered in world communication for fifty years. That day Arthur Clarke mentioned recalling his past that "We all are a postal family. I first worked in Bishop Lydeared Post Office. These days I never dreamt of anything like this". In October 2005 Arthur C Clarke Centre in Moratuwa held a well attended Science Exhibition commemorating 60 years service for the Communication Concept. During that year he was awarded the highest Presidential Award 'Sri Lankabhimanya". All Sri Lankans wish Arthur C Clarke a long life to continue his services to the world.



Chinthana Wijewardena
is a Scientist who serves as the Media and Human Relation Officer at the Arthur C. Clarke Institute for Modern Technology.

Science and Science Communication



Communication is the process of sharing ideas, information, and messages with others in a particular time and place. Communication includes writing and talking, as well as nonverbal communication gestures, and visual communication. However, the communication has become an essential component of our lifestyle in the modern world. Apart from the face-to-face communication among us, we do communicate through various media of mass communication, and also through internet individually or as groups.

While the print medium which exists from olden days is developing and expanding rapidly with modern technology, electronic media affect mankind closely and strongly. Today, the communication has spread through various fields such as day-to-day events, social trends, political issues, international affairs, sports and culture. However, it is not a secret that Sri Lankan electronic media in general has devoted the major part of their air time for mere entertainment.

Meanwhile, the impact of rapidly growing modern science and technology has imposed strongly on human being of the entire globe. With the development of modern science, the man started trying to understand natural phenomena, he experienced in a different way. This understanding is used for the betterment of mankind and also to defend him from enmity.

However, the development of science and technology could be able to mitigate unfavourable situations like famines, epidemics and eradicate diseases like smallpox. Mainly due to these developments, life expectancy at birth of human being has been increased in almost all communities in the world. It leads to increase the human population to a higher level. Then their damaging actions to the nature resulted unfavourable natural conditions for them and other life forms.

Due to the enormous strength associated with the correct use of science and technology, the man gradually started to use science to find solutions for various problems that came across in day-to-day life leaving conventional practices aside. Now, it has come to a situation that having scientific knowledge and capabilities is essential for almost all human activities. These practices have become essential components of human life, so that modern society has developed a "Science Culture" together with its other cultural practices.

The knowledge of science has obtained through scientific methodology. Scientific method refers to a body of techniques for investigating phenomena and acquiring new knowledge, based on observable, empirical, measurable evidence and subject to laws of reasoning.

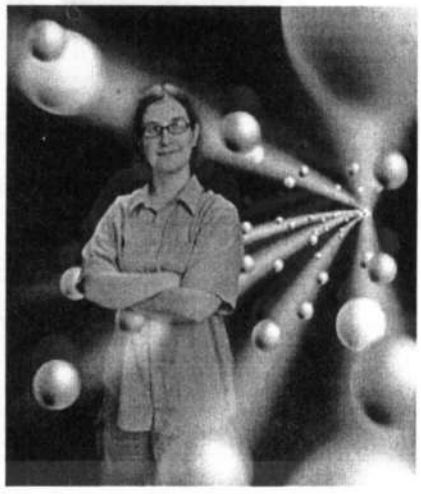
The type of science communication varies from situation to situation. Communication of science among scientists is very important for the advancement of science and technology. This usually happens in a very systematic and methodical manner through technical sessions, symposia, proceedings and peer reviewed articles in scientific journals of various national and international scientific organizations.

Science education can also be considered as another type of science communication. Science education is conducted mainly in secondary and tertiary levels of education using various techniques. Science education mainly gives knowledge and in-depth understanding of science to a particular fraction of the community.

The individuals of this community has already had interest and confidence on science and chosen their future professions in the field of science. Considering the importance of science education in general some universities have given opportunity to follow basic science courses for the students who have not registered for science based study programmes.

However, the view of the majority on science communication is quite different. They think that the science communication is taking science to the general public. Some instances, science communication is referred as science popularization. The science, which can be taken to the general public, is called as popular science by some people.

What is importance of taking the knowledge or information of science to the general public? Even if the science communication among scientists is done by themselves, carrying science to the general public is not happened in the same manner. Common belief is that communicators with the knowledge on modern science and scientists with communication skills are needed for taking science to the general public effectively. The people with such capabilities are known as science communicators.



According to the well known science communicator, Prof. Chris Bryant, the science communication is the processors by which the scientific culture and its knowledge become absorbed into the culture of the wider community. What is the wider community? One thing we should know about the wider community is, it is not homogeneous. It has individuals with different qualities and also from different backgrounds.

When we introduce a certain concept or information we should not expect to be transferred the same picture which is in our mind to everybody's mind. They will understand the concept in their own way according to their nature and the back ground. However, in many instances, we do not consider that fact and we communicate expecting to flow the knowledge from one brain to another as the way water flows through a conduit pipe.

Following results were obtained from a survey conducted by the National Science Foundation of USA to evaluate the efficiency of science communication for the general public of the United States. 15% of the participants were satisfied with existing science communication programmes and 35% of the participants have said that the awareness programmes are inadequate.

It was found that 50% of the participants did not know the following facts.

- the earliest humans lived long after dinosaurs
- the earth takes one year to go round the sun.
- electrons are smaller than atoms.
- Antibodies do not kill viruses.

But, some people question that does that not knowing any of these things matter for their day-to-day lives. Even the misinformation about antibiotics should not matter that as long as they get their prescription from a qualified medical practitioner. Does it really matter if some one thinks the sun goes round the earth? The earth will continue to go round the sun in spite of what people think. The result obtained from the similar survey conducted in the UK was not much different.

However, the above mentioned type surveys are meant to directly measure the level of the knowledge on science of the people. Through science communication, it is possible to transfer science knowledge to the public to be used for their economical development, day-to-day life, cultural aspects and social activities. In some instances, science exists in the people's mind invisibly till they get an opportunity to apply.

However, widely accepted view is that the public understanding of science and public awareness of science are not similar. Science education always leads to understanding of science and it is normally conducted in a formal manner. The other fact related to science education is that the people engage in that already have an interest and faith on science. But, the important task here is to aware the people who do not study science and that makes the majority of the community.

Increasing public awareness of science is a more difficult concept. Two well-known science communicators, Stockl Mayer and Gilbert have described the public awareness as a set of attitudes based on beliefs and feelings, accessing scientific and technological knowledge and a sense of ownership for science. Through this, a confidence is built up to investigate science and technology and their applications. This confidence will lead them to evaluate the nature of their knowledge and its importance on their personal, social and economical aspects of life.

Awareness goes further than a mere knowledge that the science exists. It implies that an affective change has taken

place in the observer that he or she feels comfortable with science, may even have a sense of ownership and pride in it. It emphasize the importance of participation. Even to understand and enjoy a science fiction, one needs to have a sufficient science knowledge.

To increase the awareness of science in the general public many techniques can be used. Print and electronic mass media can play a major role in this regard. In addition to this, lectures, discussions, workshops and even drama are broadly used for science communication globally. Science museums, zoological parks, botanical gardens and science exhibitions have strong potential of uplifting the level of awareness of science in the general public.

However, whatever the technique we use for this purpose should be very attractive and appealing to the participant without disturbing it's objectives.

Broadly speaking, the science communicators bridge science and it's stakeholders. Specially, science communicators' more important role is to develop public confidence on Science related matters while improving critical thinking capabilities of the public, rather than building an image on a particular scientist or group.



Dr Jayantha Wattavidanage
is a Scientist who serves at the Department of Zoology in the Open University of Sri Lanka.

http://www.listen.org/Templates/fact_conpetence.htm
The International Listening Association

LISTENING COMPETENCE AND OMMUNICATIVE COMPETENCE

Confident individuals listen to message content better than individuals who lack confidence (Clark, 1989).People with less confidence in themselves tend to be better listeners for the emotional meaning of the spoken message (Clark, 1989). Being more willing to communicate and less apprehensive about listening and speaking is an indicator of better listening comprehension (Clark, 1989).

When learning a foreign language, one's grammar improves if one learns to listen to the language prior to speaking it (Benson, & Heilt, 1978).

Both business practitioners and academics listed listening as one of the most important skills for an effective professional, yet only 1.5% of articles in business journals dealt with listening effectiveness (Smeltzer, 1993). Individuals agree less on the ratings of good listeners, but agree more on the ratings of poor listeners (Cooper & Buchanan, 2003). Listening accounts for approximately 1/3 of the characteristics perceivers use to evaluate communication competence in co-workers (Arnold, 1995).

Listening and listening-related abilities such as understanding, open-mindedness, and supportiveness constitute the single dimension upon which people make judgments about communication competence (Wienmann, 1977). An individual's willingness to listen is positively correlated with communication skills and negatively related to receiver apprehension and sender based communication apprehension (Roberts & Vinson, 1998).

Listening is an important component in how people judge communicative competence in the workplace (Haas & Arnold, 1995). Further, individual performance in an organization is found to be directly related to listening ability or perceived listening effectiveness (Haas & Arnold, 1995).

LISTENING AND MEANING

In a spoken message, 55% of the meaning is translated non-verbally, 38% is indicated by the tone of voice, while only 7% is conveyed by the words used (Mehrabian, 1981).Spoken words only account for 30 -35% of the meaning. The rest is transmitted through nonverbal communication that only can be detected through visual and auditory listening (Birdwhistell, 1970).

LISTENING AND MEMORY

On average, viewers who just watched and listened to the evening news could only recall 17.2% of the content when not cued, and the cued group never exceeded 25% (Stauffer, Frost, & Rybolt, 1983).
In a linear one-way listening task, when presented with a list of words, people can remember, on average, 7 items (Miller, 1956).
When presented with a series of unrelated sentences and asked to remember the last word of each sentence, people can remember, on average, 2.805 items (Janusik, 2004).
In a dynamic, conversational listening task, where people must remember a series of related questions and respond to them, people can remember and respond to 2.946 items (Janusik, 2004).

LISTENING AND SPEECH RATES

The average person talks at a rate of about 125 – 175 words per minute, while we can listen at a rate of up to 450 words per minute (Carver, Johnson, & Friedman, 1970).

LISTENING AND LEADERS

Listening is tied to effective leadership (Bechler & Johnson, 1995; Johnson & Bechler, 1998).
Leaders give good attention to the speaker by looking the speaker in the eye (Orick, 2002).
Leaders listen with an open mind by not becoming emotional or defensive (Orick, 2002).
Leaders can listen to a speaker and be respectful by not betraying the confidence of the speaker when asked to do so (Orick, 2002).

Herbal Products: Facts and Fallacies



Today there is a large number of plant extract added consumer products in the market. Among these products are various herbal soaps, toothpastes, shampoos, various creams for facial and skin application, various hair oils, mouth washing solutions and various medicinal material added preparations claiming therapeutic properties. About five decades ago, around 1950's, plant extract added commercial products could be bought only from pharmacies. These products were bought by a selected limited number of consumers. Only a very few small scale producer produced these herbal extracts containing consumer products. They have selected a few handfuls of medicinal plants containing therapeutic properties and added parts of them to consumer products. Today the problem is that not only the small scale producers, but also large manufacturers releasing herbal extract containing products to the market. These products can be bought not only from small sales outlets, but also from super markets.

Before the various medicines were produced in the laboratory, in earlier days man used natural herbal products to cure his ailments. Even today, about 75% of the human population depends on the natural herbal material to cure diseases. The main reason behind this selection is that, herbal product are able to cure without side effects according to traditional knowledge of societies. Because of this reason, if any consumer uses any products containing herbal extract he or she expects a definite therapeutic property from the said product.

The question that we should ask is that whether the consumer gets the expected therapeutic healing by using the said herbal products. To answer this question one should consider a number of factors.

The number one question is that whether the authentic medicinal plants were used to obtain the herbal extracts. If the answer is yes, the next question will be whether the plants or trees were in a sufficiently mature state? This is a compulsory question that should be asked when considering medicinal plants. Why? Because all chemicals and chemical compounds found in a plant are made by biosynthetic pathways. Generally, chemicals responsible for healing effects have been extracted from sufficiently matured herbs and plants.

The next question is that the extract is taken from which part of the plant. The therapeutics chemicals are deposited in various parts of the plant. The well known *Vinca rosea* is such a plant. The roots contain a chemical called *Adjmaledene,* it is used to treat high blood pressure. Leaves contain two chemicals called Vincristine and Vinblastine which are used to test leukemia. Because of this reason if the root extract is used instead of leaf extract, the expected therapeutic result is not obtained.

The extraction process of chemicals from the plant source is also a complex one. If the extraction process is not properly followed, there may be no active chemicals in the extract. After harvesting the plant, it is subjected to post harvest processes such as proper storage, drying, cutting and powdering. After this, it is subjected a selected, recommended extraction procedure. Water or alcohol or organic solvents have to be used. To release the chemical from plant components, correct acidity or alkalinity has to be used. If the correct procedure is not followed the wanted chemical compound may not be extracted and remains in the plant material. In certain cases the powdered plant material can be directly used instead of extracting its components.

When plant chemicals are considered, there is one important factor that has to be taken into account. Most chemicals in plants after harvesting undergo a gradual degrading and denaturing process. Because of this reason,

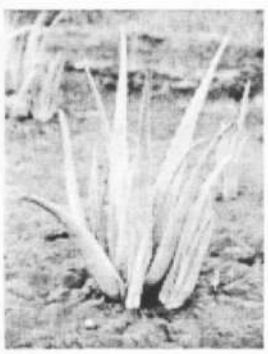
if one is adding herbal extracts to his products, the extracts have to be obtained from fresh plant material.

So far, I have mentioned some recommended procedures when obtaining plant extracts. Next we shall consider various products containing plant extracts.

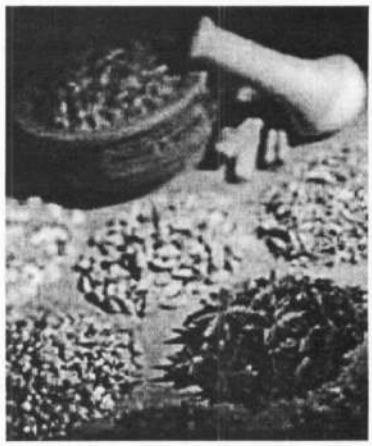
Toothpastes take the most important place carrying the herbal products. The basic maternal, the white paste is from precipitated calcium carbonate ($CaCO_3$) or from aluminum trihydroxide ($A1OH_3$). The main function of these materials is to clean, remove particles and polish the tooth surface. There are a large number of oral diseases, based on teeth. Some of them are bleeding gum, loose teeth, and inflammation of the gum. Most of the herbal extracts are added to a tooth paste to prevent or cure such diseases. Therefore, not any herbal extract, but only those extracts having preventing action should be added. They should prevent most of the tooth diseases and prolong the life of a tooth, while improving total oral hygiene.



In Ayurveda medicine and as found in research studies, there are a large number of recommended plants for this purpose. They are clove bud oil, Eucalyptus leaf oil, Cinnamon leaf oil, *Terminalia chelate, Terminalia arjuna, "Mádam"* and *"Múnamal"* bark, *"Pila"* and salt material. The plant extract has to be obtained by recommended methods and added in correct dosage in the process of toothpaste manufacture.



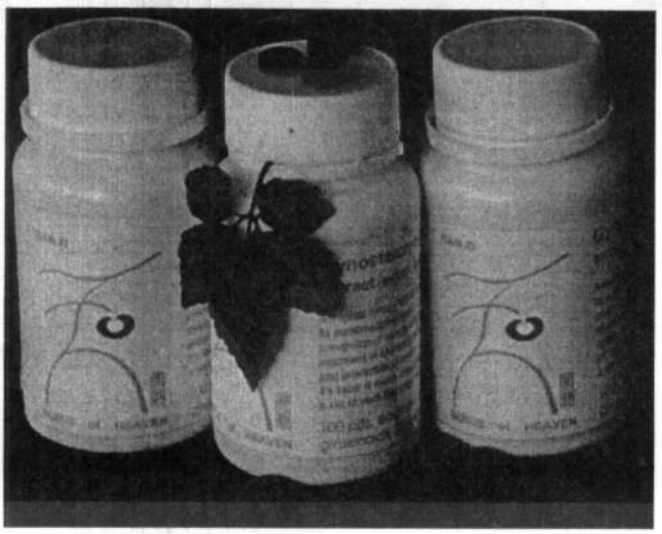
According the label and various advertisements, almost all cosmetic soaps contain one or many plant extract. Basically soaps are manufactured by reaction of coconut oil, palm oil, or lard with sodium hydroxide. Scientifically it is a salt, sodium laurate or palmitate. Its basic function is to wash out deposited oil and dirt on the skin and bring about cleanliness. A number of plant materials have been recommended for adding to soap, fro the sake of skin care. Some of them are *"kokum"* bark, Sandalwood oil, Vetiver oil, *"Venivel"*, Jasmine, Neem seed oil, turmeric, *"Pathpadagum"*, and Almond oil. They clarify sweat pores, prevent skin diseases, and bring about a bright and youthful look to the skin. This is the truth if recommend plant material in the correct form is added to soap.



Ayurveda, Unani, Allopathy and Homeopathy form of medicine have recognized much of the above mentioned plants having definite therapeutic properties. They have been found either in the age old traditional treatment, in various clinical experiments, to have the claimed therapeutic properties. We have no argument about their medicinal properties. Our question is that, whether the manufacturers have used the authentic plants in their preparation? If not whether they have used substitutes for the authentic plant material.

Now let us consider some facts about shampoos. Basically shampoo is a liquid. The base of a shampoo is sodium lauryl ether sulphate. The basic function of shampoo is to remove oil and dirt from the hair and clean the scalp. Excess removal of hair oil brings a dull look to the hair. Such oil less hair tends to tangle and matted, and uneasy to control. To control such matted hair, chemical called conditioners are added to shampoos. They prevent hair tangling and shacking to each other. Some of the common problems with the hair in untimely fall, graying, loosing luster, hair tangling matted conditions, dandruff, and having head lice.

There are a number of herbal remedies recommended for hair and hair related problems. The whole lime with peel juice, "Veralu" leaf juice, Cassia leaf juice, Fenugreek, Turmeric, "Godapara" fruit juice "Madatiya" leaf juice are some herbal extract recommended in Ayurveda medicine. The chemicals in these herbal extract are capable



of curing most of fall and graying of hair. They bring or restore the lustrous look, and good hair growth, a condition most Sri Lankan women dream to have.

Let me also consider some of the common skin creams and lotions. The base is an emulsion made by mixing water and oil. Lotion and cream when applied on the skin prevents dry skin and wrinkles, and brings a youthful look. In Ayurveda a number of herbal remedies have been recommended. Among them commonly used herbs are sandal wood paste and oil, "Venival", musk, Turmeric, "kokum" bark, and Vetiver oil. These herbal extracts are capable of preventing drying and wrinkles and bring about a healthy and youthful look to the skin. Recently, various advertisements show that Avocado fruit pulp, Gram powder, vegetable extract like cucumber, carrot and certain fruit pulps are also added to skin creams and lotions. They seem to add moisturerising properties to the skin.

Any consumer will use a tooth paste, soap or a shampoo only for a few minutes. Within such a short time it is very doubtful whether the active chemical ingredients of the herbal product are absorbed into the body.

In addition to various skin creams, lotion, shampoos and soaps, herbal teas, are now in the market. According to the label such herbal teas condition Cassia leaf and flower, Garciniya ("Goraka"), "Iramusu", "Polpala", Gotukola", and lots of other herbal remedies with vitamins and anti-oxidant properties.

Now let me consider to the actual fact of herbal based products. The consumers firmly believe that natural herbal extract and components are used in the manufacture of herbal products. They also believe that natural products have fewer side effects, bring about the expected therapeutics properties.

Therefore, if any manufacturer of such natural product fails to incorporate the label claimed herbals, he is cheating the consumer. This is a punishable offence under law.

There are a large number of herbal medicine products in the market. They claim a large spectrum of therapeutics properties. For example, "Gotukola" products are available as tablet and capsule form. The "Karavila" extracts are dried to a powder and powder is encapsulated. There are certain herbal teas claiming to control obesity. These herbal teas claimed to contain plant material such as "Ranawara", "Belimal", "Ardathoda", "Kuppamenia", "Gotukola" and "Polpala". But the labels do not mention their quantities. It is an open question whether such herbal material is actually found in the tea bag.

Ayurveda, Unani, Allopathy and Homeopathy form of medicine have proved that much of the above mentioned plants having definite therapeutic properties. They have been found either in the age old traditional treatment, in various clinical experiments, to have the claimed therapeutic properties. We have no argument about their medicinal properties. Our question is that, whether the manufacturers have used the authentic plants in their preparation? If not whether they have used substitutes for the authentic plant material.

So far there are no standards specified in Sri Lanka bout herbal products. Even in the developed countries, there are no standards specified in this field. If there are any laws specified it is only for a limited number of products. The main reason for this lack of standards is the difficulty of analysing plant extracts. What should be the exact percentage of plant product? Or whether the extraction has been carried out according to set analytical methods? How could one determine whether the said extract is a genuine one? For example "Elabatu" (*Solanum xanthocarpum*) root is recommending plant for most cough and cold remedy preparations. The manufacturer could substitute it with another plant "Wambatu" *(S. suratensee)*, a plant which abundantly available. The therapeutic property claiming chemical is also another area that has to be looked about. When a shampoo is considered find that whether there is the actual percentage of plant extract as specified in the label. As a matter of fact, many herbal shampoos do not mention on the label the actual percentage of herbal extract containing in the preparation.

Unfortunately there is no set testing or standard analytical methods set for herbal products. Because of this reason no certain figures could be obtained for accuracy of the analytical results. Thus a herbal extract in the market shampoo could contain one to few grams of the plant extract per kilogram. The manufacture is correct, as the label claims there is some herbal extract in the said shampoo.

In a herbal extract there may be more than one complex chemical. There are complex analytical or testing methods to find out their presence. They can be done only in few, well equipped laboratories. For example take the well known herbal cough product VASAKA, which contains extract from "Adathoda". The active chemical in Vasaka extract is called vasacene. Using the correct analytical method one can tell only the presence or absence of vasacene, not its extract quantity.

"Dasamula Aristaya", a well known health promoting medicinal herbal syrup has extracts from 63 plants. There are no standard methods specific to analyse the active chemicals in "Dasamula Aristaya". Because of this reason the label may claim the product as "Dasamula Aristaya", but the content could be anybodies guess. "Venivel-geta", a well known Ayurveda medicine has a yellow colour. The yellow dye could well deceive its presence. Because of this lack of standards analytical methods, many manufacturers could produce herbal product and deceive the consumer. I have seen certain producers challenging the analytical experts, top prove the absence of certain ingredients in their products. Because of this reason, the consumer has to use herbal product with a certain degree of uncertainty in Sri Lanka.



Upali Senanayake
PhD (University of New South Wales, Australia) He was the Head of the Natural Products Section from 1985 to 1996 in CISIR (now ITI).

Ref: Focus on Complementary and Alternative Medicine (CAM) at the NIH, Volume XII, Number 4: Fall 2005/ Winter 2006

A Closer Look at Ayurvedic Medicine

In India, about two-thirds of the people in rural areas use traditional medicine, such as Ayurveda, to help meet their primary health care needs

© WHO/Pallava Bagla

Ayurvedic medicine, also called Ayurveda, is a whole medical system that began in India and has evolved there over thousands of years. The word Ayurveda is made up of two Sanskrit words—ayur, which means life, and veda, which means science or knowledge. Thus, the word Ayurveda means "the science of life."

In the US, Ayurveda is considered complementary and alternative medicine (CAM). Many therapies used in Ayurveda are also used on their own as CAM, such as herbs, massage, and yoga. NCCAM is supporting some research studies on Ayurvedic therapies.

What Is Ayurveda?

Ayurveda is a whole medical system that is based on various theories about health and illness and on ways to prevent, manage, or treat health problems. The aim in Ayurveda is to integrate and balance the body, mind, and spirit. This is believed to help prevent illness and promote wellness. Ayurveda also has treatments for specific health problems.

Ayurveda is based on ideas from Hinduism, one of the world's oldest and largest religions, and ancient Persian beliefs. In India, Ayurveda has long been the main system of health care, although conventional (Western) medicine is becoming more common there, especially in urban areas.

Ayurveda and variations of it have been practiced for centuries in some other countries as well.

Looking at Health and Disease

Ayurveda has some basic beliefs about health and disease that might be described as follows:

** People, their health, and the universe are all related. Health problems can result when these relationships are not in balance.*

** A person's constitution is called his prakriti. The prakriti is thought to be a unique combination of physical and psychological characteristics and the way the body functions. Three qualities called doshas form important aspects of the constitution and control the activities of the body. They are known as vata, pitta, and kapha in Sanskrit.*

** Every person has a unique balance of doshas, with one usually the most prominent. Each dosha tends to correspond with a certain body type and personality type, and a greater chance for certain types of health problems.*

** An imbalance in a dosha can be caused by an unhealthy lifestyle or diet, too much or too little mental and physical activity, or not being properly protected from the weather, chemicals, or germs.*

** In Ayurveda, health and disease are believed to be related to the way a person's doshas are balanced, the state of his physical body, and mental or lifestyle factors.*

Ayurvedic Treatment

In working with patients, an Ayurvedic practitioner uses various techniques, including questioning, observation, touch, advising, a treatment plan, and specific therapies. Patients are expected to be active participants in their treatment, because changes in diet, lifestyle, and habits are often required.