

THE MICROBIAL WORLD: A FORMIDABLE FOE TO MANPOWER DEVELOPMENT

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Abstract

Nations all over the world have in recent times recognized the significance of the delicate balance between man and the natural resources. The microbes play very vital roles in the continuous maintenance of the conditions suitable for other forms of life. Man has been manipulating and modifying the microbial activities to his own advantage. However, the relationship between humans and pathogenic micro-organisms has ever been a wearing issue in the mind of thoughtful concerned men, considering the generations of people who have been subjected to the ravages of infectious diseases. Invaluable resources are also lost through detrimental microbial activities. For a drastic manpower development, there is a need for an increasing knowledge of how to control micro-organisms and check their negative influence on man,

Introduction

It is a well known fact that much of the wealth of any nation, particularly the developed world, is attributed to science and technology. Science has a wide range of applications in everyday life affecting virtually all areas of man's very existence namely: health and medicine, food and agriculture, transport and communication, defence, machinery, clothing, shelter and education, not the least among others. In view of these benefits, the crave for scientific advancement of the nation could be achieved through efficient school programmes as well as public enlightenment.

Milton et al (1966:199) identified the reasons why most societies teach science in the school as: Preparing scholars in various disciplines of science to improve their well being; providing a background required of individual entering technological occupation; and providing a background in the sciences as part of the individual's upbringing for effective citizenship.

It has become almost universally accepted that the measure of society's manpower development is in its ability to control its environment, utilizes its resources for its members and ensures that each member benefits from the natural resources.

Like any other developing nation, the Federal Government of Nigeria has the intention to give appropriate and functional environmental science education for profitable development of her manpower. This is aimed at transforming Nigeria from a consumer nation to -that which is self sufficient. Thus all arms of the Nigerian educational system have picked up the challenge and incorporate topics and courses of environmental interest in both curricular and extra-curricular activities.

Ochefu, Y.A. et al (1999:3), opined that science be given priority and made the "culture of the society and not just what one will encounter in the four walls of the classrooms". Accordingly, related relevant concepts for public consumption are being disseminated through various mass media, workshops, seminars, non-governmental social meetings and conferences such as this, the sole aim is to make all scientific literate for functional living in our changing environment.

This paper seeks to unfold the little fragment of the environment - the microbial world, which benefit the entire biosphere, yet remains a formidable foe that requires sustained efforts to minimize its detrimental activities if there must be effective manpower development.

Environmental science in this context is synonymous with environmental biology or ecology, which refers to the scientific study of the interactions among organisms and with their environment. The environment of a man is his immediate surrounding which is made up of two components namely; physical component (all non living matter and physical forces e.g. water, air, lighting, noise, climate, soil etc) and the biological component (comprising all living things).

The environment in which we live has to a large extent been determined by the activities of innumerable organisms interacting with each other and their immediate surroundings. Man's relationship to his environment is reciprocal in that while man extensively alters his environment to suit his needs and desires, the latter has a profound influence on his health and productivity. Drum, G. (1994) categorically states that "no organism can avoid sharing its environment with bacteria and even our body", so also with numerous other microbes.

It is obvious that microbial activities have a great part to play in the continuing maintenance of conditions suitable for other forms of life on this planet.

There has always been awareness of the need for a good understanding of how microorganisms react in the environment. Renowned scientists like Grant and Long (1981) ascertained that such "an awareness has been heightened from time to time as detrimental activities become evident under certain conditions". Thus, the need for microbial manipulations and beneficial modification on a global scale.

The Microbial World

The idea of the existence of microbial life dates back to the period before the advent of Christ and invention of microscope. The Roman Philosopher Lucretius (98-55BC) was among the first people to suggest that, creatures too small to be seen with the naked eye might cause disease.

The discovery of microscope which was a major breakthrough in the study of living organisms, led to the discovery of an entirely different world - the world of microbes or microorganisms. Anton Van Leeuwenhoek (1632 - 1723) was one of the earliest scientists who discovered and accurately described micro organisms within the previously hidden world of drops of rain water. Microbes are groups of organisms that cannot be seen with unaided eyes. They are assigned two kingdoms - The Monera kingdom which are prokaryotic in nature and made up of bacteria and cyanobacteria (blue green Algae), and the kingdom protista - all Eukaryotic and consist of protozoa, algae and lower fungi.

Microbial life is found everywhere. They inhabit soil, rocks and woods, water and air and virtually anywhere life is found. Campbell (1999:503), puts it in his own words that "more prokaryotes inhabit a handful of dirt, or the human mouth or skin than (the total number of people who have ever lived, dominating the biosphere and outnumbering all eukaryotes combined)". Protists also share the same environment or habitat. Most live in water - in rivers, sea, moist places and body fluids of other living organisms including man.

Some microbes are free living, producing their own food from simple inorganic materials either using light energy or chemical energy from chemical reaction. These live in association with other organisms for mutual benefit. Yet some are parasitic in their mode of life or depend on organic matter for survival.

Roles of Microbes

The microbial population inhabiting the soil and waters represent the most significant in long term maintenance of the biosphere (Grant and Long, 1989; Brum et al, 1994; and Campbell, 1999). The evolutionary history of life on earth has it that the prokaryotes were the earliest organisms to colonize our planet and have continued to adapt, flourish and help to change the earth (Campbell, 1999).

Atoms of organic molecules in the body of the living organism are made up of inorganic compounds of the soil, air and water. Continuity of life therefore depends on the recycling of chemical elements between the biological and physical components of the environment. Minerals play essential roles in these substances' cycles such as carbon, sulphur, nitrogen etc.

The free living autotrophic microbes are the producers, building organic compounds from simple inorganic materials -- water and carbon dioxide using energy from sun or chemical reaction. They become source of food for other forms of life in the habitat. They also give off oxygen as a by-product thereby restoring it to the environment. Campbell (1999) in explaining the many metabolic capabilities of microbes states that they (Prokaryotes) are the "only organisms able to metabolize inorganic molecules containing elements such as iron, sulphur, nitrogen and hydrogen". Examples include Chrysophytes (golden brown Algae), Zanthophyte (yellow green alga), sulphur and iron bacteria to mention just a few. Others like cyanobacteria in addition, fix nitrogen into its compounds for organisms to use.

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Many microorganisms are decomposers which break down organic molecules of corpses and waste products to the simplest forms (inorganic) which are used up by higher plants or producers.

Microbes more often interact with other species of their kingdom and those of other kingdoms. Symbiotic microorganisms are of immense importance, for example nitrogen fixing bacteria and cyanobacteria live in the nodules of legumes converting atmospheric nitrogen into usable nitrogenous compounds for the plants and they in turn get supply of carbohydrate for energy.

Bacteria and Protozoa that live in the alimentary tracts of some herbivores like cattle and sheep digest cellulose for them. Fermenting bacteria living in the human birth cana acids that

maintain a pH between 4.0. and 4.5. The acid helps to suppress the growth of yeast and other potentially harmful microorganisms, Campbell (1999:516). Those in the alimentary tract of man (protozoa and Escherichia coli) are believed to synthesise Vitamin K that help in blood clotting. They also help to keep off harmful bacteria by starving them.

In short harmless microbes are found as normal flora virtually in every organism and in naturally occurring food such as milk (E. coli) and sap of palm tree (yeast - saccharomyces cerevisiae).

Application of Microbes

Man has learned many ways of exploiting the diverse metabolic capabilities of microbial life both for scientific research and practical medical and economic purposes.

Consequently, Grant and Long (1981) opined that there is "the need for microbial manipulations". And "Beneficial modification on a global scale".

Campbell et al (1999:517) testified that "we are just beginning to explore the great potential prokaryotes (as well as protists) have for helping us solve some of our environmental problems".

Many species of microorganisms are now genetically engineered to make human food such as alternate food source - single cell protein (SCP) includes pruteen (from Bacterium) Chlorella (from single Algae Cell) Mycoprotein (from Mould).

Many species of mucus are used with soybeans to make cheese called sufu - the boneless meat.

We are all aware of the application of bacteria and yeast in the production of ancient food and drinks such as bread, cheeses, yogurts, beer, wine, vinegar and other alcoholic drinks.

Microbes are also been employed to resolve the problem of both scarcity and high cost of fuel in some parts of the world like Brazil and USA. They are now used in the production of alternate sources of fuel namely: Biogas from the action of archaeobacteria (methanogen) - a methane producing organism on Drug, Agricultural and domestic wastes. The gas is used as domestic gas or and is compressed in cylinders to be used in cars and tractors. The residue or sludge is used as fertilizer. Gasohol (10% ethanol and 90% petrol) is made by sugar fermentation by yeast. The raw materials are maize (in USA) and Sugar cane (in Brazil) (Kent, 2000).

Environmental Scientists are also employing microbes in solving the problems of environment pollution. Modern waste treatment plants employ bacteria to process raw sewage to a safe substance free of disease - causing microorganisms before recycling (ABU, Zaria).

Furthermore, soil bacteria called pseudomonades are being employed to decomposed pesticides, other synthetic compounds and petroleum products. This technique is said to be the fastest and least expensive way yet devised to clean up oil spills (Campbell, 1999).

Fossilized Diatom walls, major constituent of sediments called diatomaceous earth are mined for their great economic and industrial significance. They are used in polishing, filtering and insulating materials.

Genetically engineered microbes are now used to produce antibiotics and other compounds of medical and industrial use. For instance human insulin, for treatment of diabetics, vaccines for vaccination against infectious diseases, silk and adhesives, acetone, butanol for industrial uses, and human growth hormone, vitamins and many antibiotics for human health.

Microbes have been and will continue to be used as 'model' organisms in scientific research work. It is very clear from the above stated benefits (few of course) that life on earth would become impossible without employing the microbial work force, yet a small minority of microbes has remained a human formidable foe, causing diseases, contaminating food and water and deteriorating his useful products.

Microbes: Man's Formidable Foe

Exposure to harmful or disease causing microbes (pathogens) is a certainty. They live successfully like the normal microflora in any habitat that support life - soil, air, water, food, living body and any other object.

In his own words, Brum et al (1994:799) said that:

A single gram of fertile garden soil harbours more than 2 billion bacteria, each time you inhale, millions of bacteria enter your respiratory tract, in fact, cells in billions more occupy your skin.

Spread of Pathogens

Pathogens enter the human body through; cuts, burns, wounds and abrasions on the skin, nose, mouth urino-genital opening and body contact.

The air - borne pathogens enter the body in the air that is breathed in and affect the respiratory system. They leave the body of the infected person in droplets through exhalation, sneezing, coughing and spitting. Diseases like pneumonia, tuberculosis, influenza and mumps are airborne. Air borne droplets can carry pathogens that remain viable for hours or even days and can travel long instances to infect susceptible person (Kent 2000:336).

Some are spread by drinking contaminated water. These often affect the intestine causing diarrhea, cholera and typhoid.

Food borne pathogens enter and leave the body of the host via the mouth and in the faeces (and urine) respectively. They affect the intestine causing diseases like bacillary dysentery, amoebic dysentery, salmonella food poisoning and cholera. Food can be contaminated by poor personal hygiene, contaminated water and by animal vectors especially insects. Diseases like malaria, sleeping sickness are transmitted by insects.

Certain pathogenic organisms are spread by direct physical or skin contact from person to person. They are called contagious diseases. Examples include leprosy, ringworm, yaws, syphilis and gonorrhea and HIV/AIDS. They last three are called sexually transmitted diseases.

Kent (2000) reported that "at least there are thirty new recorded diseases between 1976 and 1996". In many of these, the mode of transmission is yet unknown.

Microbes in the Body and How They Harm Man

Pathogenic microbes usually become established and cause disease when the immune system becomes weak, as a result of malnutrition, stress, drug abuse, environmental pollution and disruption of the normal flora in the body, as well as in infants where normal flora is not yet established (Volk and Wheeler, 1988). The organisms harm the body by utilizing the host's nutrient for their own metabolism and in addition destroying the tissues of the affected parts.

Effects of Pathogenic Microbial Life on Manpower Development

History' is filled with accounts of microbial infectious diseases that have killed off vast numbers of people yearly. Malaria is said to have plagued mankind since the dawn of civilization and contributed to the fall of the ancient Greek and Roman empires (Kent, 2000). It is caused by protozoa of the genus plasmodium and transmitted by female anopheles mosquitoes through a bite. In West Africa, Nigeria inclusive, it hindered the penetration and exploration by the westerners until certain measures were taken. We are aware that many explorers for example Mungo Park and Christian Missionaries died of the infection. It is estimated that "Malaria affects 200-500 million people each year, and kills up to 2.7 million people worldwide" (Kent, 2000:324). In the tropical countries including Nigeria about 300 million people are infected and up to 2 million die from the disease (Campbell, 1999).

AIDS (Acquired Immune Deficiency Syndrome) is caused by one of the most dangerous of all human pathogen known as HIV (Human Immune Deficiency Virus). It is contacted majority by sexual intercourse. AIDS, which was first identified in 1981, kills more people than any other disease transmitted by sexual activities (Kent, 2000). By 1993 HIV had infected an estimated 14 million people, with over 3 million estimated cases of AIDS. By late 1995 the number rose to 23 million, estimated of 3.1 million new infections, and 1.5 deaths worldwide. By the year 2000, around 40 million people may be infected (Taylor et al, 1998). According to Drum (1994:785), "every 12 seconds, a person contracts this disease making it even more prevalent among the sexually active people".

The trend is same for other infectious diseases. What is more, both old and new deadly diseases are becoming more and more resistant to antibiotic and chemotherapy, and many more diseases are caused by normal body flora that are introduced into the body through some life saving apparatus like respirators and catheter. Other infections are also acquired from contact with hospital personnel, carrying virulent organisms (Volk and Wheeler, 1988).

From the ancient times till now, scientific giants are also not spared. Brum (1999:785) confirmed this as he narrated the "*The burden of proof. Germs and Infectious Disease*" he (a Hungarian physician Ignaz Semmelweis) died of an infection caused by the same bacteria he tried so

l hard to fight against in his hospital". Some health care workers have been reported to have acquired HIV infection by contaminated needles (Volk and Wheeler, 1988).

That pathogenic microbes are a hindrance to man power development is just to state the obvious. Apart from the casualties in the war fronts, many are unhealthy, sickling, weak and very unproductive as a result of microbial infections.

Moreover, huge amount of material and financial resources is expended on research, the cure and preventive measures as well as rehabilitation of some sufferers. Valuable possessions are also lost as well as food that is not even sufficient for the growing population is lost on the farm, store as well as markets and kitchen, due to the activities of harmful microbes. About 3,500 cattle were lost out of dairy herd in just a month in early 1992 (Kent, 2000).

Algae blooms affect aquatic life as well as human activities in the sea. For instance Red tide dinoflagellates produce a powerful toxin that kills fish which prey on them and any man that feeds on tissues of oysters, mussels and clams that are not affected, (Brum, 1999) but serve as reservoir of the toxin.

Microbial Control and Suggestions

Continuous and sustained efforts are required to minimize the detrimental impacts of microbes, if any meaningful manpower development is to be attained.

The Federal Environmental Protection Agency (FEPA) should motivate, inspire, and raise the level of environmental awareness among the people. She should also make continuous effect to bridge the gap between environmental awareness and action.

The following principles should be adopted to exclude microorganisms from any area where they might do harm (Volk and wheeler, 1988):

Contaminated clothings and bed linens, should be disinfected by use of disinfectants or boiling. Water should be boiled for quality time or and filtered.

Chemical agents should be used in every day practices in medicine, agriculture, industries, food processing and preservation as well as microbiological laboratories. Soaps and detergents are ideal to hinder germicidal activities.

Other measures include food hygiene-safe keeping of food and its cleanliness, and proper cooking. Individuals should maintain good personal hygiene.

Environmental sanitation should be routinely carried out - the interior and the exterior surroundings, including water and its sources as well as pests in the house should be kept clean.

Hand washing is highly recommended; after almost every activity, before and after eating, attending to a sick one, after washing of a soiled articles and filthy places, napkin change, working in the garden or animal pens, and cleaning up sputum and or vomit (Volk and Wheeler, 1977; McInnes B., 1977; Borick, P.M., 1972).

Habits such as drug abuse, sex abuse, over work and stress that lower the immune system and expose one to infection should be avoided.

Proper diet rich in natural food like fruits and vegetables should be taken for protection and proper functioning of the body.

It is common sense not to share belongings that have contact with one's body with anyone, to avoid contagious diseases.

Since we cannot avoid living with microbes, sustained efforts are required to minimize their detrimental impacts. According to Kent (2000); McInnes, B. (1977); Volk and Wheeler (1988);

Antibiotics alone will not win the war against diseases because of the appearance of new deadly microbial diseases that resist antibiotics and chemotherapy. If microbes change their mode of life to get adopted to changing environment, then man who seems to be on the losing side needs to do the more.

Conclusion

There is every need to learn how to live more successfully today in our changing environment. Increasing knowledge of what microbes are, where they are, how they live, and where their strengths and weaknesses lie equips man to control them more, considering their benefits.

Harmful microbial life is a risk to man and other organisms. Microbial contamination must be eliminated at its sources in a large measure. It is essential to appreciate both the potentials and limitations of all resources, particularly harmful microbes. Undue exploitation - manipulation and modification result in the break of delicate balance that result in disease which consequently hinders manpower development.

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