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Materials

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CONTENTS

THE MAJOR CHALLENGES FACED BY THE LIFE SCIENCE INDUSTRY

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Abstract

The challenges faced by ecology has wide range of view starting from the difficulties endured by a small land farmer or talking about big tourism crisis which leads to starvation for those animals involved in the tourism industry. Science doesn't happen in a silo and events in the outside matter a lot when it comes to the way this sector is funded and regulated. People intent to buy big branded costumes with a fat amount of money but when it comes to buying vegetables from small vendors they start bargaining, I believe that everything is connected in this life science industry so the act of one effects the other. So here I would like to emphasize those challenges those look small yet puts huge amount of impact.

Keywords: Efficiency, crisis, agricultural demands, challenges, change, flexibility, technology

Introduction

When we were in school, we all have had to take a course titled "Life Science" or similar. We have seen textbooks about life sciences without ever knowing what that means. What is life science after all?

Life science is an enormous field of study that examines every living thing on earth. From bacteria to begonias to beluga whales, life sciences aim to learn everything about life on this planet.

Figure 1: Life in molecular level

Image source -https://www.lifescienceleader.com/doc/three-challenges-facing

"Life Sciences" to encompass companies in the fields of biotechnology, environmental, pharmaceuticals, biomedical technologies, life systems technologies, nutraceuticals, cosmeceuticals, food processing, biomedical devices, and organizations and institutions that devote the majority of their efforts in the various stages of research, development, technology transfer and commercialization. More generally we define 'Life Sciences' as all sciences that have to do with 'organisms', like plants, animals and human beings. Every day, we see the world constantly changing. Whether it's advancements in technology, culture, arts, or sciences, there are many things to look forward over the horizon. One of the industries continuously experiencing breakthroughs are the life sciences. The life sciences have always been an industry dedicated to the protection and improvement of human, animal, and natural life.

The Actual challenges.

There are lots of industries which are running daily life through using the natural sources. In the face of increasing global competition, there are overriding challenges facing the Life Science industry today.

1. EFFICIENCY

Organizations are under increasing pressure to simultaneously increase productivity and reduce waste.

Life Science companies operate in a competitive global marketplace being intensified by expiring patents, new product introductions, price pressure from generics and concern over rising healthcare expenditure.

Modernization combined with digital transformation is one of the biggest challenges today. Better use of data and analytics is needed to drive a continual cycle of improvement that improves production capacity, increases availability, reduces downtime, improves processes and decision making, and eliminates waste.

There are times when natural calamities occurs or a time of crisis takes place at that time the agriculture industry face huge amount of loss, there food products are wasted or even the crops cannot grow well, facing challenges with monetary loss also they have to maintain their standards with their food prices, quality and the amount of waste they are generating. With food prices reaching their lowest levels since 2006, governments have been under increased pressure to increase tariff protection or provide state aid to guarantee remunerative prices and maintain farm income domestically, often at the expense of smaller countries that cannot compete with the treasuries of large agriculture players. A review of trade-restrictive measures applied in the last 10 years confirms the resurgence of such isolating trade policies and a significant shift towards more government subsidies and market access protection. Based on this data and a review of recent policy changes in major economies such as the EU, US, India and China. Example - In

September 2015, the UN General Assembly adopted the 2030 Development Agenda, including a set of 17 highly ambitious Sustainable Development Goals (SDGs) supported by 169 targets. Under Goal 2, member states commit to correcting and preventing trade restrictions and distortions in world agricultural markets, including by eliminating export subsidies, as one of the means of achieving global food security, ending hunger and promoting sustainable agriculture. Building on these commitments, the Nairobi Ministerial Conference of the World Trade Organization (WTO) established, three months later and for the first time in WTO history, a binding prohibition and gradual phase-out of trade-distorting export subsidies, taking one critical step towards the implementation of SDG 2. While significant in itself, this outcome only addresses one part of the broader agricultural trade reform agenda currently under negotiation in the WTO, with several other trade-distorting practices remaining in place. Yet if the SDGs are to be achieved, further reform will be essential. According to the OECD-FAO Agricultural Outlook for 2016–25 (OECD/FAO, 2016), a 'business as usual' approach in agricultural policies would see the number of undernourished people decline from around 800 million today to under 650 million in 2025—or at too slow a rate to achieve the SDG target of ending hunger and malnutrition by 2030.

2. As trade diplomats come back to the negotiating table to tackle unfinished business, however, recent changes in global commodity prices may significantly affect the dynamics of on-going negotiations in this area and therefore of progress towards SDG .Over the last five years, the prices of several agricultural commodities have experienced a continuous decline from their 2011 peak. As these prices reach their lowest levels since 2006, domestic pressures facing policymakers worldwide are likely to evolve, ultimately affecting the prospects for international cooperative action.

3. In times of high prices, the main challenge facing many countries usually consists in ensuring that domestic consumers, mostly in urban areas, have access to affordable food, not least to avoid food riots. During the 2007–08 and 2011 food price spikes, for example, several governments reacted by lowering tariffs on imported food or restricting exports to reduce domestic prices and increase available supply (Figure 2). Others focused on building domestic stocks through government purchases of food at administered prices. Still others provided direct support to consumers and vulnerable groups in the form of consumption subsidies or through social safety nets.

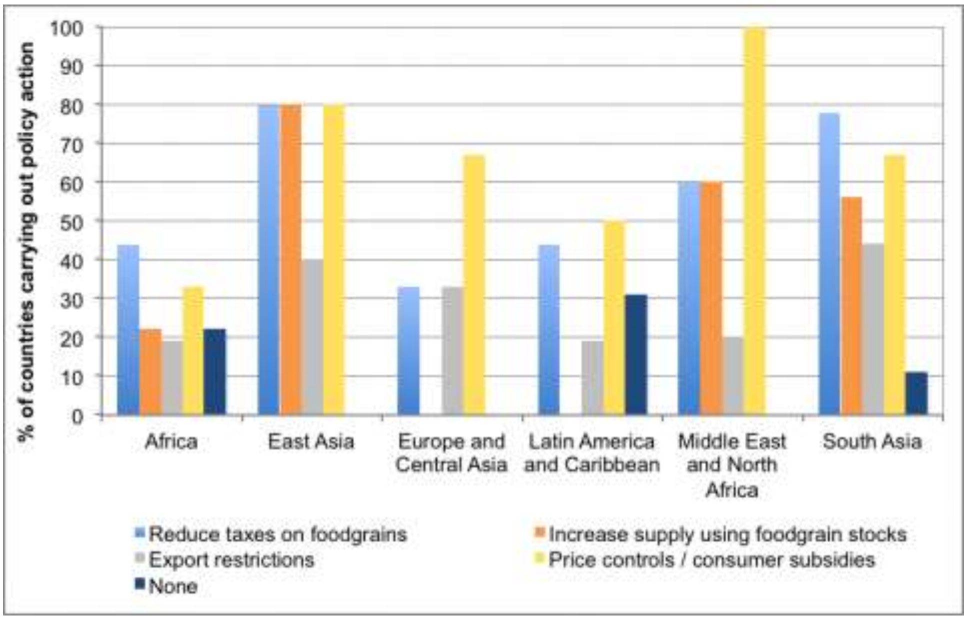

Figure 2: Responses to high food prices by region in 2007–08

Image source - https://journals.openedition.org/poldev/2384

In times of low prices, domestic pressures are more likely to come from producers concerned about remunerative prices and the need to maintain farm income.

2. FLEXIBILITY

Stability and meeting production targets are no longer enough. Time to market is critical and companies have to be able to react and adapt quickly.

The ability to respond quickly to opportunities and challenges is now a key success factor within all areas of Life Science activities. Whether driven by market dynamics, company strategy or short-term targets, management are demanding greater flexibility from operations. An agile approach is needed to meet production changes (e.g. product value, potency and volumes), implement new technologies, increase delivery precision, and shorten time to market. For example - Rice is the second most widely grown cereal crop and the staple food for more than half the world's population. More than 3 billion people consume more than 100 kg of rice per year. Rice is cultivated on 155.5 million with an average growth rate of 0.39% a year, in the last 30 years. In the near future, the possibility for expanding areas under rice-based systems will remain very limited because of the scarcity of global water resources for agriculture, the expansion of urban and industrial sectors in Asia where land is already limited and the high costs of developing new lands that are suited for rice production in Sub-Saharan Africa and Latin America.

The average growth rate of rice yield was 3.68% per year in the early 1980s, but it has decreased to 0.74% per year in the late 1990s. Several factors may contribute to the decline of the area under cultivation and in yield growth. The most important of these factors are: limited returns as we approach the yield potential of the high yielding varieties, declining productivity in intensive rice production systems, pressures from abiotic and biotic stresses, low returns in developing countries, increasing production costs in industrialized countries, and increasing public concern for the protection of environmental resources. One of the most effective means of addressing the issues in rice cultivation and raising the average yields at the farm level is through research and subsequent dissemination of the resulting data. Rice science has made considerable progress. In the area of rice varietal improvement, recent advances in hybrid rice and the new rice for Africa (NERICA) are just two examples of the successful contributions of science to the development of rice.

Figure 3 – showing the situation of a drought.
https://www.google.com/url?sa=i&url=https%3A%2F%2Fwww.weforum.org%2

3. CHANGE

Around 80% of change programs fail to meet expectations. Ensuring change delivers sustainable value is today's key business challenge.

Meeting the combined challenge of efficiency, flexibility and quality requires change in some form. Implementing change, however, is only half the battle. Ensuring it results in greater sustainable value is the real challenge. Change is almost never a straight journey from A to B. Succeeding with value-driven change requires taking a persistent, stepwise journey along a winding path. It requires insight and an integrated, flexible approach that combines people, processes and technology. For example – 1.The only way to force elephants to give rides or perform tricks is through violence and domination. So it's no surprise when they snap and strike back. Countless humans and other animals have sustained injuries and even been killed because of these.

Elephants are seen by their handlers as little more than moneymaking tools. They're forced to give rides to tourists and treated with no respect for their health or well-being cruel tourist attractions. So to meet tourist increasing demands unfriendly measures are used for elephants or on all those animals who works for the tourism industry, they are doing such activities to get adjusted with the new increasing demands of the tourists. This behaviour is even a drawback to the tourism industry and even for the animals.

Figure 4: A starving elephant from srilankan wildlife century

Image source - https://www.petaasia.com/news/captive-elephant-incidents/

4. Finding the optimal compliance level

Responses show that a large segment of the industry simply doesn’t know the optimal level for their compliance efforts. Finding this optimal compliance level is crucial to reach business objectives, including digitalization. Without it, companies risk setting compliance objectives too high, overspending on time and resources, or too low, putting them at risk during regulatory inspection.

Life Science companies are often conservative and risk averse, so they opt for a very high level of compliance. Uncertainty about regulatory requirements leads to excessive compliance efforts. Critical efforts are not separate from unnecessary or legacy efforts. This type of overspending on time and resources hampers efficiency and wastes money.

Consider the example of a biotech company that is appropriately conservative on the production side, and then applies these same risk-averse, high quality standards to their IT systems. The IT systems could be validated with less risk-averse, more flexible quality standards. The company spends extra time and money on validating IT systems, some of which are even outdated. Beyond losing flexibility and efficiency, they have difficulty adopting new technology. Digitalization goals fall behind. This simplified scenario highlights the importance of finding the optimal compliance level, and why so many Life Science professionals identified this as the biggest challenge facing the industry in the next five years.

5. Keeping up with new technology

Another major trend in the responses: practitioners and regulators are uncertain about how regulations relate to new technology. Regulatory bodies are not always seen as ‘front-runners’ of innovation, and technology is developing so rapidly that they can’t always keep up.

How can the industry understand and incorporate the rapidly advancing technology – while also staying in compliance with the current regulatory requirements?

One impact of new technology is that medical device software development moves so quickly, the software is often already outdated by the time it is approved by regulators. This challenge goes across the board for all companies. It also creates an opportunity—you can differentiate your company by using risk-based validation procedures with the optimal compliance level in mind. And clever companies will also get an advantage post-release by creating processes to update the medical device software after regulatory approval.

At the moment, there is a gap in understanding and awareness between regulators and industry. The regulations currently in place are important, but the interpretation by companies and inspectors needs to be more aligned. Regulations are most often viewed in a traditional manner, but a new way of thinking must be applied to them, so they support challenges from technology, processes, data and more.

Example – farmers, small firm businessman

6. Low key Motivation for the failures

Every industry face setbacks but they have to get innovated with due course of time but then there are many who cannot face it and get depressed.

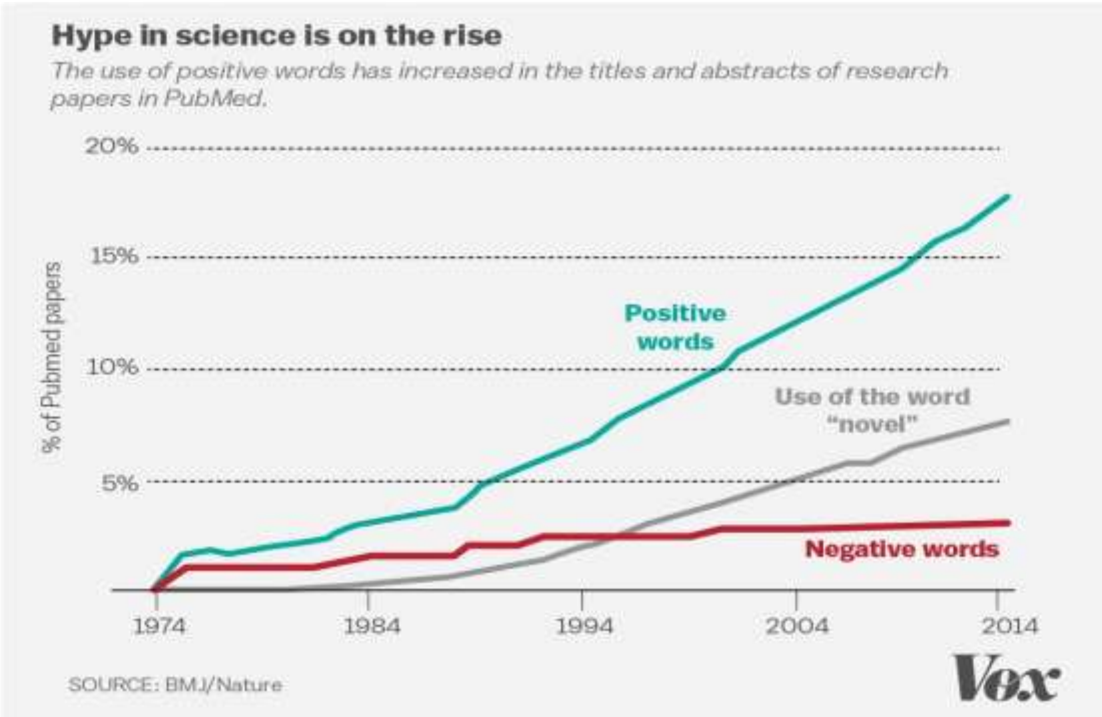

Figure 5 – showing how positive words proved helpful for farmers

Image source - https://www.google.co.in/url?sa=i&url=https%3A%2F%2Fwww.vox.com%2F2016%2F7%2F14%2F12016710%2Fscience-challeges

Conclusion

A digital marketing agency specialized in life science marketing can be of great help when you try to overcome your marketing challenges. Through their experience in servicing life science companies, such agencies become well-versed with the technique of solving marketing issues faced by life science firms. When trying to find such an agency, look for the following: The agency should provide solutions tailored to the needs of its clients. It should have a vast experience of assisting life science companies. It would be great if the company has a few professionals highly qualified in the domain of life sciences. This would show that the agency has an in-depth understanding of your industry, its challenges, and most importantly, what works and what doesn't in this industry. It should have highly skilled web developers experienced enough in building user-friendly e-commerce websites for life science companies specifically. The agency should have a proven track record of successfully meeting the needs of biotech, biopharma, pharma and other life science companies.

With the assistance of a reliable life science digital marketing agency, you can remove all your marketing bottlenecks, and reap the rewards of your marketing efforts. As I discussed the problem which was related to meeting the rice production on time for that Research could also help reduce the gap between the potential yield obtained on experimental stations and the actual yield obtained in the fields. This could be possible by developing and promoting rice integrated crop management (RICM) systems for improving productivity and reducing the production cost per unit of output. The need for a sustainable increase in rice production affects everyone. The International Year of Rice provide us with a chance to improve food security, alleviate poverty and preserve the environment for the billions of people for whom Rice is Life. Even a mental health consultation should be there when are going through a depressed phase of state.

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THE IMPACT OF THE FINANCIAL CRISIS ON THE WORLD AND PUBLIC HEALTH

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Abstract

The economic downturn unfolded in the recent years is expected to produce adverse social and health effects. Several studies support the fact that such financial depressions have a direct impact on the overall health, on the public spending directed to the health care system, on the quality of the provided services and on the restructure of the roles and functions of the health care personnel. The purpose of the present study was to review data on the factors that economic crisis affect population's health and health care professional's role. The objectives were to investigate how economic changes can affect early mortality and morbidity rates, suicide tendencies, mental disorders and to highlight the emerging problems that health care professionals are faced with, in both the workplace environment and the educational field.

Fig. 01: Image source: https://www.maravipost.com/

Keywords: Economic crisis, health implications, public health, unemployment.

Introduction

Whole world is going through a deep crisis due to COVID-19, which has deeply penetrated into the economic, social, political and even ethical spheres of our societies. The high rates of unemployment, and increased poverty and social inequalities, particularly in southern Europe, are among its worst effects.

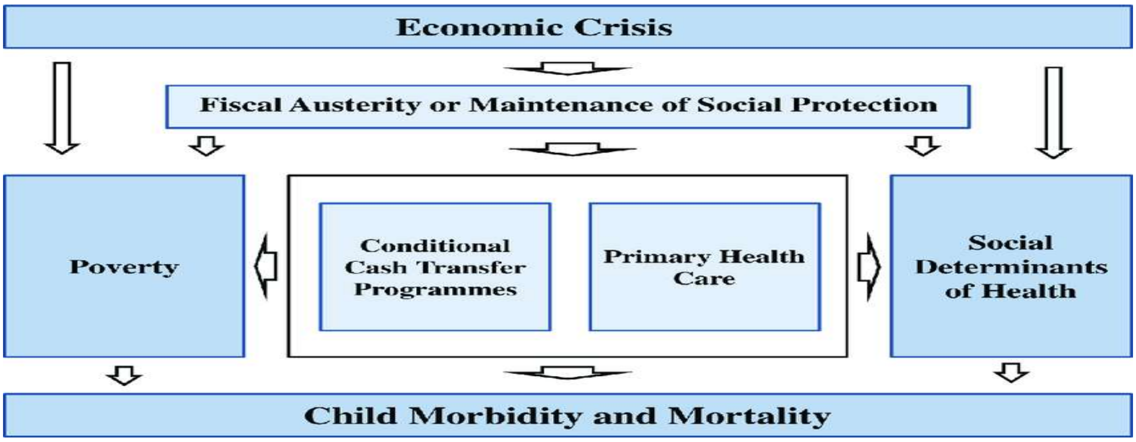

Fig. 02: Image https://www.researchgate.net/

However, a pro-cyclical relationship has also been described, so that mortality increases in periods of expansion and decreases during economic downturns. This could be due to improving health of people who remain in the labor market during recessions and the decline of some causes of death, which would compensate for the deterioration of health in other groups.

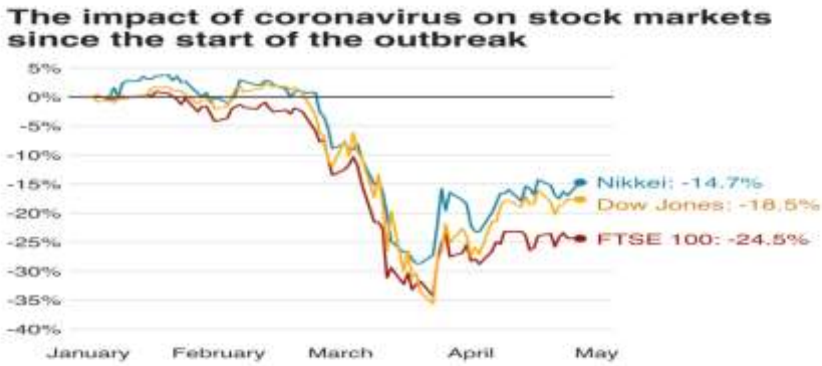

Fig. 03: Image source: Bloomberg, 27 April 2020, 07:00 GMT

Main text

One aspect that has scarcely been researched so far is the impact of the economic crises on social inequalities in health [1]. At present it is clear that the negative consequences of the crisis are being primarily borne by the most disadvantaged populations, who are concentrating the major risks of some crucial social determinants of health, such as unemployment and poverty [2]. Moreover, the austerity policies are leaving these populations especially vulnerable to such disadvantages [3]. Many studies in recent years have shown that the unequal distribution of the social determinants of health undermines health equity [4]. However, the change in the pattern of social inequalities does not directly affect the profile of social inequalities in health within a population, since the interactions between both phenomena are complex [5, 6].

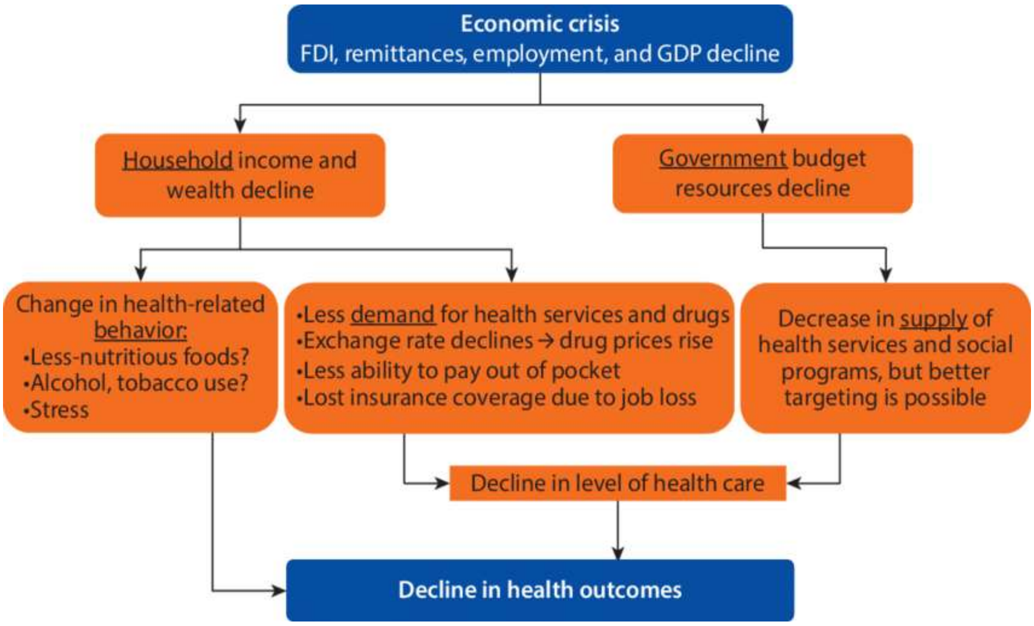

Fig. 04: Image source: https://www.researchgate.net/

Although poor populations in all countries are likely to be the first and hardest hit by any downturn, it is not just the poorest countries that will be affected by the current crisis. This section briefly examines how different countries are likely to be affected. It then traces, on the basis of past experience, how an economic downturn is likely to have an impact on health [7].

The pathways through which a recession in rich economies can affect other countries are becoming evident. Export growth may decline – this is already reflected in a major fall in commodity prices; foreign direct investment is likely to be reduced; sudden and dramatic falls in exchange rates are possible, although not inevitable; access to capital may become more difficult as interest rates and risk premiums rise; remittances may fall; and, most critically for the poorest countries, aid from donors may be significantly delayed or reduced [8].

Many high-income and upper middle-income countries will experience negative real income growth and substantial increases in unemployment, with their consequent impact on health. In those countries where the financial crisis has required IMF emergency assistance, the situation is likely to be particularly serious for health service financing, if spending restrictions are imposed during loan repayment. Before the current crisis, many low- and middle-income countries were badly affected by increases in food and fuel costs, others prospered during the boom in commodity and oil prices. With a fall in demand, prices have fallen, to the advantage of net importers but to the detriment of those more dependent on export revenues [9].

Results and discussion

Fig. 05: Image source: http://www.chinadaily.com.cn/

Study after study has linked stress to physical and mental problems caused due to economic crisis. The biological effects of stress include:

- Higher risk of heart disease and hypertension
- Acute sleep deprivation, which alters the body's immune and hormone-secreting systems
- Depressed mood or anxiety
- Unhealthy behaviors such as overeating, smoking, and alcohol use
- Increased frequency and severity of upper respiratory infections
- Decreased response to vaccines
- Shortened telomeres (the protective caps at the ends of chromosomes), which are associated with accelerated aging and early death,

Health spending:

Total health spending in countries that have been affected by an economic downturn tends to fall, but not consistently. A logical response in the short term, it can, however, lead to longer-term problems if the downturn is sustained. Reductions in maintenance, medicines or other operating costs related to surveillance or supervision are likely to have a more damaging and immediate effect on service delivery [10].

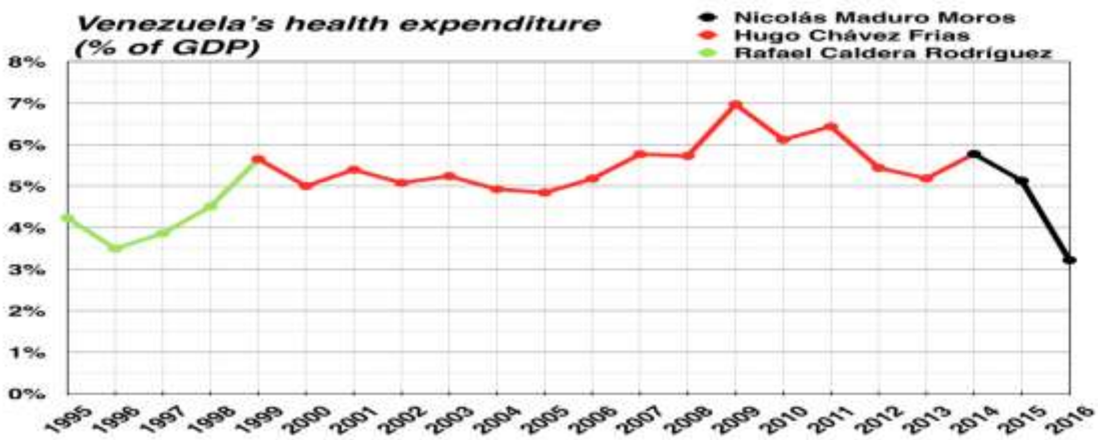

Fig. 06: Image source: Venezuela's health expenditure;

Falling remittances

Income from remittances (which at about US$ 240 000 million in 2007 is more than twice total official development assistance) has held up well through some. WHO – The financial crisis and global health past economic downturns. In current circumstances, where the initial impact of the recession has been in the industrialized economies, this may not be the case. There is already evidence that remittance income has started to fall. Thus a decline in remittance income may not be reflected in levels of population health. Nevertheless, these expenses still have to be met. Borrowing locally at high rates of interest can lead to impoverishment or increasing levels of debt [11].

Reduction in household income

The economies of many low-income and middle-income countries have benefited from the rapid growth of export industries in areas such as ready-made garments, food and flowers, and business processing. As demand declines in developed economies, job losses are likely with consequences for family income and the ability to pay for health care. Many of the human consequences of recession are often hidden [12].

Utilization of health services

Decreasing health spending, increased costs of treatment, and reduced family income and/or insurance coverage will affect use of health services and their quality. The most common effect is to lower demand for private care with a consequent transfer of demand to the public sector. If public services are also compromised, they may not be adequately equipped to cope, and overall quality may decline [13].

Health outcomes

A significant reduction in spending on life-saving interventions will increase mortality, but data relating changes in mortality to periods of economic recession are scarce and sometimes contradictory. The current food crisis in particular has been estimated as being responsible for pushing more than 100 million people back into poverty – with serious consequences for health outcomes and nutritional status. Shortages of food and consequent malnutrition predispose individuals to disease and thus act in vicious concert with the economic downturn.

Monitoring the impact of the crisis

Given the rapid evolution of the crisis and the uncertainty surrounding its impact in different countries, monitoring its effects is a priority. Monitoring should take place at several different levels: (a) changes in employment, housing and income – the most distal causes of ill-health; (b) changes in behavior relevant to health, including changes in the use of health services (including mental health care) and changes in the behaviours of health workers themselves (including patterns of migration); and (c) changes within the health sector, including the cost and availability of key commodities and treatment [14].

Increasing the effectiveness of spending for health

Economic recession makes the task of defending health budgets more difficult. In countries affected by the financial crisis, recapitalizing banks and other financial institutions may be given priority. In countries affected by economic recession, sectors that generate employment or increase agricultural production will seek additional funding.

Increasing the health impact of public spending

Where resources for a significant fiscal stimulus are available, countercyclical public spending is seen as vital for reviving the economy. Many countries are dealing with several simultaneous threats to people's health – notably the food crisis, climate change and other environmental problems. Spending in all these areas can positively influence health, providing that health impact is carefully reviewed and understood. Health policy-makers should be assertive in seeking a seat at the table when public spending plans in these areas are being developed.

Conclusions:

This commentary has reviewed the studies that have examined so far the effects of the economic crises on social inequalities in health. Despite its wide methodological and approach variability, the negative impact of crises on health equity is shown, although not systematically. Additionally, some of the factors that can help shed some light on understanding their results have been described. However, the simultaneous occurrence of social phenomena in periods of pre-crisis and crisis both at the state and supra-national level make any understanding of the health impacts very complex. Similarly as it happened with the debate about the impact of the crisis on the population's health as a whole, it is likely that as the number of studies on the influence of the crisis on health equity increases, the scientific discourse will merge with the ideological one. The reason is that beyond what data indicate objectively, what is at stake is a much deeper debate about whether the neoliberal orientation of capitalism is exacerbating inequalities in health. In other words: which should be the best social and economical model for health equity?

To respond to this question, it will be convenient to incorporate new methodological approaches beyond hard quantification of impacts, which enables a better understanding of the negative consequences of current socioeconomic transformations for health and health equity.

Moreover, we should not only be aware of the impacts of the current crisis, but also of those that will stem from the new social structure that is being progressively imposed by a minority. with the excuse of overcoming the crisis. Therefore, today more than ever, epidemiology should enhance its social scope and work together with other disciplines to become more engaged in producing societies in which health equity is a central aim [15].

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IMPACT OF BIOMEDICAL WASTE ON ENVIRONMENT AND HUMAN HEALTH

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Abstract

This article reviews that how around us the harmful chemicals from biomedical waste are causing a considerable amount of damage to our environmental health and also to our own health. Biomedical waste being produced and then discharged in our very own environment without treating the harmful chemicals in it is just not acceptable.This article focuses on the point that we must realise the severeness of this situation and to take immediate actions against it. So far we know THE NOBEL CORONA VIRUS has led to a complete lockdown almost all over the world,resulting into the shutdown of many MNCs.This has caused a sudden and unbelievable change in the environment,which is extremely appreciable.Definitely this deadly virus has took so many innocent lives,caused so much of economic imbalance all over the world but it has also caused some,in fact,a lot good to the environment. Would it be wrong to say that we are merely paying back the environment for the horrible things we have done to it?

Keywords: biomedical wastes, environmental damage, human health, damage, preventive measures.

Introduction

To deal with the any problem in order to solve it,we must know the cause of the problem firstly.So far we know that biomedical wastes are generated from biological and medical sources and acivities,for example-diagnosis,prevention or treatment of diseases.Medical facilities generate waste hazardous chemicals and radioactive materials. Though these wastes are normally not infectious but their proper disposal is definitely required.

Main text

Types of biomedical waste:

1. Sharps
2. Infectious waste
3. Radioactive
4. Pathological
5. Pharmaceuticals

6. Chemicals
7. Genotoxic waste
8. General non-regulated medical waste

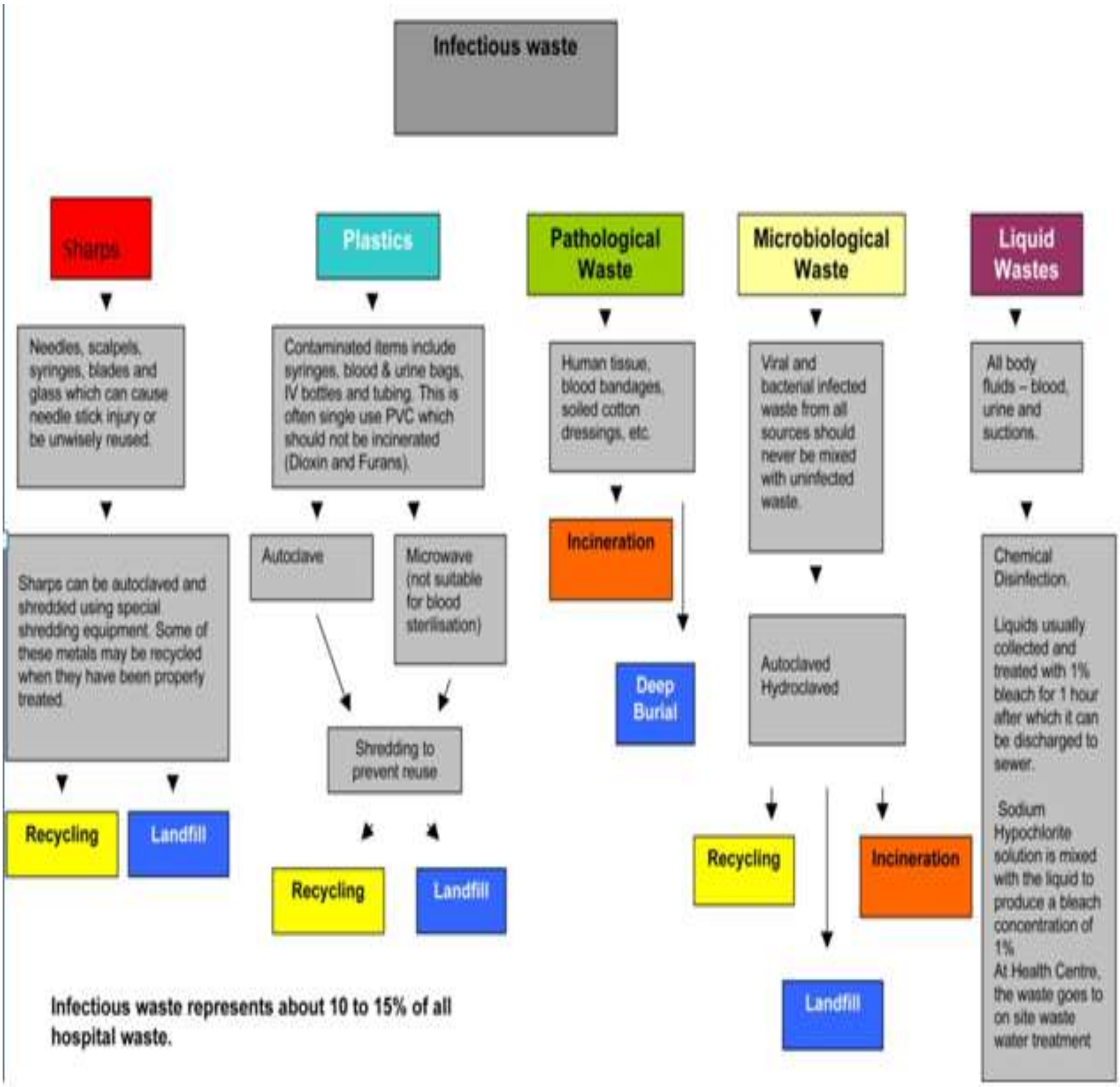

Figure 1: Biomedical waste

Medical waste facts:

- 5.9% Millions Tons per year
- 85% is non-hazardous

- 16 billions injections per year
- 2 million needles per day
- 800,000 needle sticks per year,per NIOSH

Where Medical Waste Gets Disposed of?

On-Site Treatment

The on-site treatment of medical waste is generally limited to large, well-monied hospitals and facilities. On-site treatment is extremely cost-prohibitive. That's because the required equipment is expensive to buy, expensive to maintain, and expensive to manage and run. The regulatory maze around such equipment (and its use) presents yet another barrier to entry.

Off-Site Treatment

Off-site medical waste treatment is a far more cost-effective option for most small and mid-sized medical practices and facilities. Third-party vendors whose main business is healthcare waste collection and disposal have the equipment and training needed to handle the process. Vendors can collect the waste either by truck or by mail.

- Truck services require a contract with a specially licensed disposal company to haul the waste away for regular destruction. The waste is hauled in special containers to a dedicated disposal facility.
- Mail or box services use the U.S. Postal Service to ship the waste safely to a facility for treatment. This is generally the most cost effective of all the methods. It requires a vendor fully versed and experienced in all special Postal Service regulations and best practices.

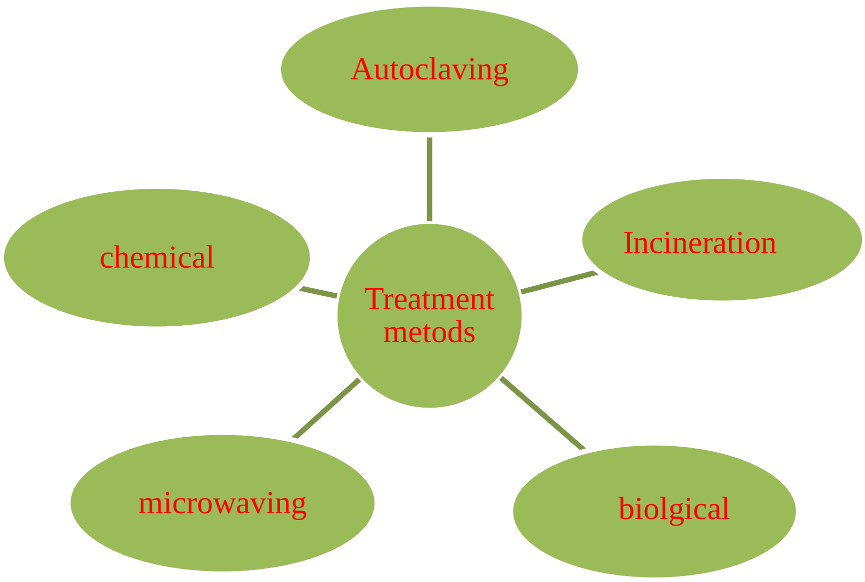

Figure 2: Medical Waste Treatment Methods

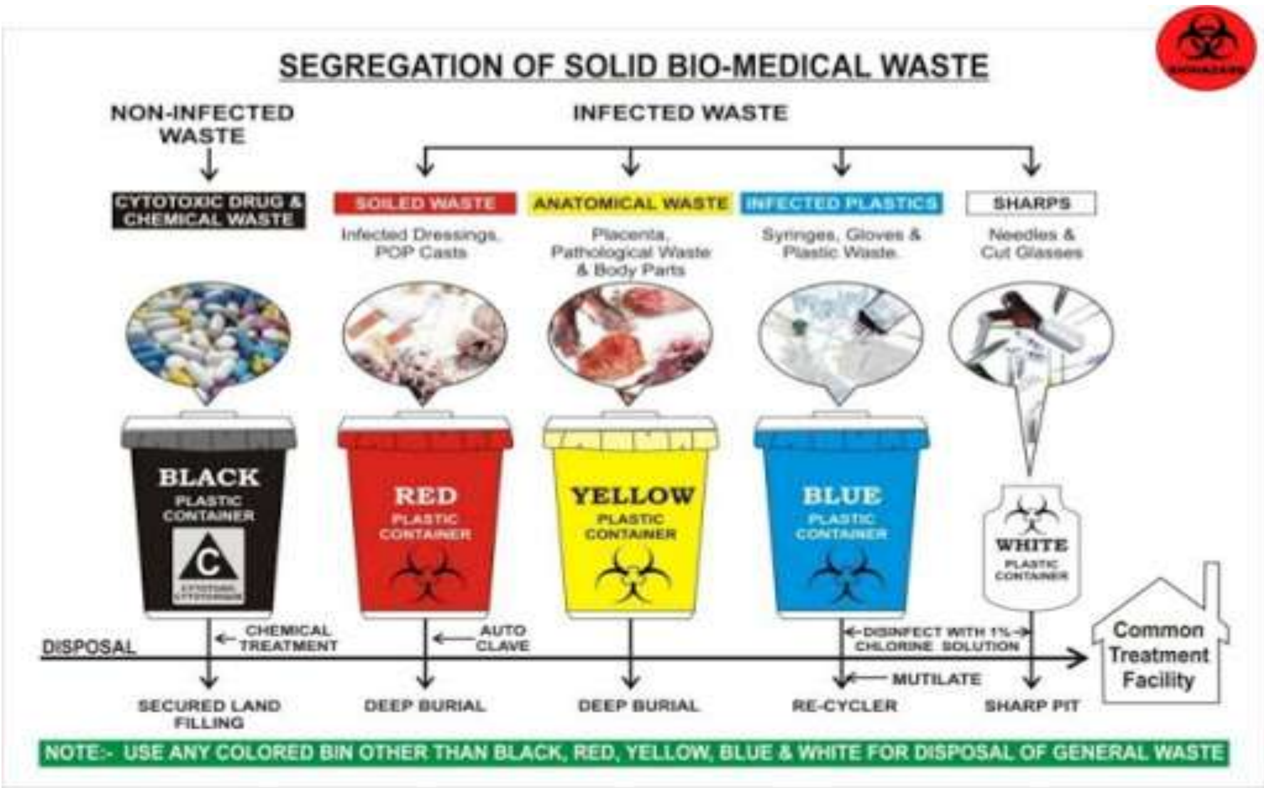

Figure 3: Segregation of biomedical waste

Best Practices for Medical Waste Handling-

Healthcare workers can avoid most medical waste problems by adhering to a few key best practices. Employees should know the laws, then classify and separate all waste by type into the correct, color-coded waste containers. Waste should be labeled depending on its category, and the right documentation should accompany all containers during transit. A dependable medical waste disposal company can help a facility put these best practices to work.

- Know the healthcare waste laws. Healthcare waste is regulated by the DOT, EPA, OSHA, and the DEA. It's vital to be aware of all guidelines from each agency when preparing, transferring, and disposing of hazardous waste.
- Classify medical waste correctly. Identifying the kind of waste you're dealing with is the first step in properly disposing of it. Avoid putting non-hazardous waste in with the rest to prevent overspending.
- Separate the waste by type. Waste should be separated out into the different categories, including sharps, pharmaceutical, chemical, pathological, and non-hazardous. Regulated medical waste goes in red bags. Sharps that go into these bags must be put into puncture-proof containers first.
- Use the right medical waste containers. Put all waste in approved containers depending on how it's classified. Some waste can go in certified cardboard boxes, while other waste gets put in special tubs or even locked up for transit.

- Prepare the containers properly. Healthcare waste containers and bags must be taped for shipment, then packaged according to DOT weight restrictions. Containers should be stored in a secure, dry area before pickup or shipping. It's essential to properly label all waste before transport as well.
- Include the right documentation. Proper documentation of healthcare waste is crucial to protect both the provider and the waste disposal company. The right paperwork should accompany each container and bag throughout the process.
- Use the medical waste disposal color code. The color coding system for waste segregation calls for all sharps to go in puncture resistant red biohazard containers. Biohazard waste goes in red bags and containers. Yellow containers are for trace chemo waste, while pharmaceutical waste goes into black containers for hazardous materials and blue for all others. Radioactive wastes like Fluorine-18 or Iodine-131 get put in shielded containers marked with the radioactive symbol.
- Hire the right waste disposal company. Multiple regulating bodies, various hazards, and several different kinds of waste present a daunting challenge for healthcare employees. Partnering with a reliable vendor is often vital.

The Dangers of Medical Waste

Unless it's managed properly, medical waste can present several health hazards to healthcare employees, waste workers and the general public. Discarded needles can expose us to needle sticks and possible infection if they're accidentally sent to recycling facilities, or if containers break open in transit. Housekeepers and janitors are also at risk when sharps poke their way out through plastic bags.

Hazardous waste can expose us to microorganisms, radiation burns, poisoning, pollution, and other dangers. Finally, improperly treated waste sent to landfills can contaminate our drinking water and environment.

Conclusion

Medical waste is classified as any possibly contaminated byproduct of medical research, treatment, or other healthcare activity. It can come from physician's offices, dentists, veterinary clinics, research laboratories, or funeral homes.

The guide above explains the definition, types, history and dangers of healthcare waste, including how it gets disposed of, best practices, tools, resources, and regulating bodies.

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HEAVY METAL TOXICITY

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Abstract:

Several heavy metals are found naturally in the earth crust and are exploited for various industrial and economic purposes. Some of these heavy metals such as copper, cobalt, iron, nickel, magnesium, molybdenum, chromium, selenium, manganese and zinc have functional roles which are essential for various diverse physiological and biochemical activities in the body. However, some of these heavy metals in high doses can be harmful to the body while others such as cadmium, mercury, lead, chromium, silver, and arsenic in minute quantities have delirious effects in the body causing acute and chronic toxicities in humans. Therefore it aims to highlight on biochemical mechanisms of heavy metal intoxication which involves binding to proteins and enzymes, altering their activity and causing damage. More so, the mechanism by which heavy metals cause neurotoxicity, generate free radical which promotes oxidative stress damaging lipids, proteins and DNA molecules and how these free radicals propagate carcinogenesis are discussed.

Keywords: heavy metals, toxicity, neurotoxicity, carcinogenesis, free radicals, health effects

Introduction

Metals are found all over the earth including the atmosphere, earth crust, water bodies, and can also accumulate in biological organisms including plants and animals. Among the 35 natural existing metals, 23 possess high specific density above 5 g/cm3 with atomic weight greater than 40.04 and are generally termed heavy metals [1, 2]. Heavy metals include: antimony, tellurium, bismuth, tin, thallium, gold, arsenic, cerium, gallium, cadmium, chromium, cobalt, copper, iron, lead, mercury, manganese, nickel, platinum, silver, uranium, vanadium, and zinc [1, 2]. Some of these heavy metal's such as cobalt, chromium, copper, magnesium, iron, molybdenum, manganese, selenium, nickel and zinc are essential nutrients that are required for various physiological and biochemical functions in the body and may result to deficiency diseases or syndromes if not in adequate amounts [3] but in large doses they may cause acute or chronic toxicities. These heavy metals are distributed in the environment through several natural processes such as volcanic eruptions, spring waters, erosion, and bacterial activity, and through anthropogenic activities which include fossil fuel combustion, industrials processes, agricultural activities as well as feeding [4]. These heavy metals do bioaccumulation in living organisms and the human body through various processes causing adverse effects. In the human body, these heavy metals are transported and compartmentalized into body cells and tissues binding to proteins, nucleic acids destroying these macromolecules and disrupting their cellular functions.Long term accumulation of heavy metals in the body may result in slowing the progression of physical, muscular and neurological degenerative processes that mimic certain diseases such as Parkinson's disease and Alzheimer's disease [5]. . More so, repeated long-term contact with some heavy metals or their compounds may even damage nucleic acids, cause mutation, mimic hormones thereby disrupting the endocrine and reproductive system and eventually lead to cancer [6].

In this article, more focus will be laid on the various mechanisms that lead to heavy metal toxicity with emphasis on macromolecule and cellular damages, carcinogenesis, neurotoxicity and the molecular basis for their noxious effects. The various toxic effects along with the signs and symptoms of some heavy metals in the human body will be discussed.

Sources of heavy metal exposure to humans:

Heavy metals are naturally present in our environment. They are present in the atmosphere, lithosphere, hydrosphere and biosphere [7]. Although these heavy metals are present in the ecosystem, their exposure to humans is through various anthropogenic activities of man. In the earth crust, these heavy metals are present in ores which are recovered during mining activities as minerals. In most ores heavy metals such as arsenic, iron, lead, zinc, gold, nickel, silver and cobalt exist as sulphides while others such as manganese, aluminium, selenium gold, and antimony exist as oxides. Heavy metals may be transported through erosion, run-off or acid rain to different locations on soils and water bodies. As reviewed from [8], the sources of specific heavy metals are described below.

Arsenic. Arsenic is the 20th most abundant element on earth and the 33rd on the periodic table. The inorganic forms such as arsenite and arsenate compounds are lethal to humans and other organisms in the environment. Humans get in contact with arsenic through several means which include industrial sources such as smelting and microelectronic industries. Drinking water may be contaminated with arsenic which is present in wood preservatives, herbicides, pesticides, fungicides and paints [9].

Lead. Lead is a slightly bluish, bright silvery metal in a dry atmosphere. The main sources of lead exposure include drinking water, food, cigarette, industrial processes and domestic sources. The industrial sources of lead include gasoline, house paint, plumbing pipes, lead bullets, storage batteries, pewter pitchers, toys and faucets [10]. Lead is released into the atmosphere from industrial processes as well as from vehicle exhausts. Therefore, it may get into the soil and flow into water bodies which can be taken up by plants and hence human exposure of lead may also be through food or drinking water [11].

Mercury. The metallic mercury is a shiny silver-white, odourless liquid metal which becomes colourless and odourless gas upon heating. Mercury is used in producing dental amalgams, thermometers and some batteries. Also, it can be found in some chemical, electrical-equipment, automotive, metal-processing, and building industries. Mercury can exist in a gaseous form thus it can be inhaled. Other forms of mercury contamination in humans may be through anthropogenic activities such as municipal wastewater discharges, agriculture, incineration, mining, and discharges of industrial wastewater [12].

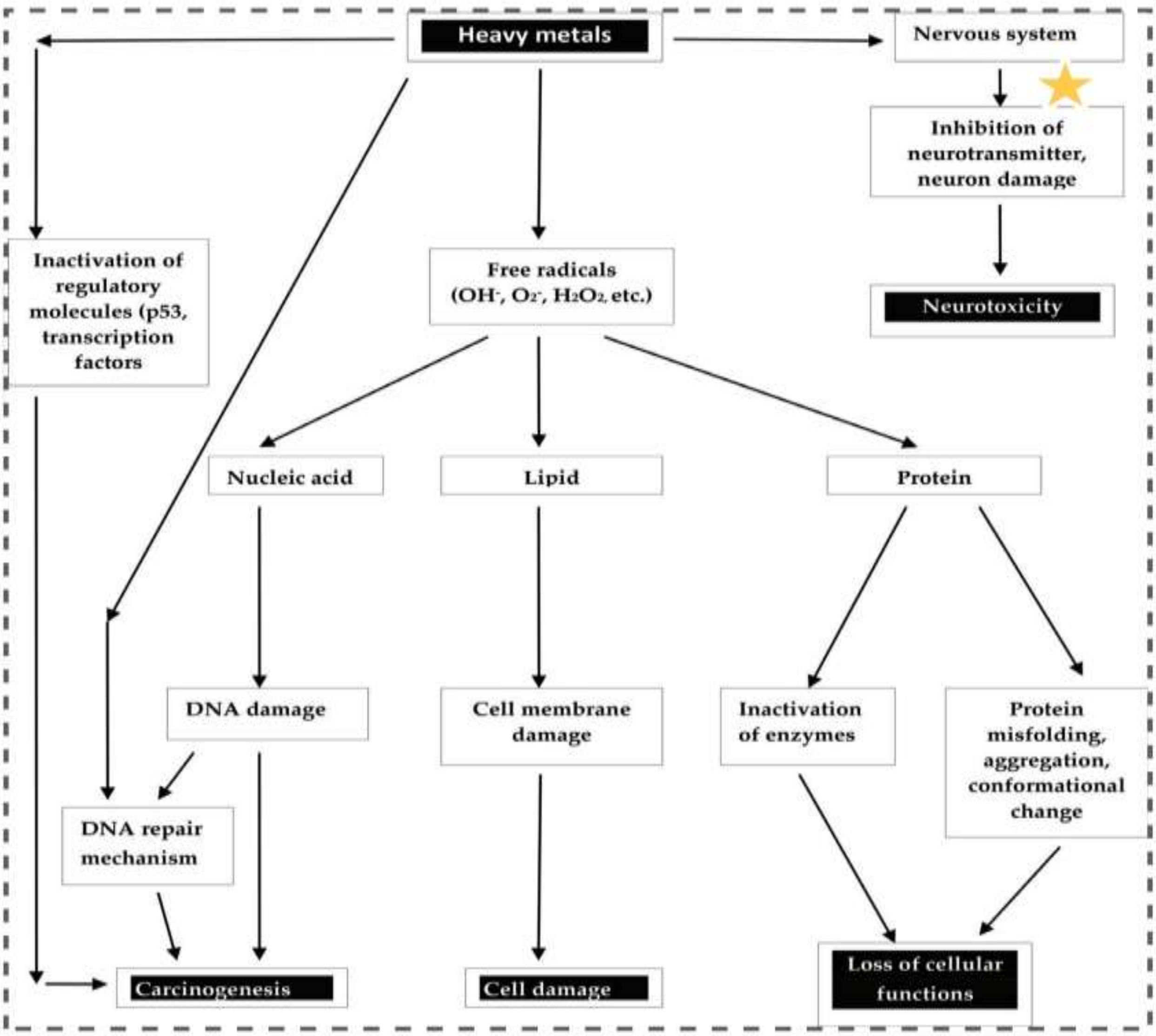

Figure 1.
Pathway of heavy metals sources and exposure to humans.

Route of exposure, bio-uptake and bioaccumulation of heavy metals in human:

Humans may directly get in contact with heavy metals by consuming contaminated food stuffs, sea animals, and drinking of water, through inhalation of polluted air as dust fumes, or through occupational exposure at workplace [14]. The contamination chain of heavy metals almost usually follows this cyclic order: from industry, to the atmosphere, soil, water and foods then human [7]. These heavy metals can be taken up through several routes.

As via GIT (when eating food stuffs): lead, cadmium, manganese, arsenic. Others can enter the body by inhalation while others such as lead can be absorbed through the skin. Most heavy metals are distributed in the body through blood to tissues [15]. Lead is carried by red blood cells to the liver and kidney and subsequently redistributed to the teeth, bone and hair mostly as phosphate salt [14]. manganese vapours diffuses across the lung membrane to the Central nervous system (CNS). Organic salts of manganese which are lipid soluble are distributed in the intestine for faecal elimination while inorganic manganese salts which are water soluble are distributed in plasma and kidney for renal elimination. Arsenic is distributed in blood and accumulates in heart, lung, liver, kidney, muscle and neural tissues and also in the skin, nails and hair. The regulatory limit for some selected heavy metals is shown in Table 1.

Table 1. Regulatory limit of selected heavy metals

Heavy metals	EPA limits in drinking water (ppm)	OSHA limit in workplace air (mg)	EDA limit in bottled water/ food (ppm)
Arsenic	0.01	10	-
Barium	2.0	0.5	-
Cadmium	0.005	5	0.005
Chromium	0.1	1	1
Lead	0.015	0.15	-
Mercury	0.002	0.1	-
Selenium	0.05	0.2	-
Silver	0.0001	0.01	-
Zinc	5	5	-

Mechanism of heavy metal toxicity:

Heavy metal-induced oxidative stress and oxidation of biological molecules:

Certain heavy metals are known to generate free radicals which may lead to oxidative stress and cause other cellular damages (see [16] for review). The mechanism of free radical generation is specific to the type of heavy metal.

Arsenic has also been shown to generate free radicals such as superoxide (O2•–), singlet oxygen (1O2), nitric oxide (NO•), hydrogen peroxide (H2O2), the peroxyl radical (ROO•) [17], dimethylarsinic peroxyl radicals ((CH3)2AsOO•) and also the Dimethylarsinic radical

((CH3)2As•) [18] in some studies though the mechanism for the generation of all these reactive species remains unclear.

Heavy metal-induced carcinogenesis:

Some heavy metals are known to have carcinogenic effect. Several signalling proteins or cellular regulatory proteins that participate in apoptosis, cell cycle regulation, DNA repair, DNA methylation, cell growth and differentiation are targets of heavy metals [19]. Thus, heavy metals may induce carcinogenic effect by targeting a number of these proteins. More so, the carcinogenic effects of certain heavy metals have been related to the activation of redox-sensitive transcription factors such as AP-1, NF-κB and p53 through the recycling of electrons by antioxidant network. These transcription factors control the expression of protective genes that induce apoptosis, arrest the proliferation of damaged cells, repair damaged DNA and power the immune system [16].

Arsenic induced carcinogenic mechanisms include epigenetic alterations, damage to the dynamic DNA maintenance system and generation of ROS [20, 21]. Alterations of histones, DNA methylation, and miRNA are the key epigenetic changes induced by arsenic which have shown to possess potentials to cause malignant growth [21]. In vitro studies have shown arsenic to alter the expression of p53 protein which also led to decreased expression of p21, one downstream target [22]. Arsenic compounds have been shown in an in vitro cell line study to promote genotoxicity in humans and mice leucocytes [23]. Also, a methylated form of arsenic was shown to inhibit DNA repair processes and also generate ROS in liver and spleen as metabolic products [24]. Arsenic can bind DNA-binding proteins and disrupt the DNA repair processes thereby increasing the risk of carcinogenesis. For example, the tumour suppressor gene-coded DNA was suppressed when arsenic was bound to methyl-transferase [25]. Also, cancers of liver, skin, prostate and Kupffer cell were associated with Arsenic poisoning.

Lead. The mechanism of lead-induced carcinogenic process is postulated to induce DNA damage, disrupt DNA repair system and cellular tumor regulatory genes through the generation of ROS [26]. Studies have supported with evidence that ROS generation by lead is key in altering chromosomal structure and sequence [26]. Lead can disrupt transcription processes by replacing zinc in certain regulatory proteins [26].

Mercury. Little is known on the potential of mercury to act as a mutagen or carcinogen. However, the proposed mechanism of mercury-induced cancer is through the generations of free radicals inducing oxidative stress thereby damaging biomolecules. Mercury has been shown to induce malignant growth through the generation of free radicals as well as disruption of DNA molecular structure, the repair and maintenance system [27].

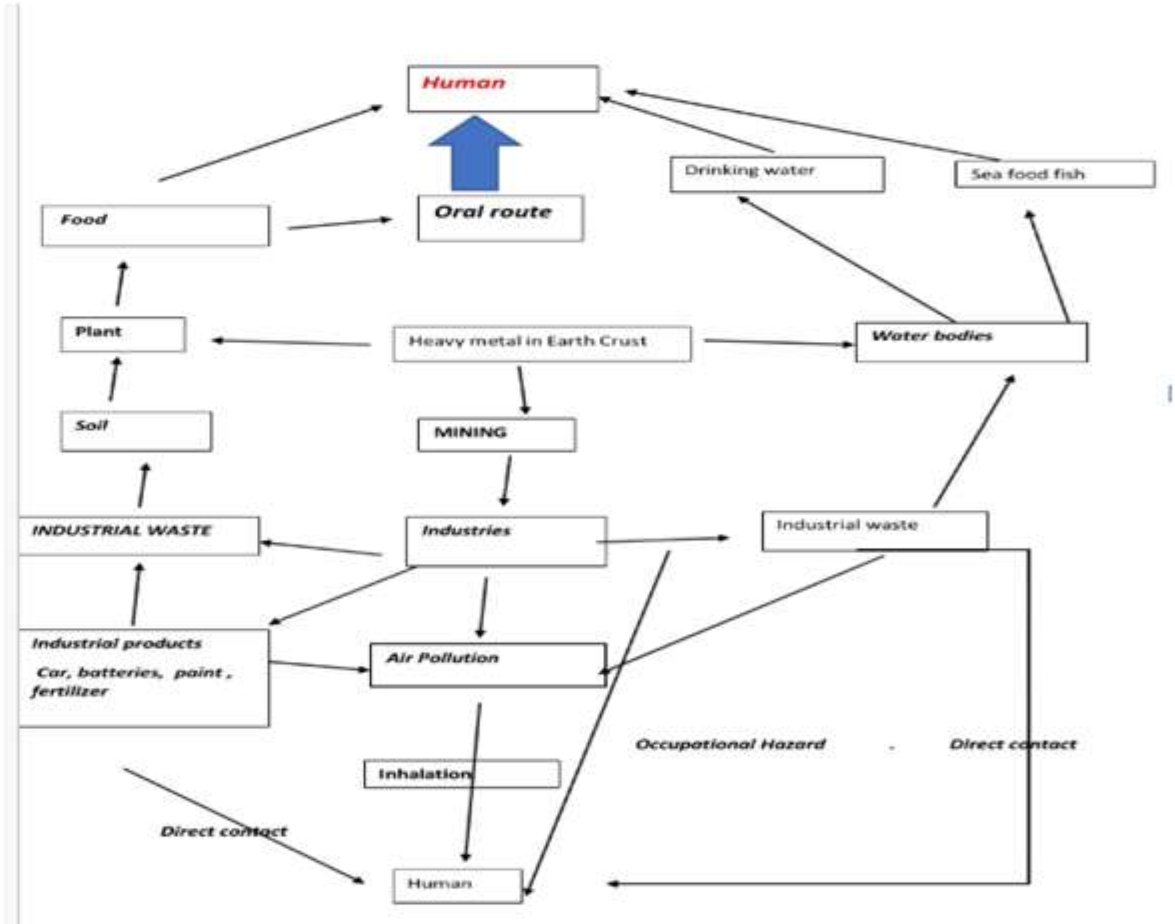

Figure 2: Mechanism of heavy metal toxicity

Effects of heavy metal toxicity in humans:

Heavy metal toxicity can have several health effects in the body. Heavy metals can damage and alter the functioning of organs such as the brain, kidney, lungs, liver, and blood. Heavy metal toxicity can either be acute or chronic effects. Long-term exposure of the body to heavy metal can progressively lead to muscular, physical and neurological degenerative processes that are similar to diseases such as Parkinson's disease, multiple sclerosis, muscular dystrophy and Alzheimer's disease. Also, chronic long-term exposure of some heavy metals may cause cancer [6]. The various health effects of some heavy metals will be highlighted below.

Arsenic exposure can lead to either acute or chronic toxicity. Acute arsenic poisoning can lead to the destruction of blood vessels, gastrointestinal tissue and can affect the heart and brain. Chronic arsenic toxicity which is termed arsenicosis usually focus on skin manifestations such as pigmentation and keratosis [28].

Lead poisoning is mostly related to the gastrointestinal tract and central nervous system in children and adults [29]. Acute exposure of lead can cause headache, loss of appetite, abdominal pain, fatigue, sleeplessness, hallucinations, vertigo, renal dysfunction, hypertension and arthritis while chronic exposure can result in birth defects, mental retardation, autism, psychosis, allergies', paralysis, weight loss, dyslexia, hyperactivity, muscular weakness, kidney damage, brain damage, coma and may even cause death [28]. . A number of prospective epidemiologic studies in children less than 5 years of age have shown that low-level of lead exposure (5–25 μg/dL in blood) resulted to the impairment of intellectual development which was manifested by the lost of intelligence quotient points [30]. As such, the Centres for Disease Control (CDC) in the United States has reduced the tolerable amount of lead in children's blood from 25 to 10 μg/dL and recommended universal screening of blood lead for all children.

Mercury is an element that can easily combine with other elements to form inorganic and organic mercury. Exposure to elevated levels of metallic, inorganic and organic mercury can damage the kidney, brain and developing foetus while methyl mercury is highly carcinogenic. Organic mercury is lipophilic in nature and thus can easily penetrate cell membranes. Mercury and its compound affects the nervous system and thus increased exposure of mercury can alter brain functions and lead to tremors.Mercury exposure to pregnant women can affect the foetus and offspring may suffer from mental retardation, cerebellar symptoms, retention of primitive reflexes, malformations and other abnormalities. This has been confirmed in recent studies in which pregnant women exposed to mercury through dietary intake of whale meat and fish showed reduce motor neuron function, loss of memory, impaired speech and neural transmission in their offspring.

Conclusion

The exposure of heavy metals to humans involve various diverse forms through food and water consumption, inhalation of polluted air, skin contact and most important by occupational exposure at workplace. Though some heavy metals such as iron and manganese are essential for certain biochemical and physiological activities in the body, elevated level in the body can have delirious health effects. Most of the other heavy metals are generally toxic to the body at very low level. The main mechanism of heavy metal toxicity include the generations of free radicals to cause oxidative stress, damage of biological molecules such as enzymes, proteins, lipids, and nucleic acids, damage of DNA which is key to carcinogenesis as well as neurotoxicity. Some of the heavy metal toxicity could be acute while others could be chronic after long-term exposure which may lead to the damage of several organs in the body such as the brain, lungs, liver, and kidney causing diseases in the body.

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ENVIRONMENTAL TOXICOLOGY

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Abstract

Increasingly, chemists are faced with legislation requiring assessment of hazard and risk associated with the production, use, and disposal of chemicals. In addition, the general public are concerned about the dangers that they hear may result from the widespread use of chemicals. They look to the chemist for explanations and assume that chemists understand such matters. When they discover that chemists are often ignorant of the potential of chemicals to cause harm, their confidence in the profession is lost and chemophobia may result. In 1993, IUPAC agreed on a joint project between the Toxicology Commission and the Committee on Teaching of Chemistry to address the issue of the teaching of toxicology in the chemistry curriculum. Part of the project was a distance learning program, which is available through the Internet and on CD. The program currently consists of seven modules, one of which deals specifically with environmental toxicology. The contents of each unit will be explained as each has some input into environmental matters and green/sustainable chemistry. The program is aimed at teacher and student alike, and each module has self-assessment exercises at the end of the module. Additionally, there is material on health and safety, ethical matters, and a case study of the use of dichlorodiphenyltrichloroethane (DDT).

Keywords: toxicology; environment; distance learning; fundamental toxicology; environmental toxicology

Introduction

Toxicology is the science of the assessment of how substances, whether natural or synthetic, can harm life by physicochemical reactions with living cells. Inevitably, such a definition implies an interaction with the environment and therefore has implications for the application to green/sustainable chemistry. Chemicals are used increasingly in domestic and nontechnical environments, where their safe handling is no longer solely the concern of qualified chemists. For instance, consider the use of domestic cleaners; solvents and detergents; weed killers and pesticides; and proprietary medicines. The question is asked, therefore, who is the person to whom the public might turn to seek help and advice in the safe handling of these chemicals? As like as not, the answer that comes back is, the chemist. It is not unreasonable that the chemist is seen as the person who can give help and advice on the handling of chemicals, on the toxic effects associated with them, and on how to deal with an incident when and if it occurs. However, this need may not recognized in the curricula for the training of the chemist, and indeed, apart from what he or she may pick up indirectly as part of the general educational process, there may not be a formal training in toxicology. That makes the chemist very vulnerable. The public's perception of chemicals and the chemical industry is not favorable. It sees both as threats to health and the environment, and this has had an adverse effect on chemistry and on the use of its products. Despite this, globally, very few college or university chemistry courses incorporate toxicology.

Main text

In industrial terms, the management of chemicals is referred to as the "life cycle" of the chemical and is the management of the chemical throughout its processing from "cradle to grave". This is illustrated by reviewing the chloralkali process from "cradle to grave". The chloralkali process is the industrial manufacture of sodium hydroxide, chlorine, and hydrogen from sodium chloride by the electrolysis of brine. It is a manufacturing process on a large scale, and therefore these chemicals are referred to as heavy chemicals. Sodium chloride has a low level of hazard for humans (unless ingested in large amounts), but high risk may be associated with handling it in large amounts as part of an industrial process. It should be noted here that sodium chloride may be highly toxic for some organisms such as freshwater fish or terrestrial plants.

The chloralkali process is a good example as it illustrates many of the hazards of industrial processes as indicated in Table 1.

Table 1 Hazards of the chloroalkali process.

Process	Hazard
Mining of NaCl	Hazardous for miners and environment Loss of farmland Waste disposal (see below)
Transportation	Combustion of fossil fuels Risk of accidents and spillage
Manufacture of NaOH, Cl_2, H_2	High temperature (100 °C) High electrical input Highly hazardous products
Waste disposal	Major problem with heavy chemicals Subject to legislation
Transport of NaOH, Cl_2, H_2	See above Highly hazardous materials
Manufacture of derivatives	Highly hazardous starting materials Dependent on product properties
Transportation	See above
Waste disposal	See above

Results and discussion

Table 2 Some common types of chemicals and their health risks.

Chemical	Specific example	Health risk
Dust/fume	Small particles (10 µm or less)	Lung damage, cancer
	Nanoparticles (100 nm or less)	Lung and heart damage
Gases	Sulfur/nitrogen oxides	Lung/nose irritants
	Carbon monoxide	De-oxygenated hemoglobin
	Hydrogen cyanide	Cellular respiration
Solvents	Volatile organic solvents	Effect many organs
Metals	Lead	Anemia, brain/nerve function
	Mercury	Nervous system
	Nickel/chromium	Dermatitis, lung cancer
Acid/bases	Mineral acids	Corrosive, lung damage
	Strong bases	Corrosive, deep skin sores
Pesticides	Most pesticides	WHO classification defines severity

Common types of chemicals that cause health risks In this section, chemicals are subdivided into six common groups, and some examples in each group are considered for their toxicity and health risk. These are summarized in Table 2.

Conclusions

This distance learning program is freely available through the IUPAC Web site and in CD form, and is suitable for teachers and students alike. It demonstrates how the practice of toxicology and protection of the environment are closely linked, as environmental issues are raised in virtually every section. It is not intended that the program should be limited to the sections presented here; in the longer term, it will be expanded to cover other aspects of toxicology. It is part of a wider IUPAC program in toxicology that already includes a number of publications, in addition to those already mentioned above [1–4]. Currently, the "Explanatory Dictionary of Key Terms in Toxicology" is in preparation and should be available toward the end of 2006.

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RISKS FROM MERCURY FOR HUMAN HEALH

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Abstract

Mercury exposure is too hazardous to human life which includes the foetuses too. There are different forms of mercury that get exposed to human life and cause toxicity are organic mercury, inorganic mercury, elemental or metallic mercury. Most of the mercury exposure to human life is through aquatic forms where maximum amount of mercury is accumulated and enter into the higher levels of food chain. Mercury enters into the environment naturally by volcanoes, soil, forest fires, weathering of rocks. It can also be reintroduced into the environment by evaporation of ocean water. Mercury also enters into the environment by human activities like burning of fossil fuels or medical waste. Mercury poisonings from intoxicated food usually occurs in population results in neurological disorders and developmental troubles for children who are exposed. It is rare to encounter situations or severe intoxications , but still efforts remain necessary to decrease the mercury concentration in the environment and to reduce risk on human health due to low level exposure . As a part of this effort in 2013, the Minamata Convention on Mercury was adopted by the international community with the aim of preventing negative impacts on human health and the environment from mercury.

Keywords: mercury poisoning, minamata convention, aquatic forms, neurological disorders.

Intoduction

Mercury poisoning is a kind of heavy metal poisoning whose symptoms depend upon the dosage, age factor , method of poisoning and duration of exposure. Shockingly if a pregnant mother is exposed to mercury , the foetus is affected too. Most human exposure results from fish consumption and dental amalgam. The target organ of mercury is primarily the brain which results in neurological disorders. Mercurous and mercuric salts mostly damage the gut lining and kidneys. It is observed that methyl mercury can be distributed throughout the body. Ingested mercury can undergo bioaccumulation which leads to progressive increase in body burdens. Soil contaminated by mercury or the redistribution of contaminated water or soil can enter into the food chain through plants and animals which will cause bioaccumulation in any further levels in the food chain. Mercury enters into the environment naturally by volcanoes, soil, forest fires, weathering of rocks. It can also be reintroduced into the environment by evaporation of ocean water. Mercury also enters into the environment by human activities like burning of fossil fuels, mining of mineral ores, wastes from the factories, medical waste etc. Almost 42 % of mercury emissions is manmade. Once the mercury is released into the atmosphere it can travel miles and reach the earth's surface and within 5 - 14 days mercury deposition takes place from air. Clinical symptoms of exposure to different forms of mercury vary from nausea, abdominal pain to tremor, paralysis, memory loss and kidney damage. The Minamata disease, the so-called "mad hatter syndrome" and acrodynia are caused by chronic exposure to different organic and inorganic mercury compounds. Early life is the window of sensitivity for exposure to mercury. During pregnancy, mercury compounds cross the placental barrier and can interfere with the development of the foetus, causing attention deficit and developmental delays during childhood. In view of the impact from mercury on health and the environment, the international community adopted the Minamata Convention with the main objective of protecting human health and the environment from anthropogenic emissions and releases of mercury and mercury compounds.

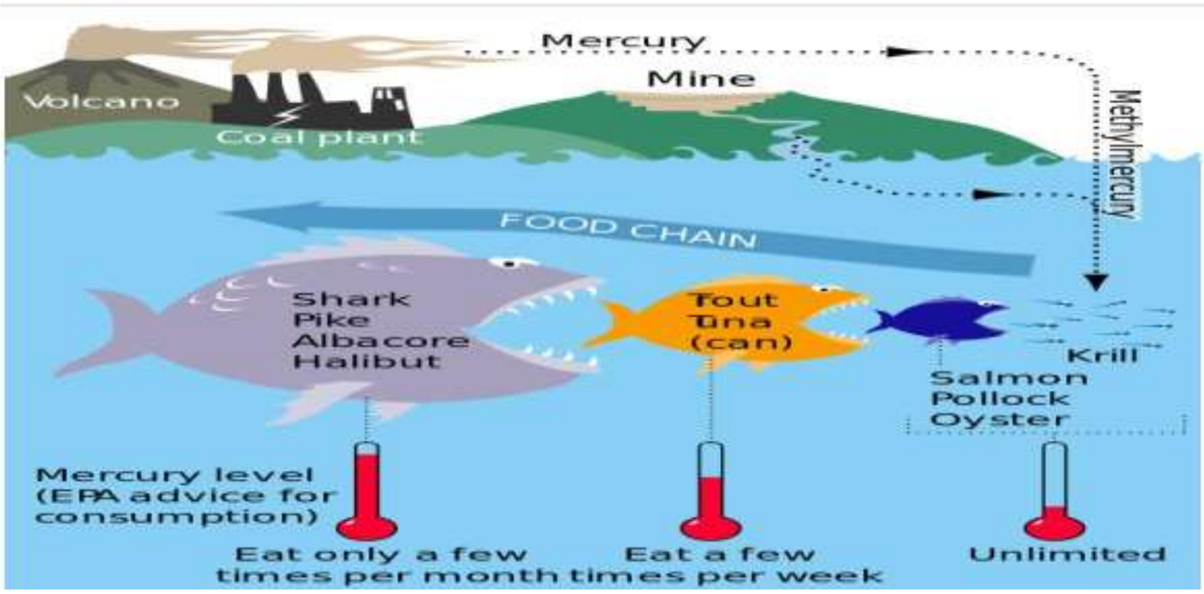

Figure 1: Levels of mercury toxicity

Main text

Every form of mercury are toxic for the environment but the pattern of poisoning and health effects varies with its chemical form (metallic, inorganic, organic), the route of exposure (inhalation, ingestion), the amount (low concentrations can have an impact), the duration (acute and chronic), timing/life stage of exposure (exposure in early life is the most dangerous) and the vulnerability of the person exposed. Mercury persists in the environment for longer periods by cycling back and forth between the soil and air while changing its chemical forms . Organic methyl mercury can stay in the soil for decades while the atmospheric inorganic elemental mercury can stay upto two years. The point to be noted is that mercury is never removed from the environment it is just moved from one location to another eventually buried under soils and sediments.

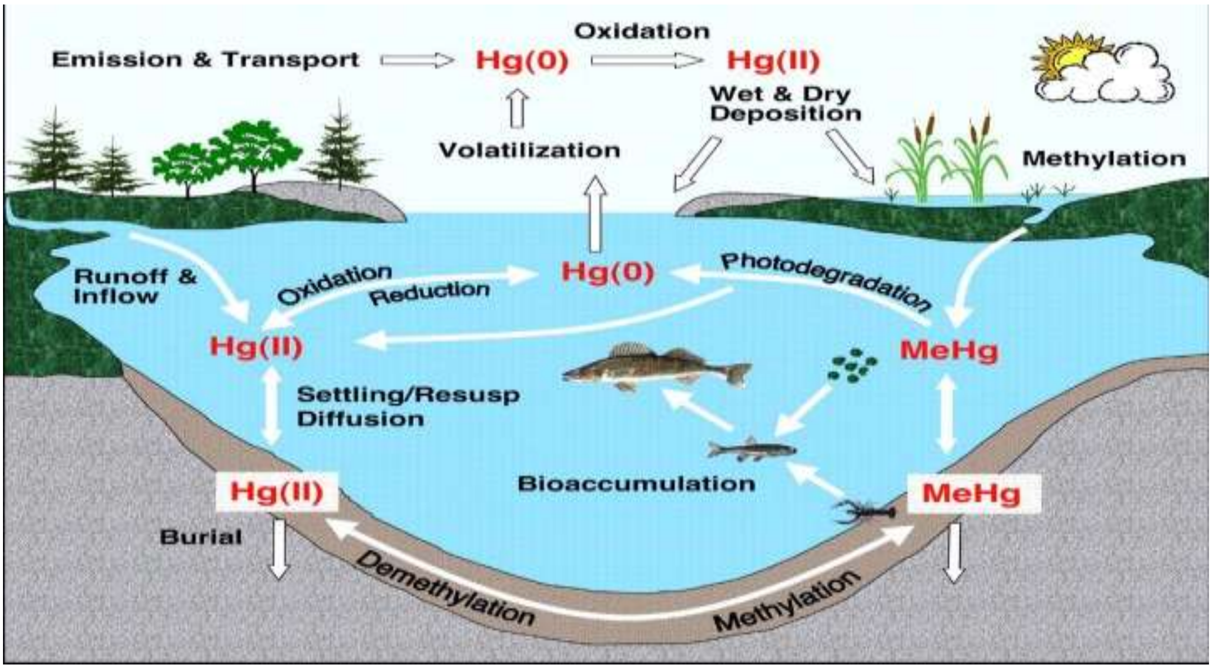

Figure 2: Transformation of mercury in the environment

Mercury is a global pollutant that can enter into aquatic system via two routes .

1) point source discharges

2) atmospheric deposition

Emission from coal fired power plants are the largest source of mercury deposition in the atmosphere which is deposited primarily as inorganic mercury . The conversion of inorganic mercury to organic methyl mercury is called methylation and is the most important step in the mercury cycle because of its toxicity and potential to accumulate in aquatic organisms. The evidence is that mercury found in fish tissue is mostly methyl mercury. Antropogenic cause of mercury deposition is by coal combustion and improper disposal of medical waste . Waters with large sources of mercury from mining of gold or mercury within the streams watershed will also have high methyl mercury in fish. Mercury reaches the air because of fossil fuels nd biomass. Air emissions of mercury are highly mobile while aquatic releases are localised. Methyl mercury normally accounts for 90% in fish.

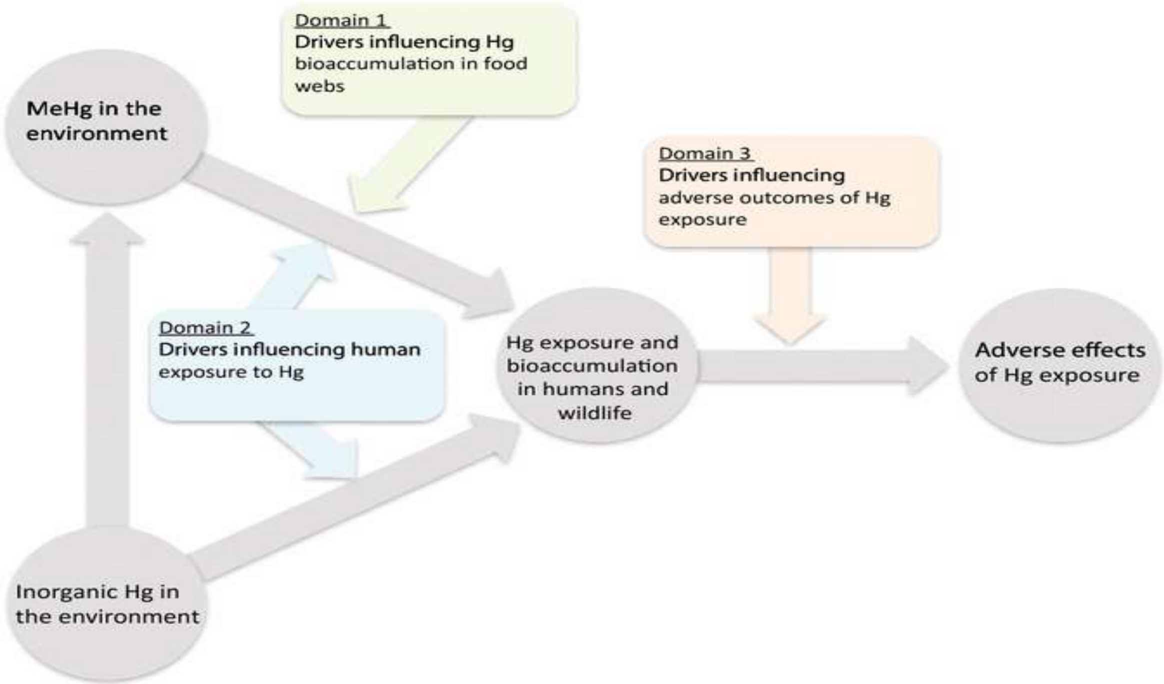

Figure 3: Entry of mercury through various domains into different levels of mercury toxicity

Mercury is introduced into the environment by vocanic eruptions, forest fires, cement plants, vinyl chloride monomer plant, chloro alkali plant and coal power plant. Waste incineration and cremation can cause leakage of mercury into ground water.

Life cycle of mercury:-

1) Mercury is released into the atmosphere

2) Mercury can fall directly from the sky into water bodies . It also enters lakes rivers and water streams via rain and snow runoff

3) Mercury sinks harmlessly to the bottom until bacteria turn it into harmful methyl mercury which is absorbed by animal tissue

4) Small bottom feeders absorb traces of the toxin. As the prey moves up the food chain the mercury becomes more and more concentrated.

5) Concentrations in top predators can triggers health advisories limiting fish consumption.

Results and discussion

People can be exposed to elemental mercury when household items that contain mercury are broken. Elemental mercury can also be brought into your house from abandoned industrial sites and other places. Breathing mercury vapors in air is the most common way to be exposed to elemental mercury, and is the most harmful to your health. If mercury is swallowed most of it passes through your body and very little is absorbed. If you touch mercury for a short period of time a small amount may pass through your skin, but not enough to harm you.

If mercury spills in your house:

- it can absorb, or be drawn into carpet, furniture, floors, walls and other items.
- it can be tracked throughout the house if it is not cleaned up right away.
- it will vaporize into the air over time. Mercury vapor is heavier than air and tends to remain near the floor or area where the spill happened. It can build up in poorly ventilated or low-lying areas in your house.
- vapors can get into the ventilation system and be spread throughout your house.

If mercury is spilled onto a hot surface, such as a burner on a stove, mercury will vaporize quickly and can be more dangerous. Any amount of mercury spilled indoors can be hazardous . the more mercury spilled , the more its vapour will build up in the air and the more hazardous it will be .even a small spill such as from a broken thermometer can produce a hazardous amount of vapour .

The health effects that can be caused by breathing mercury depend on how much mercury vapor you breathe and how long you breathe the vapors. Health problems can result from short term or long term mercury exposure.

Health effects caused by short term exposures

- Cough, sore throat
- Shortness of breath
- Chest pain
- Nausea, vomiting, diarrhea
- Increase in blood pressure or heart rate
- A metallic taste in the mouth
- Eye irritation
- Headache
- Vision problems

Health effects of long term exposure

- Anxiety
- Excessive shyness
- Anorexia
- Sleeping problems
- Loss of appetite
- Irritability
- Fatigue
- Forgetfulness
- Tremors

- Changes in vision
- Changes in hearing Urine or blood samples can be tested to see if you have been exposed to too much mercury. A urine test is preferred for measuring elemental mercury. Urine samples may be collected over a 24-hour period, or taken once (preferably in the morning after awakening). A blood test can be used to measure exposure to high levels of mercury if you can be tested within three days of being exposed.

Table 1 – Neurological and non-neurological diseases caused due to mercury toxicity

Neurological	*Non – Neurological*
Ataxia	Alopecia totalis
Chorea	Autoimmunity
Blindness	Fatigue
Depression	Hypersalivation
Drowsiness	Keratosis
Excitability	Melanosis
Fearfulness / anxiety	Recurrent infections
Insomnia	Ulcers
Irritability	
Low intelligence quotient	
Memory loss	
Mental retardation	
Parasthesias	
Quarrelling	
Restlessness	
Temper out bursts	

Who is most likely to have health problems after breathing mercury vapors?

- Pregnant women - Mercury can pass from a mother's body to her developing fetus.
- Infants - Mercury can also be passed to nursing infants through breast milk.
- Young children - They tend to play on floors where mercury may have been spilled, and are more likely to breathe more vapors than an adult because they breathe faster and have smaller lungs.

Mercury poisoning remedies

1) Increasing intake of vitamin C foods and greeny leafy vegetables.
2) Chelation therapies
3) Intake of fermented foods like yogurt, kefir, and veggies.

4) Eating protein and omega 3 rich foods.

5) Drinkings plenty of water and exercising regularly.

Conclusion

Mercury is persistent in the environment, highly bioaccumulative and can cause a variety of toxic effects including nephrotoxicity, teratogenicity and damage to the cardiovascular system. Endocrine-disrupting and immunotoxicological properties are under scientific discussion.Mercury vapour is colourless and odourless substance therefore patients with various unexplained symptoms and clinical conditions should be questioned about possible exposure to mercury. Clinical symptoms of exposure to different forms of mercury vary from nausea, abdominal pain to tremor, paralysis, memory loss and kidney damage. The Minamata disease, the so-called "mad hatter syndrome" and acrodynia are caused by chronic exposure to different organic and inorganic mercury compounds. In view of the impact from mercury on health and the environment, the international community adopted the Minamata Convention with the main objective of protecting human health and the environment from anthropogenic emissions and releases of mercury and mercury compounds. The role of the health sector in the implementation of the Convention was agreed by ministers of health at the Sixty-seventh World Health Assembly in resolution 67.11 on public health impacts of exposure to mercury and mercury compounds and the role of WHO and ministries of public health in the implementation of the Minamata Convention. It includes: phasing out the manufacture, import and export of mercury-added products from health care practice by 2020; phasing out mercury skin-lightening cosmetics, including soaps, and topical antiseptics; reducing the use of dental amalgams worldwide; developing public health strategies to address the impacts on health of the use of mercury in artisanal and small-scale gold mining; assessing the risk to human health in contaminated sites to inform action to reduce this risk; developing health programmes to identify and protect vulnerable populations at risk; ensuring the provision of diagnostics and of health care; and ensuring the exchange of health information, public awareness-raising, and research into and the monitoring of health. Relevant capacities should be built in the health sector for these purposes.

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BIOlOGICAL WEAPONS AND BIOTERRORISM

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Abstract

Bioterrorism and poses a unique and serious danger to all nations' security, endangers public health and disrupts economies. During the past century, rapid advancements made in life science have simplified the development and production of bioweapons. With the discovery of ricin toxin, the concern over bioterror has heightened and resulted in the declaration of war against bioterrorism. The foremost strategy to control bioterrorism is to minimize the easy access to the biological materials. Other such initiatives and necessary measures must be taken by all nations to maintain laboratory biosecurity, including physical protection, border controls and law enforcement efforts. For implementing security at the laboratory working level, bio risk policies should be created and updated by the policy-makers. The governments around the globe should increase surveillance, awareness and preparedness in order to identify as well as disarm biological agents

Keywords: Bioterror agents, biosecurity, surveillance centres, vigilance tools, bioterrorism acts.

Introduction

The international terrorist attacks are changing over the past 25 years towards the use of more deadly weapons for massive civil disruption (fas.org). Most terrorists use explosive and guns but some groups now show interest in using chemical, biological, radiological, or nuclear (CBRN) materials in order to cause mass casualties such are called as ***biological weapons*** . Many countries including Algeria, Bulgaria, China, Cuba, Egypt, France, India, Israel, Iran, Iraq, Libya, Laos, North Korea, South Korea, Syria, South Africa, Taiwan, Vietnam, Russia *etc.* are possessed, pursued or capable of acquiring weapons (fas.org). In contrast of accessing functional chemical, radiological or nuclear materials, biological materials are produced easily. The deliberate release of such materials including toxin, disease causing microorganisms (pathogens) as well as their products to inflict harm on a wider population is termed as ***bioterrorism*** . Although, it needs trained aggressor and have unpredictable mortality to the civilian, terrorist can use them as their trump card in the emergency situations. Origin of these weapons is contemporary biotechnology research that made great advances in agriculture and industrial processes along with revolution in the practice of drugs as well as therapeutics formulation. The very technologies that fuel these benefits to society, also pose a potential risk as well. According to Gerald Fink Report, "Biotechnology research in an age of terrorism: Confronting the dual-use dilemma" (National Research Council of the National Academies, 2003). The dual-use research concept came in early 2001, when an experiment was conducted for the development of viral contraceptive to control rodent populations by Australian scientists groups

History of bioterrorism

Biological weapons including filth and cadavers, animal carcasses, and contagion have been used to wage war and promote terror throughout history (Robertson and Robertson, 1995). The very first recorded incident of bioterrorism was in city-state Assyria of Mesopotamia in 600 BC. They employed rye ergot from fungus Claviceps purpurea, which contains mycotoxins in the wells of their enemies (Rega, 2004). After then, bioweapons have been employed repeatedly by nations, groups and individuals. In 1346, the siege of Caffa controlling seaport in a well-fortified Genoese (now Feodosia, Ukraine), attack the Tartar force and experienced an epidemic of plague (Wheelis, 2002). This plague (also known as Black Death) appeared as the most devastating public health disaster that spread to Europe and North Africa in the 14th and 15th centuries, killing more than 25 million Europeans. Furthermore, during the battle between Russian troops and Swedish forces, plague cadavars were used in Reval in 1710. In addition, the deliberate use of smallpox by Sir Jeffrey Amherst, the commander of the British forces in North America was suggested to diminish the native Indian population during the French-Indian War in 1754-1767 (Christopher et al., 1997; Henderson et al., 1999

Biological Agents of Bioterrorism

The US 'Centre for Disease Control and Prevention' (CDC) has classified potential bioterrorism agents into three priority categories, labeled A, B, and C on the basis of their ability to be disseminated, mortality rates, capability of causing public panic and actions required for public health preparedness .

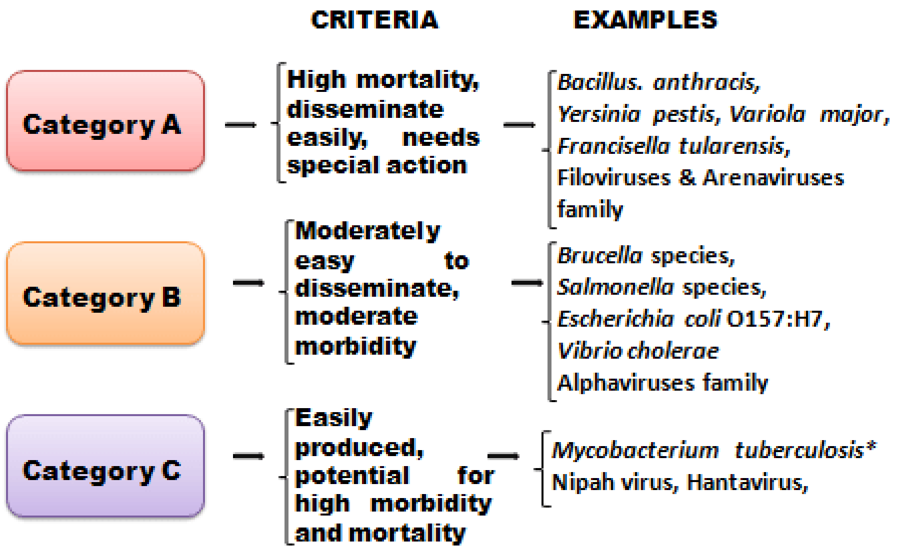


Figure 1: Classification of biological weapons

Although there are several human biological pathogens, only handful of them has the potential to be used as effective bioweapons. For mass casualties and civil disruption, bioweapons should have infectivity and toxicity, environmental stability, ease of large-scale production, large geographical area coverage and disease severity properties. In addition, the aerosol route provides a large-scale attack therefore pathogens should be stable in aerosol and capable to be dispersed (5-17µm particle size). They should have the ability of being communicable from person to person and having no treatment or vaccine (Kortepeter and Parker, 1999) and can be improved by genetic engineering as well as other weaponization processes (Jansen et al., 2014). Factors like weather, season and growth stage also play an important role in the effectiveness of the agent employed (Kaufmann et al., 1997). Fulfilling these criteria, Variola major (smallpox) could be a potential bioweapon as no vaccine is available against it. Furthermore, no antiviral drug is effective, although cidofovir have in vitro activity

Causes/Targets of Bioterrorism

The main cause of bioterrorism is the globalization and the population growth that ultimately increases mass migration thereby accelerating commerce and travel. Approximately 1.8 million airline passengers cross international borders daily, that lead to a free route of radiating infectious biological materials around the world within hours (Drexler, 2010). Poverty is also intimately connected to bioterrorism which is increasing continuously with the climate change, population growth as well as agricultural ill policies (Reuveny, 2007). Growth of slums at the outskirts of developed cities is the origin of infectious diseases as these habitats lack clean water, proper sanitation and education. Some of these diseases are due to dangerous pathogens that are the subject of legitimate study in government, academic, and industry labs thereby easily accessible for the terrorist. Other climatic changes such as water scarcity, land degradation, droughts, deforestation, floods, storms and famines also hamper agriculture and trigger more migrations which lead to the hostile atmosphere (Meinhart, 2005). Some anti-social elements use this atmosphere for malevolent bioweapons production as pathogens genomic data is easily available either on the internet and open scientific literature or through legitimate research laboratories and pharmaceutical manufacturing sites. Bioterrorism have devastating effect on the environment. Most of the bioweapons are relatively easy to generate, inexpensive and capable of mass destruction while using small quantities by simple means. Potential targets for bioweapons are water supplies and water distribution systems as it is the critical need of every ecosystem health and also to the smooth functioning of a commercial and economy sector of our industrialized society (Dembek et al., 2007). Agriculture is another perfect target for bioterrorism which uses highly contagious, virulent and resistant agents that result in economic hardship on countries. In addition, animals, plants and birds could also be targeted for biological threat generation (Fig 2). According to World Organization for Animal Health (OIE), 80% of pathogens used for biowarfare are of animal origin and 60% of human pathogens are zoonotic. Furthermore, there are many animal foreign agents (foot and mouth disease virus, Bacillus anthracis and African swine fever virus) that are readily available in the nature and also from commercial sources, which require little effort in handling and dispersing these pathogens For plants, agents such as wheat smut fungus Tilletia laevis (T. foetida) and/or T. tritici (T. caries) or rice blast fungus (Magnaporthe grisea), appear more harmful than others .

Effective Control Measures

Public health is an important pillar for any national security framework and therefore an effective response is required against bioterrorism. This can be achieved through multimodal and multiagency approach and many of these approaches are relatively straightforward. Effective control measures against bioterrorism include:

i).Biosecurity

ii).Vigilance tools

iii).Research programs by NIAID

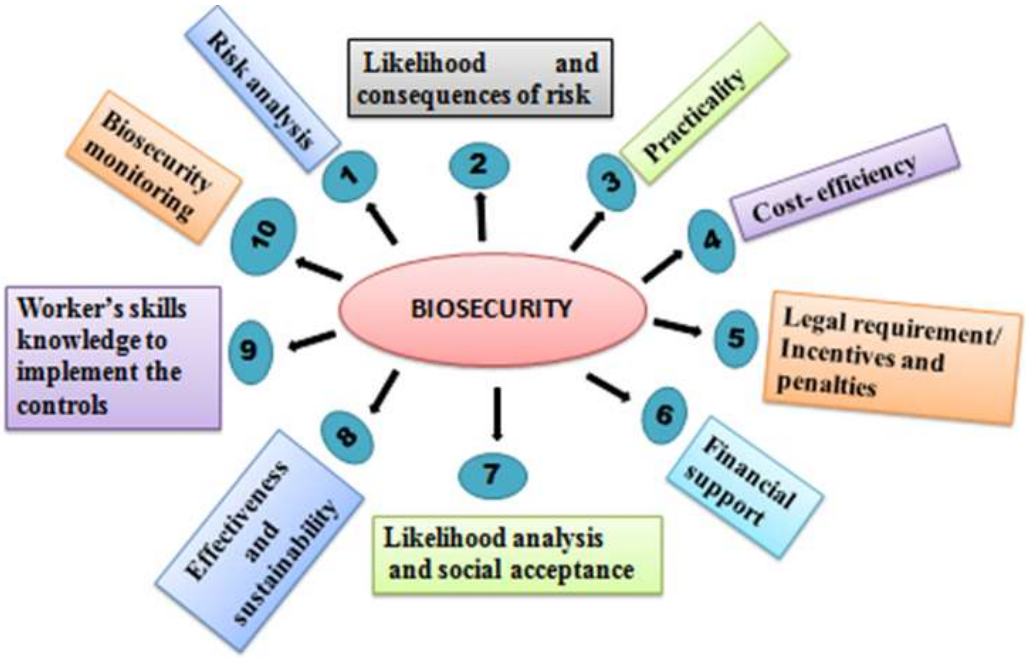
iv).Planning for risk management

v).Bioterrorism act

i). Biosecurity

Biosecurity is the method to protect and control the unauthorized access, loss, theft, intentional release thereby risk of transmission of infectious diseases in crops and livestock, quarantined pests, invasive alien species and living modified organisms .The revolutionary discoveries in life sciences lead to the unexpected paradoxes and dilemmas. Genomic information on one hand has opened the possibilities of better drugs and therapeutic formulation whereas on the other hand, malicious combinatorial bioweapons have been generated using this information. Therefore, it is necessary to have effective biosecurity that requires promotion of a set of attitudes, behaviors and systems by people which should be easy to comply with and hard to avoid. Biosecurity term is used in various context including food and agriculture biosecurity, industry biosecurity, laboratory biosecurity, farming biosecurity *etc.*

Fig 2. Analysis, designing and the steps of implementation of biosecurity



To prevent bioterrorism, national strategies have now been focusing mainly on the way of limiting access to the pathogenic microorganisms and laboratory biosecurity play immense role in this. The main components of laboratory biosecurity are physical security (restrict access to authorized individuals), personnel security (individual screening), material control & accountability (provide awareness regarding material and the responsible person), transport security (packaging and reliable carrier information), information security (sensitive information protection from public release) (www.biosecurity.sandia.gov).

ii) Vigilance tools

Various past outbreaks have led to the understanding that a regional and even global response is needed. The early recognition of a bioterror agent is essential in ensuring effective containment and reduction of casualties. Once agent is detected, appropriate response and mitigation of events is required for epidemiological capability and population risk. With greater speed and precision of detection we can better prepare a functional response against biological attacks. Some of the vigilance tools are:

a) Epidemic information exchange (Epi-X) is web-based communications network that serves as a powerful communications exchange between CDC, state and local health departments, poison control centers, and other public health professionals .

b) Early aberration reporting system (EARS) is a web-based communication method for monitoring bioterrorism during large-scale events. This network connects various cities, country and state public health officials in the US and abroad to CDC (Hutwagner et al., 2003).

c) Biowatch is a US federal government program to detect the release of pathogens into the air as part of a terrorist attack on major American cities. The air samples typically are monitored daily for signs of the particular biological agents (Goldstein, 2010).

d) Joint biological point detection system (JBPDS) consists of a biological suite that has a biological aerosol warning sensor (or trigger), collector, fluid transfer system and identifier and used to limit the effects of biological agent attacks that have the potential for catastrophic effects on US forces (www.dote.osd.mil).

e) Organic light-emitting devices (OLEDs) have been developed to detect agents of bioterrorism (e.g. lethal factor produced by Bacillus anthracis). It is based on luminescent (bio) chemical sensors, where the photoluminescence excitation source is an OLED (Tabatabai, 2005).

f) Real time public health surveillance system (RODS) provides an early alert to larger exposure or outbreaks and bioterrorism. A key component of the RODS system is the HL7 (Health Level Seven) message protocol which is an effective method of transferring health information electronically and it can be easily integrated into the mainstream (Tsui et al., 2003).

g) Microarray technology is the most effective technique to detect bioterror agents from blood with the help of blood-screening microarrays using rRNA. It is a miniature device with oligonucleotide probes; these probes are able to differentiate the PCR products from pathogens using small amounts of sample (Ramachandran, 2008). Real-time PCR assays also provide higher specificity and shorter assay times than classical PCR techniques. One exciting report describes the development of real-time PCR protocols using reagents that are stable at ambient temperatures (Qu et al., 2010). Biofilms containing species can be detected using peptide nucleic acid fluorescence in situ hybridization (PNA FISH) through confocal laser scanning microscopy (CLSM) .

h) Raman microspectroscopy is capable of identifying anthrax endospores inside a sealed paper envelope through a turbid medium (Arora et al., 2012).

i) Bioinformatics tools (Table-1)

Tools	**Detection**	**References**
Bioterrorism and Epidemic Outbreak Response Model (BERM)	Program for estimating healthcare staffing needs forresponse to a bioterrorism attack or large-scale naturaldisease outbreak, based on number of current staff andnumber of patients expected to require rapid treatment.	www.ahrq.gov

Desktop cDNA Annotation System (dCAS)	Allows users to import raw cDNA sequences, buildsequence contigs, perform SignalP analysis, and compareBLAST contigs against numerous BLAST databases .	www.niaid.nih.gov
GPS-Prot	Allows facile integration of different HIV interaction datatypes as well as inclusion of interactions between humanproteins derived from publicly-available databases,including MINT, BioGRID and HPRD.	Fahey et al., 2011
Join Solver	Performs IgE nucleotide and amino acid alignment as wellas extensive mutation and CDR3 analysis, recombination analysis.	joinsolver.niaid.nih.gov
'open-target' approach to Biosensing	A relatively small, non-specifically designed, DNAmicroarray is capable of identifying the presence ofmultiple organisms in mixed samples coupled with amathematical model and laboratory generated data	Mohtashemi et al., 2011
Papillomavirus Episteme (PaVE)	Graphic visualization of sequence features using a novel "locus view", precise BLAST results against thepapillomavirus-specific PaVE databases.	www.niaid.nih.gov
PhyloMap	Combines ordination, vector quantization, and phylogenetic tree construction of influenza A virus genome sequences.	Zhang et al., 2011
SNP Explorer	Visualizes and analyses SNPs from custom Affymetrix resequencing Hyper-IgM/CVID microarrays.	www.niaid.nih.gov

iv). Planning for risk management. Planning is outlining necessary actions, identifying resources, assigning roles and responsibilities, and ensuring overall coordination which is crucial for combating bioterrorism .

a) Hospital preparedness program (HPP) is to prepare the nation's healthcare system to respond appropriately to mass-casualty incidents, whether due to bioterrorism, natural disaster, or other public health emergencies.

b) Social media comprises Buttons and Badges, Widgets, Content Syndication and many more social networking websites that are used to provide information, commentary and descriptions of events and highlight certain audio or video contents for emergency preparedness.

c) National Notifiable Diseases Surveillance System (NNDSS) is a multifaceted program that enables all levels of public health (local, state, territorial, federal, and international) for collection, analysis, and sharing of notifiable disease-related health information (wwwn.cdc.gov). NNDSS Modernization Initiative (NMI) is underway to give more comprehensive, timely, and higher quality data than ever before for public health decision making.

d) BioSense is a syndromic public health surveillance system that provides efficient, rapid and collaborative monitoring as well as response to harmful health effects of exposure to diseases or hazardous conditions .

e) National Pharmaceutical Stockpile (NSP) program was also established by the CDC which is an essential response element for the Bioterrorism Preparedness and Response Initiative. This program is mainly concerned with the maintenance of pharmaceuticals and medical supplies that should be delivered to the communities during mass casualties due to biological or chemical terrorist attacks .

v).Bioterrorism acts :

Table 3: Bioterrorism acts and their functions

ACTS	COUNTRY	YEAR	FUNCTIONS
The Pandemic and All-Hazards Preparedness Act (PAHPA)	United States	2006	Improve the nation's public health, medical preparedness and response capabilities in emergencies.
Public Readiness and Emergency Preparedness Act (PREP Act)	United States	2005	Protects from liability claims arising from administration, vaccine manufacturers, distributors, program planners, and qualified persons involved in the administration.
Biodefense and Pandemic Vaccine and Drug Development Act	United States	2005	Provides incentives for domestic manufacturing of vaccines and broad liability protections to the companies.
The Project Bioshield Act	United States	2004	Provides permanent funding for the procurement of medical countermeasures during emergencies.
Public Health Security and Bioterrorism Preparedness and Response Act (Bioterrorism Act)	United States	2002	Issue regulations on enhancing controls on dangerous biological agents and toxins, protecting safety and security of food and drug supply, drinking water Security and safety.
Homeland Security Act	United States	2002	Create the Department of Homeland Security (DHS), that prevent or minimize damage and assist in recovery for terrorist attacks
USA Patriot Act	United States	2001	Uniting and strengthening America by providing appropriate tools required to intercept and obstruct terrorism
Chemical and Biological Weapons Control Act	United States	1991	Strengthen efforts to control chemical and biological agents, precursors, and equipment.

Conclusions

Over the years, the weapons have been shifted from swords to malevolent biological weapons. Although, very few pathogens can be used as bioweapon, their considerable ease of production along with the immense mass casualty and civil disruption made them effective arms. Since bioterrorism attacks are unpredictable, early detection, containment, treatment and communication are crucial for appropriate response against it. New programs and systems should be designed to insure our national security. In addition, to limit the access to biological materials, laboratory biosecurity and regulations should be created and updated according to the risk assessment by the policymakers. There is heightened and urgent need of increased collaborations among the academic sector, government private industry and nations which will provide benefits far beyond protection from deliberate acts of bioterrorism.

Future perspectives

Technological advancement in any field comes with new national security risks and use of bioweapons is the cruelest act in the current dates. Therefore, current surveillance, awareness and preparedness strategies have been the focus for improvement and research in health emergencies. There are needs of methods and technologies that can generate effective diagnostics and therapeutics against a new as well as variant infectious agent within days or weeks after its identification. In addition, robust plan should be prepared which are hopeful, flexible and rapidly responsive. Biosensoring technology should be started at the regional, state and federal levels as they are financially feasible. Furthermore, preliminary detection of biological agents is made through mobile rapid-screening units that play important role in surveillance programme and various such devices may soon more frequently used in future Federal agencies such as the NIH and the NSF (National Science Foundation) engaged in funding for biodefense research programs.

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IMPORTANCE OF VITAMIN IN HUMAN HEALTH

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Abstract

Vitamin are more important for human health, growth, development, reproduction and maintenance and their deficiencies are imposing serious health hazards. There are thirteen true vitamins. Further these vitamins are classified as water soluble and fat soluble. Fat soluble vitamins are Vitamin A, E, K and D whereas, Vitamin B1 (thiamine), B2 (riboflavin), B3 (niacin), B5 (pantothenic acid), B6 (pyridoxine), B9 (folic acid/ folate/folacin), B12 (cobalamin), biotic and Vitamin C or ascorbic acid are ware soluble vitamins. Vitamin deficiencies are causing the serious health problems. Basic introduction of vitamins, their biological importance, daily dietary requirement and dietary sources for vitamins are discussed in this article.

Keywords: Vitamin A, vitamin B complex, vitamin C, biotin, vitamin E, vitamin K.

Introduction

Vitamins are groups of highly complex compounds, organic in nature, present in foodstuffs. These vitamins are necessary for our normal metabolism. Absence of these vitamins causes deficiencies whereas resupply of these vitamins can cure these deficiencies. Vitamins in diverse in nature like fat, carbohydrate and protein. Vitamins are differentiated from other organic compounds in their chemical nature and function.

In the early days of vitamin discovery, chemical composition of vitamins is unknown and these factors were designated with alphabet letters. Alphabetizing become complicated due to different forms of vitamins (vitamin B complex), differences in chemical structure within groups and determination of chemical function. Vitamins were also named based on their function and sources. Example: Vitamin K is derived from Danish word *koagulation* meaning *coagulation.* Rules for nomenclature of vitamins were established by Committee on Nomenclature of the American Institute of Nutrition.

Human body is unable to synthesize the vitamins so, their intake through diet is necessary. Vitamins are chemically complex compounds and have significant role in growth.

Fat soluble vitamins:

Vitamin A:

Biological Importance

Vision, support to immune system and inflammatory system, cell growth and development, antioxidant activity, promoting proper cell communication.

Daily requirement

Daily intake requirement of vitamin A for young male is 900 micrograms, for female is 700 micrograms and for children 300-400 micrograms.

Dietary source

Provitamin A carotenoid sources are sweet potato, carrots, spinach, Romaine lettuce, bell pepper, parsley, broccoli, asparagus, chili pepper, tomatoes, papaya, grapefruit etc.,

Preformed vitamin A sources are shrimp, eggs, cow's milk, cheese, yogurt, salmon, chicken, turkey, beef and lamb.

Vitamin D:

Biological importance

Vitamin D is important for normal body functioning as its deficiency causes malformation and softening of bones. Vitamin D deficiency is associated with many disorders like osteoporosis, rickets, osteomalacia, loss of balance, diabetes, rheumatoid arthritis, asthma, depression, epilepsy and lowered function. Vitamin D also maintain the blood calcium level by pulling out calcium from bones. Vitamin D deficiency is reported to be increasing since 1980's due to increased use of sunscreens and decreased exposure to sunlight.

Daily requirement

Dietary intake should be 15 micrograms in daily basis for teenager males and females.

Dietary source

Egg yolks, tuna, salmon, mushrooms, cow's milk, soy milk, orange juice.

Vitamin E:

Biological importance

Low density lipoprotein cholesterol is protected by vitamin E from oxidative damage caused by free radicals. Deficiency of vitamin E is associated with heart attack, cancer, stroke, cold sores, Alzheimer's disease.

Daily requirement

Daily recommended intake of vitamin E is 15 milligrams for males and females of adult age while 5 milligrams for children.

Dietary source

Vitamin E dietary sources are sunflower seeds, spinach, avocado, peanut, shrimp, olives, raspberries.

Vitamin K:

Biological importance

Blood clotting is beneficial or harmful depending upon the conditions of occurrence. Vitamin K is important for bone health and its deficiency increases the risk of bone fracture. Osteoclasts are special type of the cells involved in demineralization of bones and make the minerals available for other body functions but too muck demineralization can harm the bones.

Daily requirement

Daily value for vitamin K intake is 80 micrograms, for female 90 micrograms, for males 120 micrograms while 55 micrograms for children.

Dietary source

Specially, food sources for Vitamin K1 are dark green leafy vegetables, for K2 are eggs, meat, fish, dairy, fermented animal foods and fermented plant foods whereas, K3 is not naturally present in dietary foods.

Water soluble vitamins:

Vitamin B1:

Biological importance

Importance of vitamin B1 can be realized with the fact that it acts as gate keeper among the carbohydrate breakdown, Krebs cycle and electron transport chain. Deficiency of vitamin B1 can seriously affect the nervous system, digestion and heart. Parkinson’s, Alzheimer’s and alcohol-related brain diseases are also linked with vitamin B1 deficiency.

Daily requirement

Daily intake requirement for females is 1 milligram whereas for males it is 1.2 milligram.

Dietary sources

Thiamine dietary sources are asparagus, sunflower seeds, green peas, flax seeds, cabbage, spinach, eggplant, lettuce, mushrooms, peanuts, sweet potato, pineapple, oranges, broccoli.

Vitamin B2:

Biological importance

Glutathione is most important antioxidant which provides antioxidative protection to body and this antioxidant is recycled in the human body by vitamin B2. This vitamin promotes iron metabolism. Deficiency of this vitamin increases the risk of migraine headache, iron deficiency anemia, congestive heart failure.

Daily requirement

The daily requirement of vitamin B2 is about 1.3 milligram for males and 1 milligram for female.

Dietary sources

Vitamin B2 dietary sources are spinach, asparagus, eggs, cow’s milk, mushrooms, broccoli, soybeans, bell pepper etc.,

Vitamin B3:

Biological importance

Starch is synthesized from niacin and stored in liver and muscles as energy source. Vitamin B3 is associated with numerous diseases like high cholesterol, type-1 diabetes etc.,

Daily requirement

Daily intake of vitamin B3 for males is 16 milligrams and for female is 14 milligrams.

Dietary sources

Dietary source of vitamin B3 is chicken, turkey, mushroom, tomatoes, brown rice, egg plants etc.,

Vitamin B5:

Biological importance

Pantothenic acid is incorporated into Coenzyme A which has central position for energy metabolism. Deficiency of this vitamin causes high cholesterol, chronic fatigue etc.,

Daily requirement

Daily intake of vitamin B5 for human body is 10 milligrams.

Dietary sources

Dietary sources of vitamin B5 is sweet potato, cucumber, avocado, chicken, turkey etc.,

Vitamin B6

Biological importance

Functionally b6 is a very important vitamin as it is involved in red blood cell production, carbohydrate metabolism, liver detoxification, brain and nervous system health. Deficiency of this vitamin causes anemia, premenstrual syndrome, morning sickness, depression etc.,

Daily requirement

Young male requires 1.3 milligrams and young female require 1.2 milligrams on daily basis.

Dietary sources

Vitamin B6 dietary sources are tuna, cabbage, spinach, carrots, tomatoes, avocado, fortified cereals, strawberries, watermelon etc.,

Vitamin B9:

Biological importance

Well known role of vitamin B9 is to support the brain health. It is important for production of red blood cells and its deficiency along with deficiency of copper, iron, vitamin B6 and vitamin B12 can spoil the production of red blood cells. Vitamin B9 deficiency in females during pregnancy can cause loss of pregnancy. Deficiency of vitamin B9 causes birth defects, osteoporosis, cognitive decline etc.,

Daily requirement

Young males and females require 400 micrograms of vitamin B9 on daily basis.

Dietary sources

Dietary source of vitamin B9 are lettuce, sunflower seeds, pineapple, raspberries, kiwifruit, onions etc.,

Vitamin B12

Biological importance

This vitamin is very important for cardiovascular health of human. Succinyl CoA is the building block for hemoglobin and this building block is dependent on vitamin B12. Deficiency of this vitamin causes muscular degeneration, memory loss, kidney disease etc.,

Daily requirement

Young males and females require 2.4 micrograms of vitamin B12 on daily basis.

Dietary sources

Dietary source of vitamin B12 id salmon, tuna, lamb, yogurt, beef etc.,

Vitamin B7

Biological importance

Insulin, hormone that maintains sugar balance, production and functioning on cell are impaired due to deficiency of biotin. Deficiency of vitamin B7 causes skin rashes, cradle crap, hair loss, diabetes, pregnancy issues.

Daily requirement

Daily intake value id 30 micrograms for both males and females.

Dietary source

Vitamin B7 dietary sources are tomatoes, almond, eggs, onion, carrot, peanuts, cauliflower, sweet potatoes, oats etc.,

Vitamin C

Biological importance

This vitamin has antioxidant properties and protect the lens of eyes, molecules circulating in bloodstreams and genetic material from harmful effects of free radicals. Deficiency of vitamin C causes scurvy, common cold, asthma, gout, gingivitis, musculoskeletal injury etc.,

Daily requirement

The daily requirement of vitamin C in youngster males and females are 75 milligrams.

Dietary sources

Dietary sources of vitamin C are papaya, bell peppers, onions, banana, apple, pear etc.,

Conclusions

- ✓ Vitamin A help form and maintain healthy teeth, bones, soft tissue and skin.
- ✓ Vitamin E helps the body form red blood cells and use vitamin k
- ✓ Vitamin K is useful for coagulation of blood.
- ✓ Vitamin D helps the body absorb calcium and maintain proper blood levels of calcium and phosphorus.
- ✓ Vitamin B1 helps body cells change carbohydrate into energy.
- ✓ Vitamin B6 helps form red blood cell and maintain brain function.
- ✓ Vitamin B5 plays a role in the production of hormones and cholesterol.
- ✓ Vitamin C promotes healthy teeth and gums. It helps the body absorb iron and maintain healthy tissue. It is also essential for wound healing.

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WHAT IS NANOTOXICOLOGY AND THEIR EFFECTS IN THE ENVIRONMENT

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Abstract

Nanotoxicology represents a new and growing research area in toxicology.

It deals with the assessment of the toxicological properties of nanoparticles (NPs) with the intention of determining whether (and to what extent) they pose an environmental or societal threat. Inherent properties of NPs (including size, shape, surface area, surface charge, crystal structure, coating, and solubility dissolution) as well as environmental factors (such as temperature, pH, ionic strength, salinity, and organic matter) collectively influence NP behavior, fate and transport, and ultimately toxicity. The mechanisms underlying the toxicity of nanomaterials (NMs) have recently been studied extensively.

Keywords: nanomaterialnanotoxicology, nanomaterial toxicology, nanotechnology, nanoparticle, nanosafety, nanomaterial

Introduction

Nanotoxicology is regarded as the assessment of the toxicological properties of nanoparticles(NPs) with the intention of determining whether (and to what extent) they may pose anenvironmental or societal threat. Nanotechnology has advanced exponentially over the past decade, with nanoscale materials being exploited in several applications and in severaldisciplines (including industry, science, pharmacy, medicine, electronics, and communicationproducts). Vance et al. [1] reported a 30-fold increase in nano-based products between 2011 and2015 (Figure 1) and an estimated global market of over $1 trillion in 2015 [2]. Metal NPs(specificallyǰ carbon and silver NPs) represent the largest and fastest growing group of NPs (Figure 2). Hence, human and environmental exposure is already occurring and is predicted toincrease dramatically. This growth in nanotechnology has not advanced without concernsregarding their potential adverse environmental impacts. Severalreviews have reported on thetoxicity of various NPs [3, 4]. However, much is still unknown.

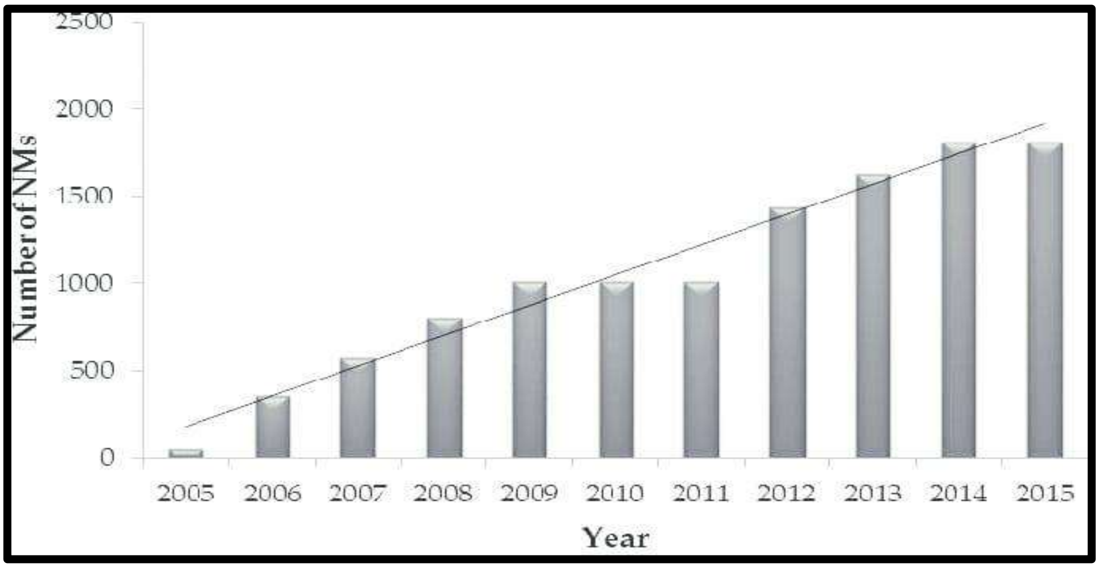

Figure 1. Nanomaterial growth trend 2010–2015 [1].

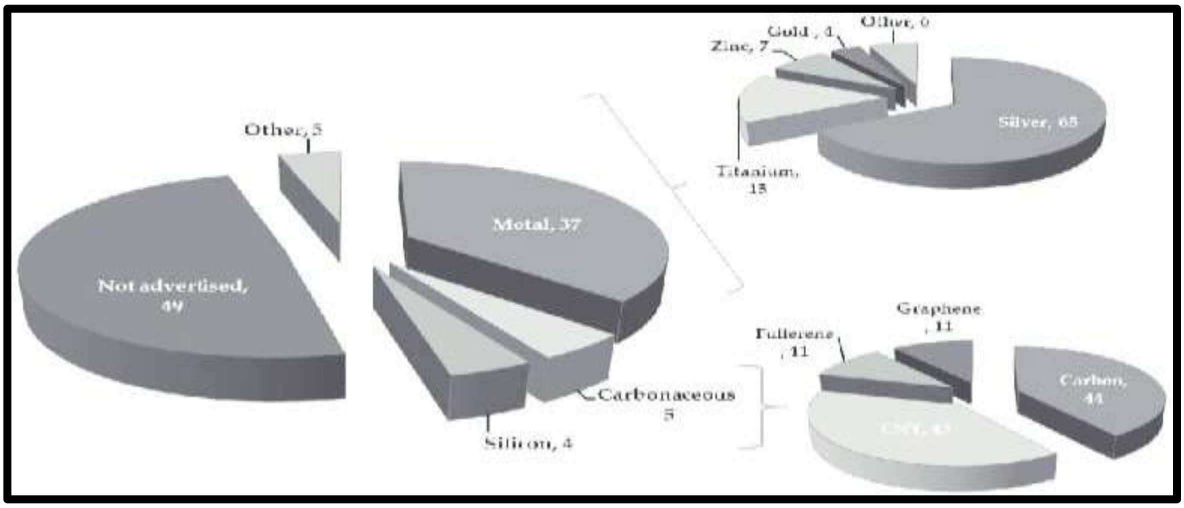

Figure 2. Composition of nanomaterials

Nanomaterials (NMs) are generally defined as a substance having particles with at least one dimension of 1–100 nm in length. Their novel physical and chemical characteristics have made them useful in several applications; however, these very properties can be potentially toxic.

Types OF Nanomaterial & Their Effect On Human Body

Nanomaterial	Effects
Fullerenes	Blood-brain-barrier penetration, Distribution in the kidneys, bone, spleen, and liver by 48 hrs

Single wall carbon nanotube	Cellular toxicity, Endocytosis, intra-cytoplasmic localization, extensive cell death.
Multiple wall carbon nanotube	Toxicity and decrease in cell viability, Dispersion in the lung and induction of an inflammatory and fibrotic response.
Titanium dioxide	DNA damage induction by sunlight illuminated TiO2, Pro-inflammatory effects, pulmonary inflammation, production of reactive oxygen species (ROS)
Iron Oxide	Decreased MTT activity and DNA content, Adhesion to plasma membrane
Cerium Dioxide	Size-dependent internalization of the particle, Decreased MTT activity and DNA content, production of reactive oxygen species (ROS)
Copper Nanoparticles	Target organs of copper nanoparticles: kidney, spleen, and liver
Gold Nanoparticles	Slight decrease in cell metabolic activity and/or proliferation induced by water-soluble gold nanoparticles.

Toxicity Environmental Exposure

Environmental nanotoxicology emphasizes ecological interactions at population, community, and ecosystem levels. Eco-nanotoxicology powerfully links exposure and engineered nanomaterial's (ENM) chemical properties, biochemical mechanisms and the ecological and physical processes that regulate ecosystem-level impacts and ecosystem services.Uncertainties in health, ecology and the environment effects associated with exposure to engineered nanomaterial raise questions about potential risks from the exposures. However, the health concerns focus on respiratory health; epidemiological studies show clear effects of ultrafine particles on respiratory illness such as inflammation, coughing, wheezing etc., (Handy, 2007; Donaldson and Seaton, 2008). Nanoparticles such as titanium dioxide, zinc oxide and silver, consumer products such as cosmetics, creams and detergents, is a key source and discharges assumed to increase with the development of nanotechnology. Environmental technologies using nanotechnology lead to direct interactions of intentionally produced nanomaterial with chemically complex mixtures present within a variety of environmental media such as soil, water, ambient air, and combustion emissions. The health effects associated with these interactions are unknown. There is need to assess the health and environmental risks associated with environmental applications of nanotechnology Nanoparticlesexposure to th environment is interrelated,. Life cycle assessment is necessary to study the interaction and exposure of nanoparticle in the environment.

1. Air
2. Soil
3. Water

Discussion and conclusion

Nanotechnology the body, including the interior of cells. Significant accumulations have been shown in the lungs, brain, liver, spleen, and bones. The pulmonary route is still the most likely exposure route in the work environment. It is important to realize that the nanoparticle deposition site in the lungs will be affected greatly by nanoparticle dimensions, which can change substantially throughout the production process. Because of their very small size, these particles offer a large contact surface per mass unit. Also, nanoparticles exert cytotoxicity on cells depending on the charge at membrane surface. Nanotoxicity may be attributed to electrostatic interaction between nanoparticles with membrane and their accumulation in cytoplasm. Nanoparticles in plants enter cellular system via roots and stomata, effect transpiration, plant respiration, and photosynthesis, and interfere with translocation of food material. The degree of toxicity is linked to this surface and to the surface properties of these nanoparticles, rather than their mass. A check on the ecotoxicity of nanoparticles is thus very important as it creates a direct link between the adverse effects of nanoparticles and the organisms including microorganisms, plants, and other organisms including humans at various trophic levels.

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GREEN CROWTH: A SYNTHESIS OF SCIENTIFIC FINDING

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Abstract

Environmental damage and abuse of science for evil purposes has become a major issue and a major problem at this time in the era of freedom. Humans have lost control in the name of freedom in the use of science and technology so that the disadvantages of science and technologies are occured in daily life such as pollution and environmental crisis. The issue of environmental pollution due to the use of pesticides is one evident of uncontrolled chemical science or ethics-neglected practice of chemistry. The pollution has affected the biochemical reactions of various organisms, including humans that have an impact on health disorders. Another issue is genetically modified organisms as biochemical engineering product that will destroy biodiversity and potentially cause health problems in humans. Green biochemistry approach to integrating biomedical ethics and the ethics of environmental chemistry is expected to be a strategy in controlling the use of science and technology in which environmentally friendly and oriented towards the protection of human health aspects. Biomedical ethics principles and ethics of chemical environment can be considered in making decisions in the safe use of chemical compounds to create green world according to the credo 6R i.e. refuse and remove, reuse, recycling, and reduce as well as respect to others. This paper discuss material of green biochemistry for integrating biomedical ethics and ethics of environmental chemistry based on bioethics core curriculum of UNESCO and some experiences in several countries or some recommendations in related fields.

Key words: Biomedical ethics, ethics of environmental chemistry, green world

Introduction:

2050 the world's population is approximately expected to 9 billion. This populationrequires a supply of water, food and energy adequately as well as good environment on good quality for the prosperous and happy life. The FAO projections indicate that world food demand may increase by 70 per cent by the year 2050, with much of the projected increase in global food demand expected to come from rising consumer incomes in regions such as Asia, Eastern Europe and Latin America (1). By the year 2050, energy use almost doubles (compared with 2009) and total greenhouse gas (GHG) emissions rise even more. Then, in the absence of efforts to stabilize atmospheric concentrations of greenhouse gases (GHGs), average global temperature rise is projected to be at least 6°C in the long term. A scenario presented in the

World Energy .Outlook that sets out an energy pathway consistent with the goal of limiting the global increase in temperature to 2°C by limiting concentration of greenhouse gases in the atmosphere to around 450 parts per million of CO2 from four main primary energy source i.e. oil, coal, gas and renewable (2,3). Eventually this condition will emerge the process of global warming with various problems resulting climate change with air pollution, waste accumulation and the accumulation of toxic chemicals in the environment that all pose a threat to human health (4). Therefore, human beings need a large carrying capacity of environment having lower pollution. the issue of global warming, both at international and local level, drastically environmental awareness become an important point in human life. Furthermore, every aspect of life is filled with the environmental movement with new perspective of ecology. Deep ecology becomes popular philosophy as the basic of green environment movement to be new concept of ecology instead of shallow ecology. Deep ecology is different from shallow ecology as former concept of ecology.

Deep ecology becomes alternative to reduce environment damage. It has been balancer from abuse of science for evil purposes which become a major issue and a major problem at this time in the era of “unlimited” freedom. Anthropocentric approach of former ecology concept made over exploitation of environment for human being using technology. Then, humans tend to have lost control in the name of freedom in the use of science and technology to exploit natural resources or environment. The impacts are the disadvantages of science and technologies occurred in daily life such as pollution and environmental crisis. Shallow ecology in anthropocentric or human-centered perspective, it views humans as above or outside of nature, as the source of all value, and ascribes only instrumental, or 'use', value to nature. Deep ecology does not separate humans- or anything else- from the natural environment. It does see the world not as a collection of isolated objects but as a network of phenomena that are fundamentally interconnected and interdependent. Deep ecology recognizes the intrinsic value of all living beings and views human beings as just one particular strand in the web of life (5). Deep ecology has an important role to make sustainable development to protect human life, public health and good climate in harmony or equilibrium with other organisms and environment to keep sustainability our life.

The global economic and political background has changed with the emergence of the concept of sustainable development. Sustainable development means a development that meets the needs of the present without compromising the ability of future generations to meet their own needs and the need to take environmental considerations into account in all other policies (alongside economic and social concerns) (4). This ides has emerged “go green” movement becoming this idea so popular and moving simultaneously in almost all part of the world. Going

Green refers to an individual action that a person can consciously take to reduce harmful effects on the environment through consumer habits, behavior, and lifestyle. This can be attained by using green products and services. In addition, go green has a meaning different thing to different people in different subject or discipline to make safety, healthy, environmentally friendly of all products and services (6). Sustainable living, green living, healthy living, organic living, green chemistry, environment friendly, green technology, green engineering are basically derived from the same concept. What biochemistry will do to support the movement to Go Green? Biochemistry are subjects or discipline curious about the chemical origins of life, the cell, the effects of organisms on the cell, and how altering conditions can improve life on earth (7).

Today, with growing awareness in industry, academia and the general public of the need for sustainable development, the international chemistry community is under increasing pressure to change current working practices and to find greener alternatives. In response, the Royal Society of Chemistry has produced Green Chemistry as a vehicle to inform all parties of the latest developments in the green chemistry revolution (8). Green Chemistry covers the following areas: 1) The application of innovative technology to established industrial processes, 2) The development of environmentally improved routes to important products, 3) The design of new Green chemicals and materials, 4) The use of sustainable resources, 5) The use of biotechnology alternatives, 6) Methodologies and tools for evaluating environmental impact (9). This revolution of green chemistry eventually need to green biochemistry becoming interface for living and non living matter in application of green chemistry related to organism.

The main aim of this paper is to examine the relationship between Biomedical and Environmental Ethics, Chemistry and Environment at present and future developments in view of analyzing the concept of "green biochemistry" in comparison with other green concept in chemistry, biology, business, economy and technology as well as the ecology awareness. Go green is a concept that not only affects the individual but the entire society with their environment. Biochemistry, in its specificity as a science, cannot ignore this crucial aspect if wants to make a positive contribution to the improvement of living conditions and in full respect of nature conservation or environment.

Method and Material:

This article offers my perspective of the concept of green biochemistry among concept of the green chemistry, environmental chemistry, green economy, green technology, green business, green biology, green laboratory and ecology as well as biomedical ethics with ethics of environment. I examined related books or ebook, articles and websites, collected through searches of databases such as Pub Med, IUPAC, Medline and EBSCO and search engines such as Google and Yahoo with keyword go green, green chemistry, green biochemistry, green biology, green economy, green laboratory, green entrepreneurship/business, green technology, green engineering, biomedical ethics and environmental ethics. Moreover, this result will be compared with UNESCO bioethics teaching material to understand the relevance of bioethics, biomedical ethics, environment ethics and green biochemistry.

The Result and Discussion:

Biochemistry according to the history has become part of chemistry developed from organic chemistry. The focus is to study all of biologic trait in basic component of chemical substances and chemical reaction. Hence, biochemistry is integration between biology and chemistry (7, 10). The end of biochemistry approach is to explore biomarker in biologic entities related to specific trait or feature in normal condition and explore how the way of the organ or organelle of the cell to proceed or produce biomarker by certain chemical reaction. Application of biochemistry is very broad from unicellular organism to multicellular organism to utilize them in daily life for producing medicine, functional food and biomimicry compound and also new species of genetics modified organisms for food production, energy providing and biodegradation of waste (7,10,11).

Green biochemistry has`consisted of combination green chemistry and green biology presented in figure 1. Green chemistry is the design of chemical products and processes that are more environmentally benign and reduce negative impacts to human health and the environment. Green biology envision that the 21st century will witness a second Green Revolution, where modern biology approaches will be used on plants and microbes to develop new technologies for protecting the deteriorating environment, resolving the emerging food crisis, and exploring alternative energy sources (12). Green biochemistry become tools for eco-innovation to create novel and competitively priced goods in manipulation biologic system, processes, services, and procedures designed to satisfy human needs and provide a better quality of life for everyone with a life-cycle minimal use of natural resources (materials including energy and cost) per unit output, and a minimal release of toxic substances (13).

Green biochemistry is integrated part of green chemistry tipically for application of chemistry in term of biology system for sustainable development. It is very important to integrate environmental criteria into the procurement of all goods, process and services of biochemistry laboratory by expert, as well as usage of product of bioengineering or biotechnology as part of green chemistry principle guided by biomedical ethics and environmental ethics to make sustainable development. It serves as an example of how the biochemists and laboratory of biochemistry have specified environmental, health and safety criteria for a range of products used in their facilities or the service and products they have been produced in accordance with principle of green chemistry and biomedical ethics and environmental ethics (chemistry). In the long term, green biochemistry becomes tools for solution the issue of environmental pollution and damage for instance due to the use of pesticides because of practice uncontrolled chemical science or ethics-neglected practice of chemistry. The pollution has affected the biochemical reactions of various organisms, including humans that have an impact on health disorders. Another issue is genetically modified organisms as biochemical engineering product that will destroy biodiversity and potentially cause health problems in humans in the long term.

All biochemistry procedures, materials and products, from cleaning practical work tools or laboratory glassware and reagent as well as specimen of patients, have an effect on the environment. They all use energy, generate waste and to some degree pollute the indoor and outdoor environment (14). This has knock-on effects for the health and well-being of staff, patients and the public at large. Go green in term of biochemistry discipline consist of the role of biochemistry to make product as natural as possible known biomimicry compound with no harm or friendly to environment and human (11). Go green in term of biochemistry as part of green chemistry. As a chemical philosophy, green chemistry applies to organic chemistry, inorganic chemistry, biochemistry, analytical chemistry, and even physical chemistry. While green chemistry seems to focus on industrial applications, chemical philosophy does apply to any chemistry choice. Green chemistry is a broad concept, encompassing the full range of ways in which the development of a chemical product (pharmaceutical or otherwise) can adversely affect the environment - from raw material extraction and processing, through manufacturing chemistry, to end-of-life breakdown in the environment. The focus is on minimizing the hazard and maximizing the efficiency of any chemical choice. Green chemistry is different from environmental chemistry. Whereas environmental chemistry is the chemistry of the natural environment, and of pollutant chemicals in nature, green chemistry seeks to reduce and prevent pollution at its source. Environmental chemistry focused on which chemical phenomena in the environment (15).Environmental biochemistry has been focused on the effect of chemical substances in environment affecting the biology system such as iodine, lead, pesticide and others.

Green biochemistry has role to assess effect of any chemical substances to human health on risk of cancer, reproductive and developmental toxicity, genotoxicity/mutagenity, endocrine disruption, immune disease and neurotoxicity for the present population and future population (16, 17). Also green biochemistry has role to assess the threshold value to determine the level of hazards resulting any chemical substances to any level organism from unicellular to multicellular. The endpoint of hazard is bioaccumulation and persistence of the product in environment. The last challenge of green biochemistry is to make alternative through bioengineering and biotechnology for providing biofuel, biocide, bioprocessor for waste degradation or treatment to make all waste environmentally friendly (18,19). Green biochemistry implies working at the roots of the problem of chemical exposures and global chemical contamination to all organism affecting normal biochemical reaction.

The basic principles of green biochemistry consist of 15 principles that are redeveloped from 12 principle of green chemistry as follow (20);

1. It is better to prevent waste than to treat or clean up waste after it is formed.
2. Synthetic methods should be designed to maximize the incorporation of all materials used in the process to the final product.
3. Whenever practicable, synthetic methodologies should be designed to use and generate substances that possess little or no toxicity to human health and the environment.
4. Chemical methods should be designed to preserve efficacy of function while reducing toxicity.
5. The use of auxiliary substances (e.g. solvents, separation agents, etc.) should be made unnecessary whenever possible and, innocuous when used.
6. Energy requirements should be recognized for their environmental and economic mpacts and should be minimized. Synthetic methods should be conducted at ambient temperature and pressure.
7. A raw material or feedstock should be renewable rather than depleting wherever technically and economically practicable.
8. Unnecessary derivatization (blocking group, protection/deprotection, temporary modification of physical/chemical processes) should be avoided whenever possible.
9. Catalytic reagents (as selective as possible) are superior to stoichiometric reagents.
10. Chemical products should be designed so that at the end of their function they do not persist in the environment and break down into innocuous degradation products.
11. Analytical methods needed to be further developed to allow for real time, in process monitoring and control prior to the formation of hazardous substances.
12. Substances and the form of a substance used in a chemical process should be chosen so as to minimize the potential for chemical accidents, including releases, explosions, and fires.
13. Respect to biodiversity and genetics entities
14. Safety of bio byproduct and biotechnology as well as services for all biological entities
15. Justice for present and future generation of biochemical product and services

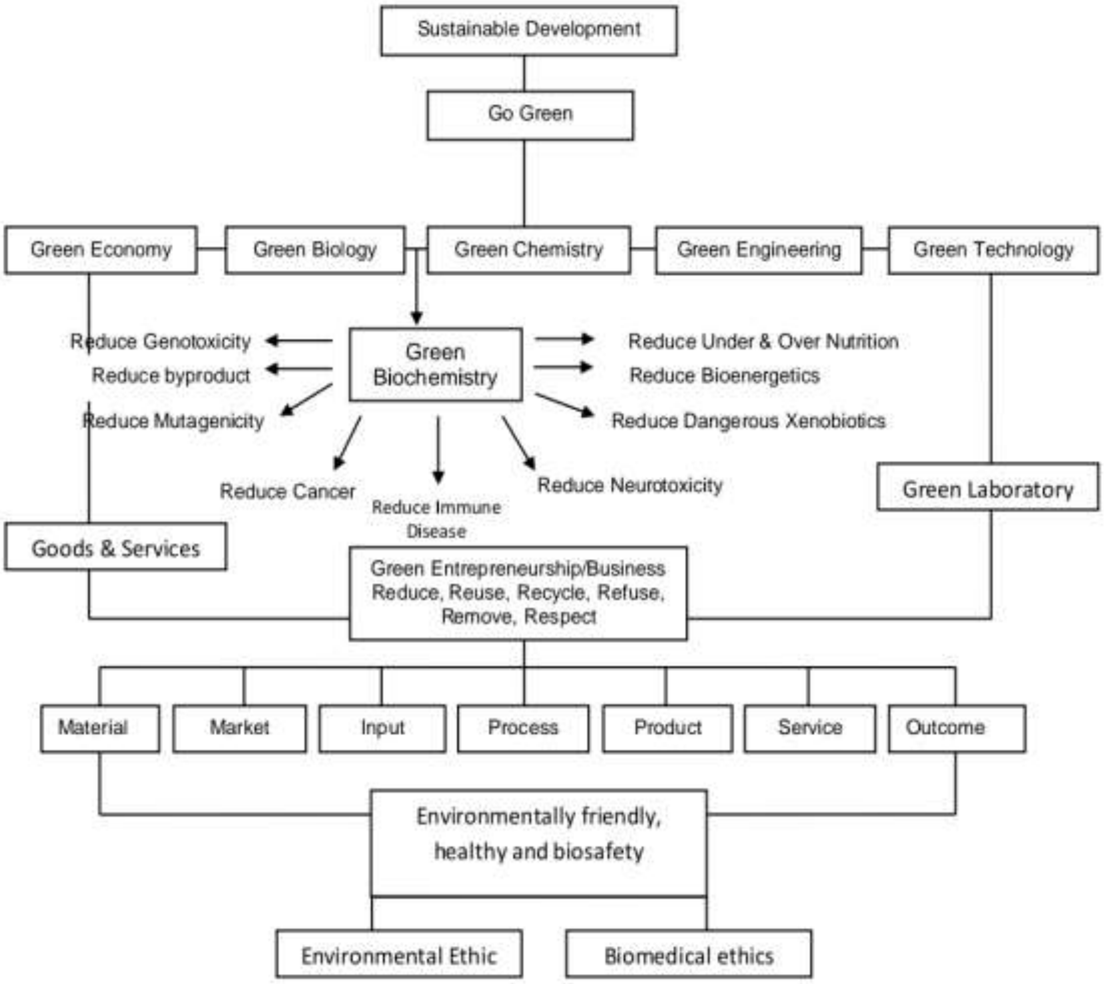

Fig. 1 The Position of Green Biochemistry

In comparison, Afsaw et al. have developed 13 principle of green chemistry using acronym GREEN AFRICA presented in Fig.2 after considering and adding with a principle from Millenium Development Goals (MDGs) (21).

Principles for Greener Africa

G - Generate Wealth not Waste
R - Regard for All Life & Human Health
E - Energy from the Sun
E - Ensure Degradability & No Hazards
N - New Ideas & Different Thinking
E - Engineer for Simplicity & Practicality
R - Recycle Whenever Possible

A - Appropriate Materials for Function
F - Fewer Auxiliary Substances & Solvents
R - Reactions using Catalysts
I - Indigenous Renewable Feedstocks
C - Cleaner Air & Water
A - Avoid the Mistakes of Others

Fig. 2 The 13 Principle of Green Chemistry for Africa Region

Additional principles of green chemistry have been developed by Gonzales and Smith and also principle of green engineering presented in table 1 below with 12 principles (22).Green (bio) engineering is the design, commercialization, and use of processes and products, which are feasible and economical while minimizing (1) generation of pollution at the source and (2) risk to human health and the environment (23). To implement fully Green (Bio) Engineering solutions, bioengineers should use principles in Table 1. Then application of knowlegde or science for practical purposes to reduce waste, energy, hazard, risk, material and cost is known green technology. Green technology encompasses a continuosly evolving group of methods and materials, from techniques for generating product and sustainable energy to non-toxic cleaning products and conserve natural resources and environment.

Table 1. Additional Principles of green chemistry and green (bio) engineering

No.	12 additional principle of green chemistry	Principle of green (bio) engineering
1	Identify byproducts; quantify if possible	Engineer processes and products holistically, use systems analysis, and integrate environmental impact assessment tools
2	Report conversions, selectivities, and productivities	Conserve and improve natural ecosystems while protecting human health and well-being
3	Establish a full mass balance for the process	Use life cycle thinking in all (bio) engineering activities
4	Quantify catalyst and solvent losses	Ensure that all material and energy inputs and outputs are as inherently safe and benign as possible
5	Investigate basic thermochemistry to identify exotherms (safety)	Minimize depletion of natural resources
6	Anticipate other potential mass and energy transfer limitations	Strive to prevent waste
7	Consult a chemical or process engineer	Develop and apply engineering solutions, being cognizant of local geography, aspirations and cultures
8	Consider the effect of the overall process on choice of chemistry	Create engineering solutions beyond current or dominant technologies; improve, innovate, and invent (technologies) to achieve sustainability
9	Help develop and apply sustainable measures	Actively engage communities and stakeholders in the development of engineering solutions
10	Quantify and minimize use of utilities and other inputs	Maintain biodiversity and creating harmony with environment
11	Recognize where operator safety and waste minimization may be compatible	Resulting biomimicry substances as natural as possible
12	Monitor, report and minimize wastes emitted to air, water, and solids from experiments or processes	Safety and respect to other organisms

The 12 principles of have played a central role in the development of the field, for example inspiring new greener syntheses of pharmaceuticals for intervention in biochemical reaction. The original 12 Principles Green Chemistry have been complemented by the 12 Principles of Green Engineering, which, while having less emphasis on basic chemistry, highlight the importance of chemical engineering in developing greener and more sustainable chemical processes including bioengineering such geneic engineering. According to Asfaw the formal statements of both sets of principles are much too detailed to be used effectively in lectures, presentations and general educational settings. So, the need for more concise statements of the principles prompted some expert to produce two abbreviated sets (Fig.3) , based on the acronyms IMPROVEMENTS and PRODUCTIVELY (21).

Principles of Green Engineering

I - Inherently non-hazardous and safe
M - Minimize material diversity
P - Prevention instead of treatment
R - Renewable material and energy inputs
O - Output-led design
V - Very simple
E - Efficient use of mass, energy, space & time
M - Meet the need
E - Easy to separate by design
N - Networks for exchange of local mass and energy
T - Test the life cycle of the design
S - Sustainability throughout product life cycle

Principles of Green Chemistry

P - Prevent wastes
R - Renewable materials
O - Omit derivatization steps
D - Degradable chemical products
U - Use safe synthetic methods
C - Catalytic reagents
T - Temperature, Pressure ambient
I - In-Process Monitoring
V - Very few auxiliary substances
E - E-factor, maximize feed in product
L - Low toxicity of chemical products
Y - Yes it's safe

Fig. 3 The 24 abbreviated Principles of Green Engineering and Green Chemistry

All above principle of green chemistry are in line with the biomedical ethics (bioethics) and environmental ethics (chemistry). Biomedical ethics has been developed by Thomas Beauchamp and James Childress consisting of beneficence, non maleficence, autonomy and justice. The detail description and explanation about biomedical ethics as below (24);

1. Beneficence :

Beauchamp and Childress suggest that there are two principles of beneficence, positive beneficence and utility. The principle of positive beneficence asks that moral agents provide benefit, while the principle of utility requires that moral agents weight benefits and deficits to produce the best result. The services and product of biochemistry research or examination should be certain for the beneficence to diagnose, predict, screening or treatment the disease for human being, animal, plant or microorganism.

2. Non maleficence :

Non maleficence is common to see the words primum non nocere, first do no harm. While hardly original, it represents in just four words the ethical principle of non maleficence; we should not harm others. It is the negative side of beneficence. This also represents the risk side of a risk-benefit analysis. In clinical research especially in biochemistry research, this is addressed in the disclosure of risks associated with being a participant in a research project. But again, the question as to what to discloseevery possible risk that could potentially occur, or just the more likely is not clearly delineated. Biochemistry services and product should do no harm or prevent the harm for all organisms in the present and future with environment.

3. Autonomy:

Autonomy minimally requires the ability to decide for the self free from the control of
others and with sufficient level of understanding as to provide for meaningful choice. To be autonomous requires a person to have the capacity to deliberate a course of action, and to put that plan into action. This creates problems in the delivery of health care or biomedical research, especially when patients are comatose, incompetent (whether due to age i.e., children, or to mental ability) or, for example, imprisoned. And this is an issue in the clinical research setting, especially as it relates to the provision of informed consent, with its need for competence, disclosure, comprehension and voluntariness. Autonomy is only for human being in medical context but in animal experimentation now is developing animal rights that should be respected in biochemistry experiment or research. For this reason the proposal of experiment and research should get ethical clearance from the ethical committee representing the community or any kind of subject in the study as actualization of autonomy principle. Autonomy included anthropocentrism (human is the central of intrest), biocentrism (all living matters are central of interest), ecosentrism (environment as central of interest) and zoocentrism (animal as central of interest).

4. Justice:

Justice addresses the questions of distribution of scarce resources, balancing action between rights and duty on research and service, respect for people’s rights and respect for morally acceptable laws. At its base, the fundamental question is, is there a universal right to get service and product or get involve in experiment or research? If there is not, how are we to provide care for those who for whatever reason cannot afford it; if there is, to what level is such care to be offered, and how will it be funded? How can we ensure fairness is the process? These are not question with obvious answers, and they lead to various ways of answering the question, from the distributive (those who need more get more, for example) to the non-distributive (each public health center will get 1000 doses of a vaccine and will provide them to whomever shows up first). In term of green biochemistry justice principle represents the benefit distributed equally for another person or organism with their environment in the present and future even in limited resources. Frontier mentality should be changed to make environment sustainable based on Justice principle (25).

Green biochemistry need on decision-making tools for predicting and rapidly evaluating the toxicity and exposure potential of chemical pollutants to living things and their environment. The primary goals of this tool, which is part of Green Chemistry Initiative, are to: make decision the types of data that are needed for identifying problem chemicals and safer alternatives to living things, and identify and review existing and emerging tools used in predicting toxicity, environmental fate and exposure, and prioritizing chemical hazards (26).These tools consist of the green purchase, green procedure routinely in biochemistry laboratory, services and experiment, green product, green services, and green impact based on biomedical ethics, deep ecology and environmental ethics (chemistry) for implementing green chemistry and green biology. In perspective of system for green biochemistry it needs to prepare comprehensively for implementing green biochemistry from the beginning of green building, green facilities, green purchasing, green packaging, green preservation, green procedures, green economics, green chemistry, green biology and green bioengineering or biotechnology guided by biomedical ethics and environmental ethics (Fig.1).

According to Keraf there are some ethical principle that should be taken for account to restore and conserve the enviromnent for future generation as follow (33) ;

a. Respect to nature

Biochemist is expected to recognize that the rules of nature need to be respected so that the nature must be kept forour next generation

b. Responsibility principle

There is collective moral responsibility not only individual responsibility to take initiative, bussiness, policy and action to keep the universe and everything in universe still sustainable to our generation

c. Cosmic solidarity

Human beings have the biggest awareness to make balance and equal of everything with nature as one cosmic creation and solidarity

d. Compassion and concern to the natural entities

As member of ecological community should have sense of equivalent to love, cherish, and care to nature and its content without discrimination and domination. Affection and concern also arises from the fact that as member of ecological community of all living beings have the right to be protected, respected, nurtured, fullfilled, cared for and not hurt

e. No harm

Humans have moral obligation and responsibility against nature. At least humans do not want to harm the nature. Therefore humans was strived to do no harm or not threaten the existence of living things in this universe as well as humans is not justified to act morally harmful to other human beings.

f. Live simply and harmony with nature

This principle emphazised the value of good quality and way of life not only for wealth. Standard of material tools was not empazised become priority to collect as many as possessions in this life by greedy action and avaricious. The most important is the quality a better life in harmony among others and sobriety.

g. Justice

In this case, equal access is important for all groups and community members in determining policies for natural resourcies and participate in conservation of nature as well as to enjoy the advantages of natural resources or whole universe

h. Democracy

This principle closely related to the essence of nature. The content of diverse nature always full of variety. Diversity is the essence of the nature, essence of life. Itself. Therefore any tendency of reductionistic approach and anti diversity and antiplurality contrary to nature and life. Democracy create a space or room for wide differences in diversity with others. Therefore humans those are concerned with environment should have democracy approach. Environmentalist is a democratic humans

i. Moral integrity

This principle is primarily intended for the public officials or gavernment official. Government official are required to have honorable attitude and behavior to uphold the moral principle in priority for public interest. Official should have honesty, clean from corruption and good character to be respected by societies in conservation program.

Conclusion:

In conclusion, go green movement have been well known in all discipline and field including in biochemistry. This idea is the concept, principle and practice for sustainable development to give benefit in present and future generation which reduce waste, energy, hazard, risk, natural resources, material and cost. Green biochemistry is part of green chemistry and integrated with green biology to make product and services environmentaly friendly to reduce genotoxicity, mutagenity, neurotoxicity, byproduct and xenobiotics, under and over nutrition and bioenergetics for all generation of human. Green biochemistry has credo 6 R i.e. refuse hazard, remove risk, reduce energy and waste, reuse and recycle waste, and respect to other organism and environment. Green biochemsitry become chain of green movement among green economy, green biology, green chemistry, green engineering, green technology, and green business which having the same spirit. Implementation of green biochemistry is guided by biomedical ethics for using organism in term of research activity and services. Green biochemistry also is guided by environmental ethics to create product andservices in green laboratory facilities. So, green biochemistry need skill for integrating biomedical ethics and environmental ethics to create balance and harmony of organism with environment during exploited of natural resource and utilized it by human beings.

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APPLICATION OF RADIOFCTIVITY IN MEDICINE

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Introduction

Radioactivity : Radioactivity is simply when very small particles in objects emit energy or smaller particles. The energy that is produced can result in cancer, serious environmental damage, or helpful technologies.

There are different degrees of radioactivity, and different exposures increase the harm it can cause.

Types of Radioactivity

There are different types of radioactivity depending on what particles or energy are released during the reaction.

The three types are:

1. Alpha - These are fast moving helium atoms.
2. Beta - These are fast moving electrons.
3. Gamma - These are photons, just like light, except of much higher energy, typically from several keV to several MeV.

Medical uses

There are many uses of radiation in medicine. The most well known is using x-ray to see whether bones are broken. The broad area of x -ray use is called radiology. Within radiology, we find more specialized areas like mammography, computerized tomography (CT), and nuclear medicine (the specialty where radioactive material is usually injected into the patient). Another area of x-ray use is called cardiology—where special x-ray pictures are taken of the heart.

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Radioactivity in X-Ray

- Chest X Ray
- Barium Enema
- Mammography

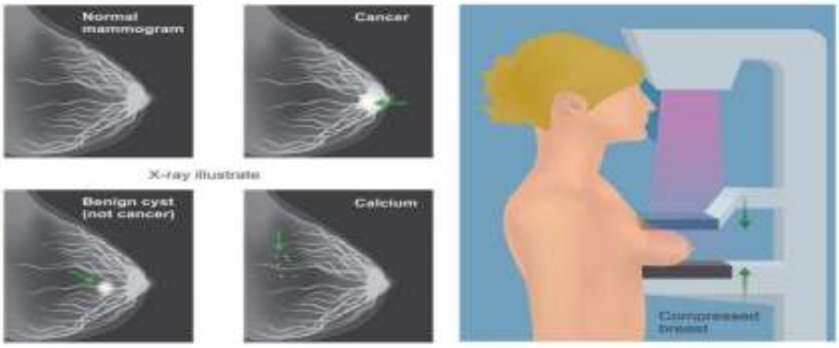
- CT(Computerized tomography)
- Chest X Ray
- A chest x ray is probably one of the most common diagnostic
- exams and is used to look at the chest, ribs, lungs, and heart with the help of radioactivity.
- We use the chest x ray to assure, perhaps, that the person is healthy enough to undergo surgery or to look for certain diseases like emphysema, pneumonia, or lung cancer.

Barium Enema

A barium enema helps us look at the large intestine or colon. Most often, a barium enema is performed by putting barium into the large intestine so it can be seen on x-ray. Barium is a contrast material that is not radioactive, but simply allows the intestine to be visible on the x ray. Watching the barium go through the intestine allows doctors to see if there are blockages or other issues.

Mammography

Mammography is a type of x-ray imaging used most often to look for or diagnose breast cancer or other breast disease. A mammogram can show even very small abnormalities and, in individuals with very dense breast tissue, these small masses can be seen up to two years before the individual can feel them.



<u>CT (Computerized tomography)</u>

Computerized tomography (CT) imaging is a technique using x-ray and computer processing to generate two-dimensionalpictures of the inside of the body. The images are called “CT slices” because one image will show all things in the body in that one location.

<u>Nuclear Medicine</u>

Nuclear medicine differs from general radiology in the following respects: you are not exposed to radiation from a machine outside the body, you are administered (intravenously or by mouth) a substance that is radioactive, you become radioactive for a short time, and with this radioactive substance in your body, we can actually determine if organs in the body are functioning like they should be.

In addition to organ function, we can use tests like this to look at blood flow, check respiratory function, look for infections, measure organ functions, and study many other functionally related issues.

<u>Cardiology</u>

- In cardiology, the most common x-ray examination is the angiogram. During an angiogram, contrast material that is not radioactive is injected into the heart arteries so the arteries can be seen by the x-ray.
- The angiogram is used to find out whether there are issues with these arteries, like a blockage. In some cases, if narrowed or blocked arteries are found during the exam, a

procedure called angioplasty might be done to clean out the blockage and a metal stent placed in the artery to hold it open.

Angiogram

- A angiogram is a common test for people with possible heart symptoms.

Brachytherapy

- Brachytherapy is a procedure where small metal implants (usually about the size of a piece of rice) are put inside the body in or near a cancerous tumor. Inside the small implant is some radioactive material .The radioactive material is sealed inside the implant and cannot get out. The implant stays in the location where it was positioned and exposes the tumor to a constant stream of radiation until the radioactive decays away.

Linear Accelerators

- A linear accelerator (also called a LINAC) is a very large device that emits high-energy x-ray and electron beams. It is the most common device used in radiation oncology for cancer treatment. The linear accelerator x-ray or electron beam can be highly collimated so the energy is delivered to the tumor while sparing normal tissues.