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Unveiling the mechanisms of action of traditional herbal medicines

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Abstract : Herbal medicine is the use of medicinal plants for prevention and treatment of diseases: it ranges from traditional and popular medicines of every country to the use of standardized and tritated herbal extracts. Generally cultural rootedness enduring and widespread use in a Traditional Medical System may indicate safety, but not efficacy of treatments, especially in herbal medicine where tradition is almost completely based on remedies containing active principles at very low and ultra low concentrations, or relying on magical-energetic principles. In the age of globalization and of the so-called 'plate world', assessing the 'transferability' of treatments between different cultures is not a relevant goal for clinical research, while are the assessment of efficacy and safety that should be based on the regular patterns of mainstream clinical medicine. The other black box of herbal-based treatments is the lack of definite and complete information about the composition of extracts. Herbal derived remedies need a powerful and deep assessment of their pharmacological qualities and safety that actually can be realized by new biologic technologies like pharmacogenomic, metabolomic and microarray methology. Because of the large and growing use of natural derived substances in all over the world, it is not wise to rely also on the tradition or supposed millenarian beliefs; explanatory and pragmatic studies are useful and should be considered complementary in the acquisition of reliable data both for health caregiver and patients.

***IndexTerms* – Herbal Medicine, Phytochemicals, Treatment, Disease.**

I. INTRODUCTION

Traditional medicine comprises medical treatment with ancient roots that has been passed over generations to maintain health, as well as to prevent, diagnose, improve or treat illnesses. The development of traditional medicine has been influenced by the different cultural and historic conditions in which they were first developed. Its common basis is a holistic approach to life, equilibrium between the mind, body and environment, and an emphasis on health rather than on disease. Rational use of traditional medicine has many aspects, including: qualification and licensing of providers; proper use of products of assured quality; good communication between traditional medicines providers, allopathic practitioners and patients; and provision of scientific information and guidance for the public. The World Health Organization supports Member States in developing their own national policies on traditional medicine guidelines and strategic research.

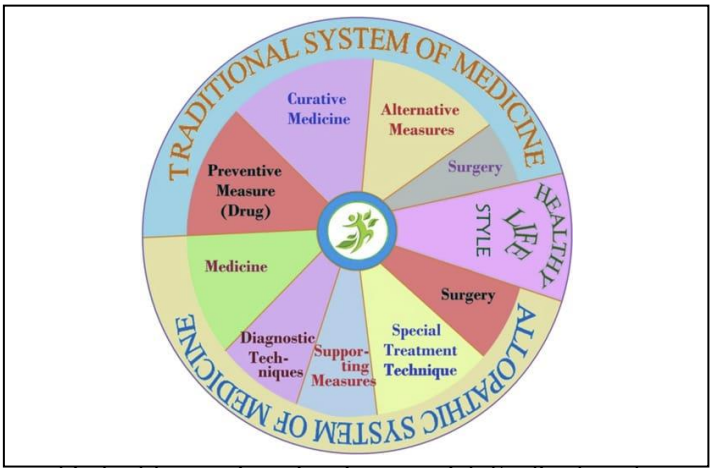

Fig 1 Systems of medicine & treatment

Medicinal plants have been used in health care since time immemorial. Studies have been carried out globally to verify their efficacy, and some of the findings have led to the production of plant-based medicines. Traditional medicine includes the diversity of health practices, approaches, knowledge, and beliefs incorporating plant, animal, and/or mineral-based medicines,

spiritual therapies, manual techniques, and exercises, applied singly or in combination to maintain well-being through treating, diagnosing, or preventing illnesses The inclusiveness of the term “traditional medicine” and the wide range of practices it encompasses make it difficult to define or describe, especially in a global context. Traditional medical knowledge may be passed on orally from generation to generation, in some cases with families specializing in specific treatments. Sometimes, its practice is quite restricted geographically, and it may also be found in diverse regions of the world. However, in most cases, a medical system is called “traditional” when it is practiced within the country of origin. Indigenous/traditional knowledge has developed as a result of human interaction with their environment. Traditional knowledge related to the health of humans and animals exists in all African countries. Every region has had, at one time in its history, a form of traditional medicine

Traditional medicine is “the knowledge, skills and practices based on the theories, beliefs and experiences indigenous to different cultures, used in the maintenance of health and in the prevention, diagnosis, improvement or treatment of physical and mental illness”. According to World Health Organization, herbal medicine is the use of plants to treat disease and enhance general health and wellbeing). Herbs can interact with other pharmaceutical medications and should be taken with care. Never stop taking prescribed medications in favor of herbs without first discussing it with general physician. Be careful about purchasing herbal medicines over the internet. Some traditional folk medicines, such as unregulated herbal medicines, may not be manufactured to the same quality and standards as regulated medicines.

Chinese herbal medicine has its origins in ancient culture. It involves the medicinal use of plants to treat illness and improve overall health and well-being. Some herbs contain powerful ingredients that should be taken with the same caution as medicines. In fact, many medicines are based on artificial versions of naturally occurring compounds found in plants. For example, digitalis for heart treatment and heart rhythmic problems. Digitalis can increase blood flow throughout your body and reduce swelling in your hands and ankles.

It was obtained from digitalis plants. Chinese herbs contain active ingredients. The active ingredients of many herbal formulations are still unknown. Some medicines are based on a single active ingredient derived from a botanical source. Herbal practitioners believe that if the active ingredient is used separately from other parts of the plant, it may lose its potency or be less safe. For example, salicylic acid is found in Meadowsweet and is used in the production of aspirin. Aspirin can cause bleeding in the lining of the stomach, but Meadow Sweet naturally contains other compounds that help to prevent salicylic acid irritation. According to the herbalist, the effect of the whole plant is greater than the effect of that part. Critics argue that the nature of herbs makes it difficult to administer measured doses of the active ingredient. Herbal medicines do not have to go through the testing that drugs do. Someherbs , such as comfrey and ephedra, can cause serious harm. Some herbs can interact with prescription or over-the-counter medicines. Plants have been used for medicinal purposes long before prehistoric period. Ancient Unani manuscripts, Egyptian papyrus, and Chinese books described the use of herbs. There is evidence that Unani Hakims, Indian Vedas, and European and Mediterranean cultures have used herbs as medicines for over 4000 years

Indigenous cultures such as Rome, Egypt, Iran, Africa and the United States used herbs in healing ceremonies, while other cultures have traditions such as unani, ayurveda and herbal medicine where herbal remedies were systematically used. Medical system has been developed. Traditional medical systems continue to be widely practiced in many ways. Population growth, inadequate supply of medicines, exorbitant treatment costs, side effects numerous artificial tablets and improvement of resistance to presently used tablets for infectious illnesses have brought about elevated emphasis on the usage of plant substances as a supply of drugs for a huge type of human illnesses. Ayush structures in India include Ayurveda, Unani, Siddha and Folk (tribal) drugs are the fundamental structures of indigenous drugs.

Among those structures, Ayurveda and Unani Medicine are maximum evolved and extensively practised in India. Medicinal vegetation is taken into consideration as a wealthy source of elements which may be utilized in drug improvement pharmacopoeial, non- pharmacopoeial or artificial tablets. A component from that vegetation plays a crucial position in the improvement of human cultures across the complete world. Moreover, little vegetation is taken into consideration as crucial supply of nutrients and because of that they're encouraged for his or her healing values. Some of that vegetation encompasses ginger, inexperienced tea, walnuts, aloe, pepper and turmeric etc. Some vegetation and their derivatives are taken into consideration as crucial supply for lively elements that are utilized in aspirin and toothpaste etc.

Herbal substances and preparations thereof play an important role in healthcare systems worldwide. Due to the variety of these products regarding origin, composition and processing procedures, appropriate methodologies for quality assessment need to be considered. A majority of herbal substances is administered as multicomponent mixtures, especially in the field of Traditional Chinese Medicine and ayurvedic medicine, but also in finished medicinal products. Quality assessment of complex mixtures of herbal substances with conventional methods is challenging. Thus, emphasis of the present work was directed on the development of complementary methods to elucidate the composition of mixtures of herbal substances and finished herbal medicinal products.

An indispensable prerequisite for the safe and effective use of herbal medicines is the unequivocal authentication of the medicinal plants used therein. In this context, we investigated the potential of three different PCR-related methods in the characterization and authentication of herbal substances. A multiplex PCR assay and a quantitative PCR (qPCR) assay were established to analyze defined mixtures of the herbal substances Quercus cortex, Juglandis folium, Aristolochiae herba, Matricariae flos and Salviae miltiorrhizae radix et rhizoma and a finished herbal medicinal product. Furthermore, a standard cloning approach using universal primers targeting the ITS region was established in order to allow the investigation of herbal mixtures with unknown content. The cloning approach had some limitations regarding the detection/recovery of the components in defined mixtures of herbal substances, but the complementary use of two sets of universal primer pairs increased the detection of components out of the mixture. While the multiplex PCR did not retrace all components in the defined mixtures of herbal substances, the established qPCR resulted in simultaneous and specific detection of the five target sequences in all defined.

Fig 2 Composition of Novel Polyherbal Formulations

II. TRADITIONAL APPROACHES TO UNDERSTANDING MECHANISMS OF ACTION

In the past, scientists derived drugs from natural products or were inspired by traditional remedies. Very common drugs, such as paracetamol, known in the US as acetaminophen, were put into clinical use decades before the biological mechanisms driving their pharmacological activities were understood. Today, with the advent of more powerful technologies, drug discovery has changed from the serendipitous approaches of the past to a more targeted model based on an understanding of the underlying biological mechanism of a disease. In this new framework, scientists seek to identify a protein target associated with a disease and develop a molecule that can modulate that protein target. As a shorthand to describe the biological activity of a given molecule, scientists assign a label referred to as mechanism-of-action for short.

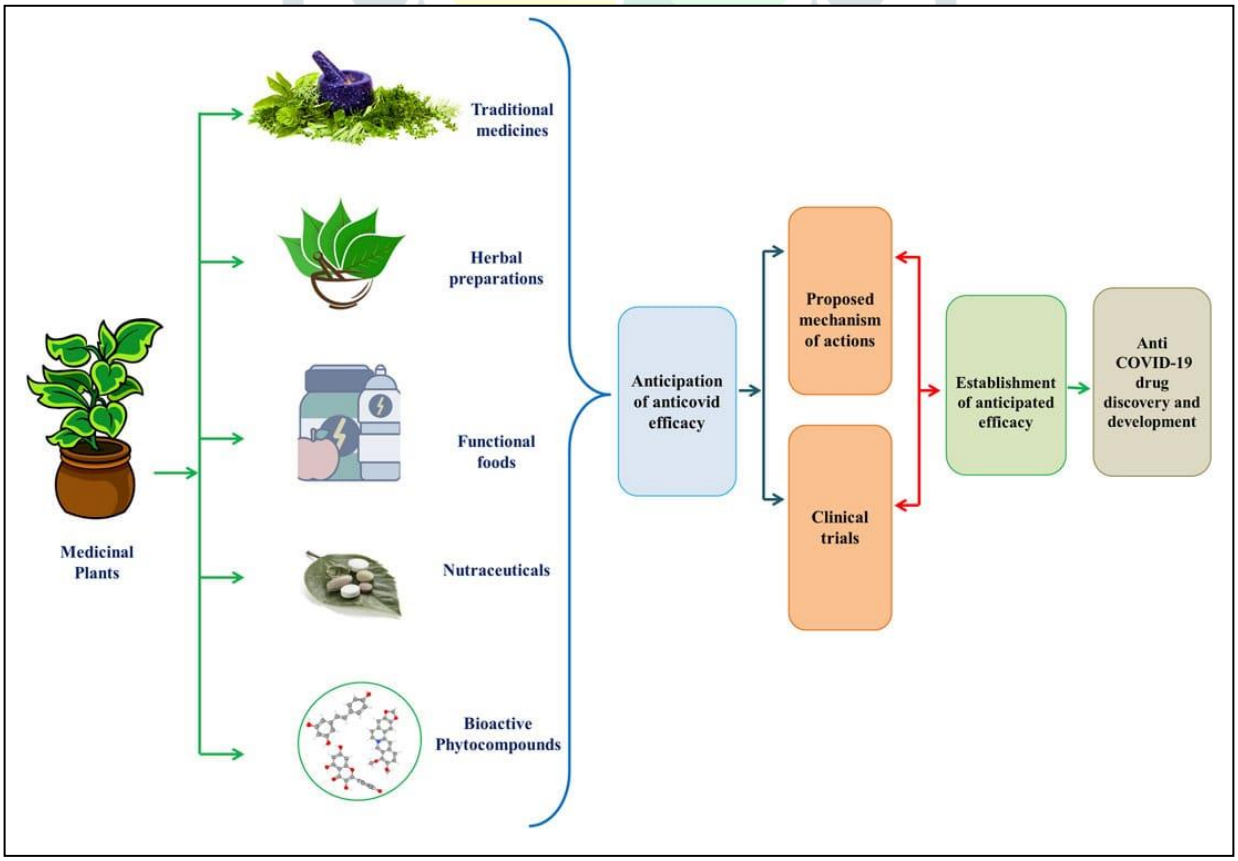

Fig 3 Development of formulation in Communicable disease

1. TM applies a holistic approach that treats the human body as a whole and not a particular body part. It relies on the concept that every organ of the human body is interconnected with others. The emphasis of TM is on maximizing the body's innate ability to heal itself.

2. TM are personalized or customized medicines encompassing a person's lifestyle, mental state, physical activity, and even spiritual beliefs
3. TM tries to balance several opposing factors of the human body.
4. TM focus on the use of polyherbal preparations whose exact chemical composition is challenging to elucidate.
5. Many of the traditional remedies are field-tested but are not explained well by modern medicine.

Herbal medicine is used to treat many conditions, such as allergies, asthma, eczema, premenstrual syndrome, rheumatoid arthritis, fibromyalgia, migraine, menopausal symptoms, chronic fatigue, irritable bowel

Herbal medicines may produce negative effects that can range from mild to severe, including:

- Allergic reactions and rashes.
- Asthma.
- Headaches.
- Nausea.
- Vomiting.
- Diarrhoea.

III. LIMITATIONS:-

1. Lack of standardization: Unlike conventional medicines, herbal medicines are not regulated in the same way, which can lead to inconsistency in their potency and quality.
2. Adverse effects: Just like any other medicine, herbal medicines can also cause adverse effects. Some herbs can interact with conventional medicines, making them less effective or causing dangerous side effects.
3. **Allergic reactions:** Some people may be allergic to certain herbs, leading to allergic reactions ranging from mild rashes to severe anaphylaxis.
4. **Misidentification of herbs:** In some cases, herbs may be misidentified, leading to the use of the wrong plant or parts of a plant, which can be harmful.
5. **Contamination:** Herbal medicines can be contaminated with heavy metals, pesticides, and other harmful substances, which can cause health problems.
6. **Lack of scientific evidence:** Many herbal medicines have not been scientifically studied, which means there is little evidence of their efficacy, safety, and appropriate dosages.
7. **Misuse and overuse:** Some people may misuse or overuse herbal medicines, leading to health problems or interactions with other medications.

IV. MODERN APPOROCHES TO UNVEILING MECHANISM

A set of TCM network pharmacology methods were created to prioritize disease-associated genes, to predict the target profiles and pharmacological actions of herbal compounds, to reveal drug-gene-disease co-module associations, to screen synergistic multi-compounds from herbal formulae in a high-throughput manner, and to interpret the combinatorial rules and network regulation effects of herbal formulae. The effectiveness of the network-based methods was demonstrated for the discovery of bioactive compounds and for the elucidation of the mechanisms of action of herbal formulae, such as Qing-Luo-Yin and the Liu-Wei-Di-Huang pill. The studies suggest that the TCM network pharmacology approach provides a new research paradigm for translating TCM from an experience-based medicine to an evidence-based medicine system, which will accelerate TCM drug discovery, and also improve current drug discovery strategies.

Chemical and Biological characterization:-

It looks at whether device components, or extracts from a device, have the capacity to cause irritation, damage, or toxicity in an animal system. This method of testing produces data that has been shown to correlate strongly with human biocompatibility

Biological characterization is a process which establishes, maintains, and controls certain biological characteristics inside one defined system. Bioactive compounds may naturally be found in various foods. Most of the bioactive compounds have antioxidant, anticarcinogenic, antiinflammatory, and antimicrobial properties. Therefore, many epidemiologic studies report that some of them also have protective effects on cardiovascular diseases. The majority of isolation procedures still utilize simple extraction procedures with organic solvents of different polarity, water and their mixtures. The methods include maceration, percolation, Soxhlet extraction, ultrasound-assisted extraction and turbo-extraction. Fractionation and purification of phytochemical substances are achieved through application of various chromatographic techniques such as paper chromatography, thin-layer chromatography, gas chromatography, and high-performance liquid chromatogram

- **Alkaloids:** This group is comprised of a wide variety of plants that contain nitrogen-bearing molecules that make them very active. Many of these plants have been used to create well-known drugs used for medicinal purposes. One such example, vincristine, which was derived from the Madagascar periwinkle (Catharanthus roseus), is used to treat some types of cancer. Another example is atropine, which is found in deadly nightshade.
- **Bitters:** This group is comprised of a variety of plants that are lumped together because of their very bitter taste. This bitterness causes stimulation of the salivary glands and digestive organs.As such, bitters can be used to improve appetite and strengthen the digestive system. Examples of bitters include wormwood and hops.
- **Cardiac Glycosides:** These compounds are found in various medicinal plants (Foxglove, Lily of the Valley) and have strong direct action on the heart. Cardiac glycosides such as digitoxin, digoxin, and convallotoxin support heart strength and rates of contraction when failing. These compounds also

have a diuretic effect that stimulates urine production and aids in removal of fluid from tissues and the circulatory system.

- **Cyanogenic Glycosides:** These glycocides are based upon cyanide, a very deadly poison, but in small doses, they can serve as a muscle relaxant. The bark of wild cherry and the leaves of elderberry (Sambucus racemosa) contain cyanogenic glycocides, which can be used to suppress and soothe dry coughs.
- **Volatile oils:** Volatile oils are extracted from plants and are used to produce essential oils that play a very important role in medicinal botany. These oils are often very complex and can be comprised of 100 or more compounds. These oils have many uses. For example, tea tree oil is a strong antiseptic. Resins and gums are often linked with essential oils, however these are not volatile.

V. IN VITRO STUDIES

The prevalence of oral fungal infections has changed dramatically in recent years (Gleiznys et al., 2015). These changes are mainly related to the increase in predisposing factors like immune-compromising situations such as HIV infection, endocrine disorders, using immunosuppressive drugs and prolonged antibiotic therapies, malnourishment, using dentures, etc. (Gleiznys et al., 2015). Candida is considered a natural flora in the human oral cavity but it can cause pathogenic conditions due to Herbal remedies are well-known for their traditional use for their soothing effects. Dentistry practice has benefited a lot from such potentials. A large number of plant products have been introduced to have tangible anti-inflammatory effects. Some researchers have used single-ingredient products and others have utilized complex formulations. Chisandra chinensis and its major lignan Schisandrin C possess anti-inflammatory properties by suppressing Interleukin-1β and Tumor necrosis factor-α

Advantages of in vitro methods

In vitro methods reduce the use of mice at the antibody-production stage (but can use mice as a source of feeder cells when antibody generation is under way).

- In vitro methods are usually the methods of choice for large-scale production by the pharmaceutical industry because of the ease of culture for production, compared with use of animals, and because of economic considerations.
- In vitro methods avoid the need to submit animal protocols to IACUCs.
- In vitro methods avoid or decrease the need for laboratory personnel experienced in animal handling.
- In vitro methods using semipermeable-membrane-based systems produce mAb in concentrations often as high as those found in ascitic fluid and are free of mouse ascitic fluid contaminants.

Disadvantages of in vitro methods

- It should be noted that each of the items below pertains to only a fraction (3–5%) of hybridomas, but they indicate some of the difficulties associated with in vitro methods.
- Some hybridomas do not grow well in culture or are lost in culture.
- In vitro methods generally require the use of FBS, which limits some antibody uses. The use of in vitro methods for mAb production generally requires the use of FBS, which is a concern from the animal-welfare perspective.
- The loss of proper glycosylation of the antibody (in contrast with in vivo production) might make the antibody product unsuitable for in vivo experiments because of increased immunogenicity, reduced binding affinity, changes in biologic functions, or accelerated clearance in vivo.
- In general, batch-culture supernatants contain less mAb (typically 0.002–0.01) per milliliter of medium than the mouse ascites method. Note that semipermeable-membrane-based systems have been developed that can produce concentrations of mAb comparable with concentration.

VI. ANIMAL STUDIES

Regarding the animal studies that are performed to gain additional pharmacokinetic information on important constituents of an herbal medicine, it is pivotal to evaluate interspecies similarities and differences between animals (such as rats) and humans in body exposure, enzyme-mediated metabolism, transporter-mediated. In animal toxicity studies, accessing the "no observed adverse effect level (NOAEL)" is a fundamental process. The NOAEL value indicates the highest dose level not producing a significant increase in adverse effects in the experimental animal. From the NOAEL value, the human equivalent dose (HED) and maximum recommending starting dose (MRSD) can be calculated; these provide core information regarding the safety range and toxic potential of certain clinical doses of drugs, including herbal products (FDA Guidance, 2005).Many animal toxicity studies for herbal plants or herbal formula were conducted to date, however no investigation showing the overview of those data was done yet. This study aimed to characterize the NOAEL and HED values of herbal medicines through a systematic survey of toxicity studies conducted to date worldwide.

VII. OMICS TECHNOLOGIES

Numerous omics studies of medicinal plants have been performed to identify molecular markers of species and functional genes controlling key biological traits, as well as to understand biosynthetic pathways of bioactive metabolites and the regulatory mechanisms of environmental responses. Omics technologies have been widely applied to medicinal plants, including as

taxonomics, transcriptomics, metabolomics, proteomics, genomics, pangenomics, epigenomics and mutagenomics. However, because of the complex biological regulation network, single omics usually fail to explain the specific biological phenomena.

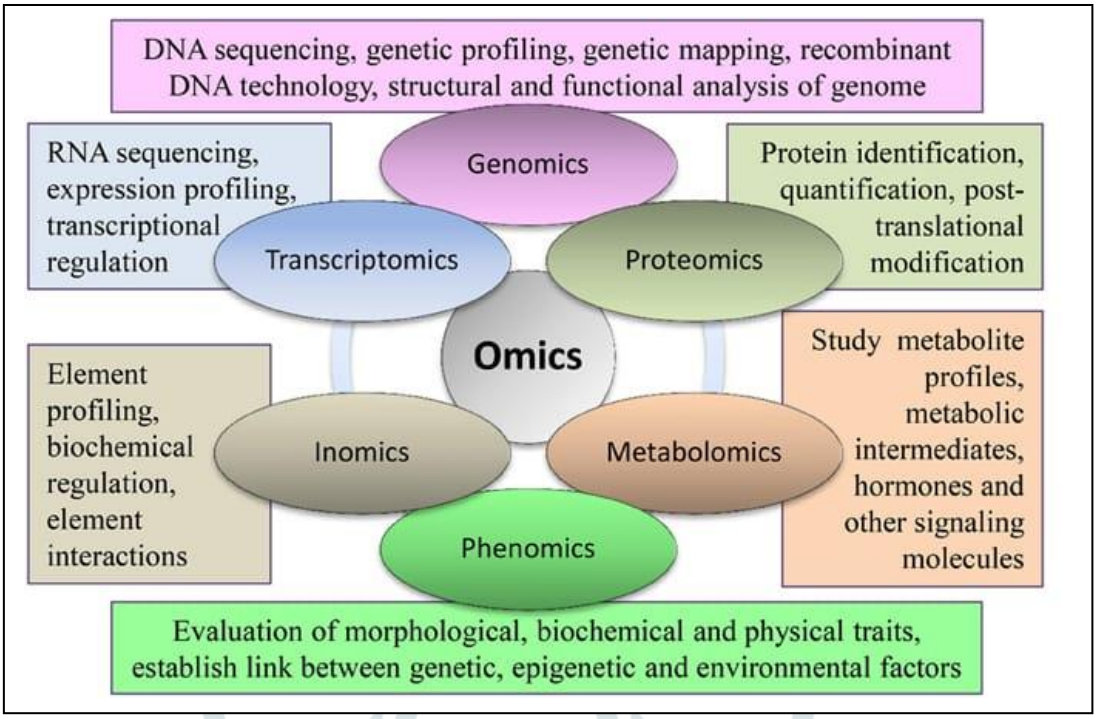

Fig 4 Role of Omics Technologies

Advantages:

Omics technologies produce large-scale datasets with information on genes, proteins, metabolites and/or protein modification by measuring the global, qualitative, and quantitative changes at the molecular, cell, tissue, and individual levels

Disadvantages:

The impact of omics is most apparent in medicine. Sequencing of the human genome, for example, has fueled advances in personalized medicine, in which decisions about disease prevention, diagnosis, and treatment are tailored to patients based on information derived from genetic and genomic research.

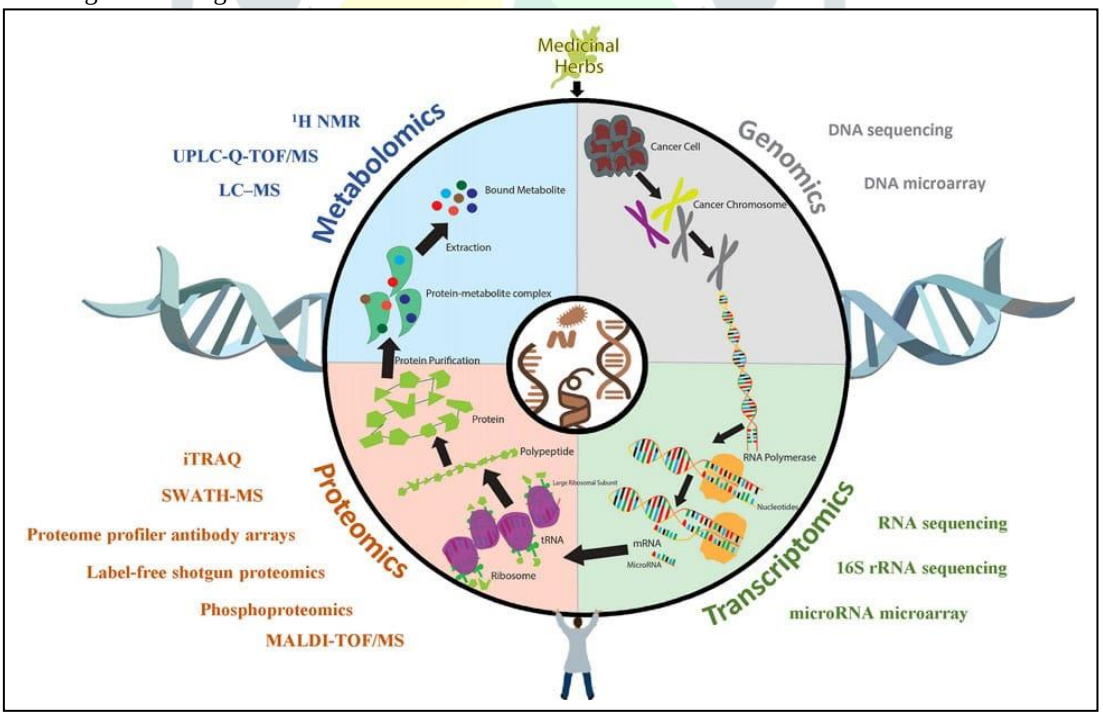

Fig 5 Mechanism of Proteomics Tools in multidisciplinary research

VIII. BIOLOGICAL APPROACHES:-

Vaccines have drastically reduced the mortality and morbidity of many diseases. However, vaccines have historically been developed empirically, and recent development of vaccines against current pandemics such as HIV and malaria has been met with difficulty. The advent of high-throughput technologies, coupled with systems biological methods of data analysis, has enabled researchers to interrogate the entire complement of a variety of molecular components within cells, and characterize the myriad interactions among them in order to model and understand the behavior of the system as a whole. In the context of vaccinology, these tools permit exploration of the molecular mechanisms by which vaccines induce protective immune responses. Here we review the recent advances, challenges, and potential of systems biological approaches in vaccinology. If the challenges facing

this developing field can be overcome, systems vaccinology promises to empower the identification of early predictive signatures of vaccine response, as well as novel and robust correlates of protection from infection. Such discoveries, along with the improved understanding of immune responses to vaccination they impart, will play an instrumental role in development of the next generation of rationally designed vaccines. Synergistic effects are the combined effects of at least two drugs that have a greater influence than either of them could have had individually. It is what happens when chemical substances or biological structures interact, resulting in a larger overall effect than the sum of their separate effects.

IX. SPECIFIC EXAMPLE OF UNVEILANCE MECHANISM:-

Echinacea. Echinacea, or coneflower, is a flowering plant and popular herbal remedy.Ginseng. Ginseng is a medicinal plant whose roots are usually steeped to make a tea or dried to make a powder.Ginkgo biloba.

1. **Turmeric**

Fig 5 Turmeric

Turmeric is a plant that has a very long history of medicinal use, dating back nearly 4000 years. In Southeast Asia, turmeric is used not only as a principal spice but also as a component in religious ceremonies. Because of its brilliant yellow color, turmeric is also known as “Indian saffron.” Modern medicine has begun to recognize its importance, as indicated by the over 3000 publications dealing with turmeric that came out within the last 25 years. This review first discusses in vitro studies with turmeric, followed by animal studies, and finally studies carried out on humans; the safety and efficacy of turmeric are further addressed.

The use of turmeric dates back nearly 4000 years to the Vedic culture in India, where it was used as a culinary spice and had some religious significance. It probably reached China by 700 ad, East Africa by 800 ad, West Africa by 1200 ad, and Jamaica in the eighteenth century. In 1280, Marco Polo described this spice, marveling at a vegetable that exhibited qualities so similar to that of saffron. According to Sanskrit medical treatises and Ayurvedic and Unani systems, turmeric has a long history of medicinal use in South Asia. Susruta’s Ayurvedic Compendium, dating back to 250 bc, recommends an ointment containing turmeric to relieve the effects of poisoned food.

Today, turmeric is widely cultivated in the tropics and goes by different names in different cultures and countries In North India, turmeric is commonly called “haldi,” a word derived from the Sanskrit word haridra, and in the south it is called “manjal,” a word that is frequently used in ancient Tamil literature. The name turmeric derives from the Latin word terra merita (meritorious earth), referring to the color of ground turmeric, which resembles a mineral pigment. It is known as terre merite in French and simply as “yellow root” in many languages. In many cultures, its name is based on the Latin word curcuma. In Sanskrit, turmeric has at least 53 different names, including anestha (not offered for sacrifice or homa), bhadra (auspicious or lucky), bahula (plenty), dhirgharaja (long in appearance), gandhaplashika (which produces good smell), gauri (to make fair), gharshani (to rub), haldi (that draws attention to its bright color), haridra (dear to hari, Lord Krishna), harita (greenish), hemaragi (exhibits golden color), hemaragini (gives the golden color), hridayavilasini

Turmeric is a product of Curcuma longa, a rhizomatous herbaceous perennial plant belonging to the ginger family Zingiberaceae, which is native to tropical South Asia. As many as 133 species of Curcuma have been identified worldwide (Table 13.2). Most of them have common local names and are used for various medicinal formulations. Some specific turmeric species are shown in Figure 13.1. The turmeric plant needs temperatures between 20°C and 30°C and a considerable amount of annual rainfall to thrive. Individual plants grow to a height of 1 m, and have long, oblong leaves. Plants are gathered annually for their rhizomes, and are reseeded from some of those rhizomes in the following season. The rhizome, from which the turmeric is derived, is tuberous, with a rough and segmented skin. The rhizomes mature beneath the foliage in the ground. They are yellowish brown with a dull orange interior. The main rhizome is pointed or tapered at the distal end and measures 2.5–7.0 cm (1–3 inches) in length and 2.5 cm (1 inch) in diameter, with smaller tubers branching off. When the turmeric rhizome is dried, it can be ground to a yellow powder with a bitter, slightly acrid, yet sweet, taste.

Composition:

component of the root is a volatile oil, containing turmerone, and there are other coloring agents called curcuminoids in turmeric. Curcuminoids consist of curcumin demethoxycurcumin, 5’-methoxycurcumin, and dihydrocurcumin, which are found to be natural antioxidants (Ruby et al. 1995; Selvam et al. 1995). In a standard form, turmeric contains moisture (>9%), curcumin (5–6.6%), extraneous matter (<0.5% by weight), mould (<3%), and volatile oils (<3.5%). Volatile oils include d-α-phellandrene, d-sabinene, cinol, borneol, zingiberene, and sesquiterpenes (Ohshiro, Kuroyanag, and Keno 1990). There are a variety of sesquiterpenes, like germacrone; termerone; ar-(+)-, α-, and β-termerones; β-bisabolene; α-curcumene; zingiberene; β-sesquiphellanderene; bisacurone; curcumenone; dehydrocurdione; procurcumadiol; bis-acumol; curcumenol; isoprocurcumenol; epiprocurcumenol; procurcumenol; zedoaronediol; and curlone, many of which are specific for a species.

Consumption and importance of turmeric:-

Turmeric has been put to use as a foodstuff, cosmetic, and medicine. It is widely used as a spice in South Asian and Middle Eastern cooking. It lends curry its distinctive yellow color and flavor. It is used as a coloring agent in cheese, butter, and other foods (Govindarajan 1980; Ammon and Wahl 1991). As a result of Indian influence, turmeric has made its way into Ethiopian cuisine. In South Africa, turmeric is traditionally used to give boiled white rice a golden color. Turmeric is also used in manufactured food products such as canned beverages, dairy products, baked products, ice cream, yellow cakes, yogurt, orange juice, biscuits, popcorn, sweets, cake icings, cereals, sauces, and gelatins. It is a significant ingredient in most commercial curry powders.

Origin, nomenclature, history, cultivation, and processing of turmeric

The use of turmeric dates back nearly 4000 years to the Vedic culture in India, where it was used as a culinary spice and had some religious significance. It probably reached China by 700 ad, East Africa by 800 ad, West Africa by 1200 ad, and Jamaica in the eighteenth century. In 1280, Marco Polo described this spice, marveling at a vegetable that exhibited qualities so similar to that of saffron. According to Sanskrit medical treatises and Ayurvedic and Unani systems, turmeric has a long history of medicinal use in South Asia. Susruta's Ayurvedic Compendium, dating back to 250 bc, recommends an ointment containing turmeric to relieve the effects of poisoned food.Ayurvedic medicine, turmeric is a well-documented treatment for various respiratory conditions (e.g., asthma, bronchial hyperactivity, and allergy), as well as for liver disorders, anorexia, rheumatism, diabetic wounds, runny nose, cough, and sinusitis (Araujo and Leon 2001). In traditional Chinese medicine, it is used to treat diseases associated with abdominal pain (Aggarwal, Ichikawa, and Garodia 2004). From ancient times, as prescribed by Ayurveda, turmeric has been used to treat sprains and swelling (Araujo and Leon 2001). In both Ayurvedic and traditional Chinese medicine, turmeric is considered a bitter digestive and a carminative. Unani practitioners also use turmeric to expel phlegm or kapha, as well as to open blood vessels in order to improve blood circulation. It can be incorporated into foods, including rice and bean dishes, to improve digestion and reduce gas and bloating. It is a cholagogue, stimulating bile production in the liver and encouraging excretion of bile via the gallbladder, which improves the body's ability to digest fats. Sometimes, turmeric mixed with milk or water is taken to treat intestinal disorders as well as colds and sore throats.

From traditional medicine to modern medicine

Although modern medicine has been routinely used in treatment of various diseases, it is less than 100 years old. Traditional medicine, in comparison, has served mankind for thousands of years, is quite safe and effective. The mechanism or the scientific basis of traditional medicine, however, is less well understood.

In Vitro Studies with Turmeric

Throughout the Orient, turmeric is traditionally used for both prevention and therapy of diseases. Modern in vitro studies reveal that turmeric is a potent antioxidant, anti-inflammatory, antimutagenic, antimicrobial, and anticancer agent (Table 13.3). Turmeric, used in cooking and in home remedies, has significant antioxidant abilities at different levels of action. Studies indicate that sufficient levels of turmeric may be consumed from curries in vivo to ensure adequate antioxidant protection. (Tilak et al. 2004). As an antioxidant, turmeric extracts can scavenge free radicals, increase antioxidant enzymes, and inhibit lipid peroxidation. Turmeric (100 μg/mL) inhibits lipid peroxidation in renal cells against hydrogen peroxide-induced injury when incubated with cells for 3 hours (Cohly et al. 1998). Using Salmonella typhimurium strains TA 100 and TA 1535, a mutagenicity study showed that turmeric inhibits the mutagenicity produced by direct-acting mutagens such as N-methyl N'-nitro-N-nitrosoguanidine and sodium azide. Turmeric extracts were found to inhibit microsomal activation-dependent mutagenicity of 2-acetamidofluorene.

In Vivo Studies with Turmeric

Both the preventive and therapeutic effects of turmeric have been examined in animal models (Table 13.4). These studies report that this yellow spice exhibits anticancer (Azuine and Bhide 1994; Deshpande, Ingle, and Maru 1997; Garg, Ingle, and Maru 2008), hepatoprotective (Miyakoshi et al. 2004), cardioprotective (Mohanty, Arya, and Gupta 2006), hypoglycemic (Kuroda et al. 2005; Honda et al. 2006), and antiarthritic properties

Turmeric has medicinal properties due to its bioactive components. One of the important components of turmeric is its volatile oil. The role of turmeric oil in in vitro animals and in human is shown in Table 13.6. Turmeric oil inhibits Trichophyton-induced dermatophytosis in guinea pigs. Apisariyakul, Vanittanakom, and Buddhasukh (1995) showed that 15 different isolates of dermatophytes are inhibited by turmeric oil at dilutions of 1:40 to 1:320. Interestingly, none of the dermatophyte isolates was inhibited by curcumin. Studies of the antiviral effects of the zedoary turmeric oil spray in the respiratory tract showed that whereas influenza virus, parainfluenza viruses I and III, respiratory syncytial virus, and adenoviruses 3 and 7 were inhibited slightly, parainfluenza virus II was significantly inhibited by this turmeric compound (Huang et al. 2007). Curcuma oil ameliorated the ischemia-induced neurological functional deficits and the infarct and edema volumes in rats.

Safety, efficacy, and contraindications

The use of turmeric as a spice and as a household remedy has been known to be safe for centuries. To date, no studies in either animals or humans have discovered any toxic effects associated with the use of turmeric (Lao et al. 2006), and it is clear that turmeric is not toxic even at very high doses. The U.S. Food and Drug Administration (FDA) has conducted its own clinical trials with turmeric and published a 300-page monograph. The FDA has declared turmeric and its active component curcumin as GRAS (generally regarded as safe). Thus, in the United States, turmeric and its components are currently being used in mustard, cereals, chips, cheese, butter, and other products. In a phase I clinical study on the safety and tolerance of turmeric oil use, the oil was administered orally to healthy volunteers for 3 months. No side effects of turmeric oil intake were observed in 3 months on body weight, blood pressure, and hematological, renal, or hepatic toxicity

X. CONCLUSIONS:-

The beneficial effects of turmeric are traditionally achieved through dietary consumption, even at low levels, over long periods of time. A precise understanding of effective dose, safety, and mechanism of action is required for the rational use of turmeric in the treatment of human diseases.

Turmeric's effect on mood disorders, depression and dementia have also been explored, but studies are small, so more research will reveal if there is a benefit." In addition to these conditions, research studies have shown some possible benefits of turmeric for: Inflammation. Degenerative eye conditions.

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