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MATERIA MEDICA OF TRADITIONAL KNOWLEDGE: FROM EAST TO WEST AND BEYOND

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ABSTRACT

Traditional knowledge is the accumulative knowledge that has been passed on since the beginning of time. It was recorded in various forms and formally in *materia medica*. Each ancient civilisations possessed its own *materia medica*; from east, Ancient China has Traditional Chinese Medicine, the Indians, their Ayurveda while the Greeks, Greek Medicine and several others. Both similarities and differences in *materia medica* are information which becomes valuable source in drug discovery. In combination with advanced and sophisticated tools, drug discovery programme aims to produce the wonder drugs for the betterment of humankind. However, in search of the magic bullet, we should not let haste and greed allow us to disregard *materia medica* as our heritage to be passed on.

Keywords: Traditional knowledge; *materia medica*; drug discovery

ABSTRAK

Pengetahuan tradisional ialah pengetahuan yang telah dikumpul secara turun-temurun. Ianya telah direkodkan di dalam pelbagai bentuk dan secara formal, iaitu *materia medica*. Setiap tamadun memiliki *materia medica* yang tersendiri; dari timur, China Lama mempunyai Perubatan Tradisi China, India dengan Ayurveda, manakala Greek dengan Perubatan Greek dan yang lain-lain lagi. Kedua-dua perbezaan dan persamaan adalah maklumat yang menjadi sumber yang bernilai di dalam penemuan ubatan. Digabungkan bersama peralatan yang terkini dan canggih, program penemuan ubatan bertujuan untuk menghasilkan ubatan yang ajaib bagi kesejahteraan manusia sejagat. Namun begitu, kita tidak sepatutnya membenarkan kegesaan dan ketamakan mengabui bahawa *materia medica* adalah warisan kita yang perlu diturunkan.

Kata kunci: Pengetahuan tradisional; *materia medica*; penemuan ubatan

1. The Initiation of Traditional Knowledge

Nature provides diverse resources; the greens, the soils, the waters, the air and the fire. Therefore, very often human turned to Nature to fulfil their needs. Human, being intelligent creature, has experimented with plants and find them to be very beneficial. It is impossible to pinpoint a particular plant or tree or herb for study without having some sort of guidance so that the research would produce substantially significant new information to be contributed to the body of knowledge. It is very much serendipitous when a researcher stumbles upon something big out of nothing. Therefore, it is very important to research a plant based on ancient report or scientific report. It is interesting to notice that all these *materia medica* do contain similar plants, for similar treatment with similar application. There are many families of plants which are considered to be medicinal. To be of medicinal value, certain criteria have to be considered, such as safety and efficacy. It is a frightening thought to understand the elders' concept of confidentially testing on human, however, that was what happened in those days. In these modern days, human testing, or clinical trials, will only be carried out when a drug has gone through rigorous testing, fully equipped with sophisticated technology.

2. *Materia Medica* of Ancient Civilisations

Materia medica is a Latin medical term referring to the cumulative knowledge which concerns with therapeutical properties of natural substances used for healing by physicians of ancient periods. The term was derived from the title of Dioscorides's work, *De materia medica libere* (Clark, 1996). The passing on of this knowledge from generation to the next generation through word of mouth or/and in written form is important for past generations so that the new generations will safeguard these well kept secrets. No one can determine exactly which ancient civilization started to document this medicinal knowledge in written form, since evidence from Assyrian, China and Egypt came from the same era of 2700-2600 B.C. The very existence of these preserved records indicated the importance of these age-old experiences (Dias, Urban, & Roessner, 2012).

The records of treatment practices of past cultures are collections of trials which had been accumulating based on beliefs and theories unique to the groups. The main purpose of these trials was to find solutions to problems regarding bodily conditions in order to maintain good health and relieve pain and sickness. The treatment practices varies according to what were convenient to these civilized communities, to be precise, what the surroundings offer. However, the similarities in their philosophies are astounding, that it is not a surprise to find in the *materia medica* of the ancient civilizations, mentions of same plants' use in the their treatments (Vogel, 1991). These *materia medica* belong to traditional medicine systems of; Traditional Chinese Medicine (TCM), which is probably the most practised in the world, Ayurveda or Indian Traditional Medicine, which is arguably one of the oldest TM, European Traditional Medicine (ETM), which dates back to Egyptian period and spread to North and South America, Arab Traditional medicine (ATM), or Unani Medicine, which was formerly influenced by Greek Medicine and Ayurveda but later when Islam came, became Islamic (Saad, Azaizeh, & Said, 2005).

2.1. *Traditional Chinese medicine*

TCM system consists of Chinese herbal medicine, acupuncture, Chinese massage (tui na) mind/body exercise, cupping, qigong, moxibustion and dietary therapy (Cheung, 2011). In TCM, a healthy human body is one that is in equilibrium in terms of its *qi* (energy) and *yin-yang* (balance). The practice has a history that is more than 4000 years of evidence-based analysis which can be read in the story of Shen-nong in *Shen Nong Ben Cao Jing* (Shen Nong Emperor's Classic of Materia Medica, c. 25 –220 AD) where, it was told that he used to taste up to 70 kinds of plants in a day for their efficacy and safety. The book is one of the most important *materia medica* for TCM, listing some 365 preparations using 252 herbs. Other earlier *materia medica* would be 'Prescriptions for Fifty-two Diseases', compiled around 300 B.C. which recorded 150 drug formula prepared from 247 agents and 'The Yellow Emperor's Canon of Internal Medicine' dated as far back as 2698 B.C. during the reign of *Huangdi*, the Yellow Emperor (Jia, n.d.; Kong, Li, & Zhang, 2009). During the Ming-Qing dynasties (1368–1911), herbal medicine thrived and Li Shizhen's *Ben cao gang mu* (Compendium of Materia Medica) was the most influential work, in which it described 1892 kinds of drugs in 62 categories (Jingfeng & Yan, 2003).



Figure 1: A TCM medical hall (Personal image)

Zhong yao (Chinese herbal medicine) is the integral part of TCM. It is categorised by nature, flavour and function. The category of nature is further classified as cold, cool, hot and warm while flavour is differentiated into pungent, sweet, sour, bitter and salty. In the function classification, it is broken down to heat-clearing, expectoration and antitussive action, dampness elimination and interior warming. An herbal prescription is supposed to act synergistically in treating the illness diagnosed (Lao, Xu, & Xu, 2012).

TCM is now very much practised by the Chinese and non-Chinese and has been adapted into other TM (Anonymous, 2001).

2.2. *Ayurveda and Siddha, the Indian traditional medicine*

The Indians practically have 3 TMs in provision for their health care, the Ayurveda, Siddha and Unani, which can be differentiated by their religious practices. However, Ayurveda has been in the mainstream since the beginning of ancient Indian. Ayurveda has been around since 6000 B.C. when Lord Brahma orally described the basic principles of Ayurveda to Dhanvantari, the incarnation of Krishna and Lord of Ayurveda. The earliest transcriptions are known as Vedas; *Rigveda*, *Samaveda*, *Yajurveda* and *Atharveda*, the oldest, most sacred compendium of books of Hindu religion and were written in Sanskrit. Hence, Ayurveda means *knowledge of life* (Raju, 2003). Since then, Ayurveda expanded with additional principles by dedicated sages, the foremost would be Sushruta (Varanasi, India, c. est. 800-600 B.C.) and Charaka (c. est. 1000 B.C.) (Patwardhan & Mashelkar, 2009). These disciples conveyed the holistic approach in living in *Sushruta Samhita* and *Charaka Samhita* dated 700 B.C. and several other medical texts (Mukherjee & Wahile, 2006). Both *Sushruta* and *Charaka Samhita* are the main texts for Ayurveda, focusing on therapeutic concepts and practices and listing up to 700 and 400 kinds of plants respectively for use in curing and treating (Dwivedi & Dwivedi, 2007). These Vedas and Samhitas, which were originally written on palm leaves, emphasise on plant-based treatments, hygiene and balance in the body's state of being, in addition to making preparations of plants mixtures for curing illnesses (Anonymous, 2010).

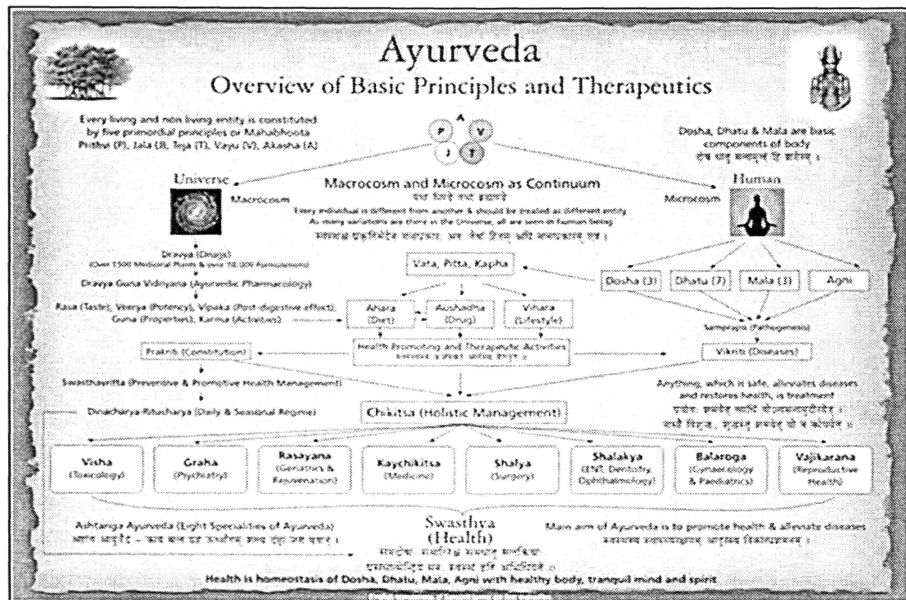


Figure 2: The basic principle of Ayurveda (Patwardhan & Mashelkar, 2009)

Ayurveda is popularly practised by the North Indians, while Siddha is more acceptable by the South Indians. Similar to Ayurveda, Siddha is believed to be one of the oldest medical systems in the world and has been around since time immemorial. The meaning of Siddha, which is in Tamil, is perfection of heavenly bliss, referring to the 18 Siddhars, who are greatly revered. It started with Sage Agathiyar, the Guru of all Siddhars, when he received the teaching from Lord Muruga, son of Lord Shiva, the Hindu Lord, who was taught by his mother, Goddess Parvathi. It is believed that Siddhars were spiritual sages who had achieved *Ashtamahasiddhi* (eight supernatural powers). Thus, in Siddha, the fundamental concept is to attain healthy soul though a healthy body. Teachings of Siddha were written on palm leaves which were kept safe in temples and can still be found in the keepings of Siddha families (Wilson, Rajamanickam, Vyas, Agarwal, & Dubey, 2007).

Both Ayurveda and Siddha are recognised in India and its neighbouring *countries*, up to South Asian countries such as Bangladesh, Sri Lanka, Nepal and Pakistan with modifications to suit their needs and practicality means (Anonymous, 2001).

2.3. European traditional medicine

European Traditional Medicine has the affluence of many ancient civilisations; Egyptian, Babylonia-Assyrian, Greek, Roman and very much later Arab. In the beginning, medicine is shrouded with religious ideology, where sickness and pain were attributed to sins and treatments were often in the form of repentance. In 2000 B.C., after inventing cuneiform writing, upon instruction by King Assurbanipal, the Sumerians kept clay tablets which recorded uses of about 250 plants and 120 minerals as drugs (Biggs, 2005). Around the same period of time, Egypt had also developed their own writing and Imhotep, the royal physician was known for his prowess. In 1500 B.C., they produced *Ebers*, the 20 m long papyrus roll, which contained over 800 formulations for various treatments using 700 drugs consists of plants, animals and minerals (Vogel, 1991).

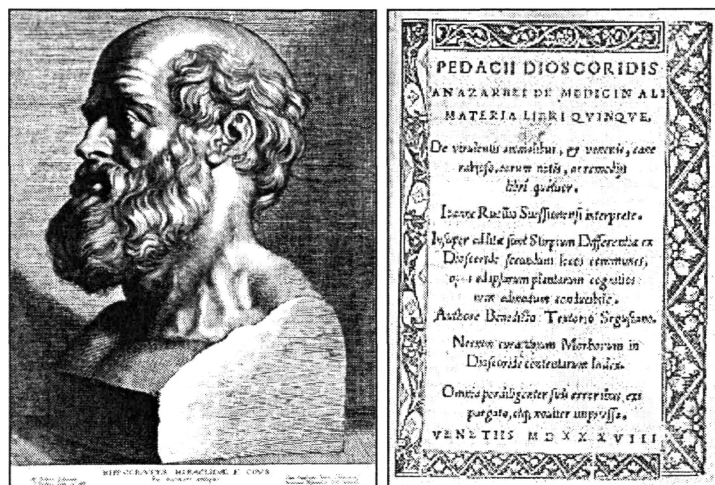


Figure 3: Hippocrates (left) and Dioscorides's *De materia medica* (right)
(Public domain image)

Even though surrounded with mythical figures, ancient Greece is considered the birthplace of modern scientific medicine. In fact, Hippocrates (Kos, Greece, c. 460–370 B.C.), the father of medicine, was trained in Asclepieion of Cos, a temple named after Asclepius, a doctor-demigod of the Greek. At the peak of his time, around 400 B.C., Hippocrates had placed fundamental principles of medicine which are practiced until today; observation, experience and rationalism. One of many of his notable contributions to Greek Medicine, is *Hippocratic Corpus*, which contained between 200–400 plant originated drugs (Kanellou, 2004).

However, the basis for modern European Traditional Medicine is *De Materia Medica*, authored by a Greek physician, pharmacologist, botanist, and Roman army surgeon, Pedanius Dioscorides (Anazarbus, Turkey, c. 40–90 A.D.), during the first century A.D. He had described the uses and actions of some 600 substances, based on empirical observation. His work on European herbal medicine eclipsed that of the Hippocratic Corpus (De Vos, 2010). In the second century A.D., Galen (Bergama, Turkey, c. 130–200 A.D.), who was inspired by Hippocrates, became famous for prescribing herbal remedies. It seemed that what Hippocrates had started, Galen of Pergamon continued and expanded (Nutton, 1984).

2.4. Unani/Arab/Islamic medicine

Unani Medicine is widely practise in the Middle-East of Asia and its neighbouring countries including North India. Unani comes from the Greek word *Ionian*, a place name given to a Greek coastal region of Anatolia. Apparently, Unani has its roots in Greek and Iranian Medicine, thus, also known as Graeco-Arabic Medicine. It is an extension of Buqrat (Hippocrates) and Jalinoos (Galen) with expansions and elaborations from Al-Razi (Rayy, Iran, c. 865–925 A.D.), Ibnu Sina (Bukhara, Uzbekistan, c. 980–1037 A.D.), Al-Zahrawi (Medina Azahara, Spain, c. 936–1013 A.D.) and Ibnu Nafis (Damascus, Syria, c. 1213–1288 A.D.) (Lone et al., 2012). Additional influences from CTM and Ayurveda are also present due to travelling and trading activities where, The Silk Road had the Arabs, Chinese and Indians exchanging trades, knowledge, religion and culture (Pormann & Savage-Smith, 2007; Juping, 2009).



Figure 4: Ibnu Sina (left) and his book, *Kitab Al-Qanun Fil Al-tib* (right).
(Public domain image)

The Arabian medicine reached its peak when Islamic empire began shaping after Prophet Muhammad p.b.u.h. united the warring tribes of Arabia in 622 A.D. In Islam, the general belief was that for every malady Allah had appointed an appropriate remedy (Shanks & Al-Kalai, 1984). During the Islamic golden era (c. 750-1258 A.D.), Al-Razi himself had compiled in his volumes of medicinal practices and observations, *Al-Hawi*, 829 drugs (Nagamia, 2003). But, in 1025 A.D., Ibnu Sina or otherwise known in his Latinised name as Avicenna, wrote his greatest compilation books, *Kitab al-qanun fil al-tibb* (Canon of Medicine), which consisted of 5 volumes, where the second book discussed the medical substances and the properties, arranged alphabetically. In the volume, he had listed 7 rules when studying a drug of natural source; stability, efficacy, mode of action, potency, effective time, standardisation and safety of drugs (Nasser, Tibi, & Savage-Smith, 2009).

Then, Ibn al-Baytar (Malaga, Spain, c. 1197-1248) wrote *Kitab al-jami fi-mufradat al-adwiya wa al-aghdhiya* (The Comprehensive Book on Materia Medica and Foodstuffs', a pharmacopoeia which alphabetically listed over 1400 simples (Falagas, Zarkadoulia, & Samonis, 2006).

2.5. Other TM and folk medicine

Beside the abovementioned TM systems, other countries are either practising folk medicine or adaptation of TCM, Ayurveda, Greek or Unani Medicine or combination of all these TMs. In Asia, in particular, the countries that are one way or another connected to China or India, either its neighbouring countries such as Japan and Korea, Sri Lanka and Bangladesh, or historically linked for example Indonesia, Malaysia and Vietnam or Thailand, even though they may seem to have their own traditional medicine system, often the case is their medicinal systems are synthesis of the older TMs (Cheung, 2011). This is very true in the case of Traditional Korean Medicine, which contain elements of TCM (Baker, 2003; Cha, 1978) and Japan *Kampo*. Japan *Kampo* is herbal medicine of TCM, which was imported to Japan from mainland China in the 14th century, comprising of an idiosyncratic diagnostic system called *syuu* and a treatment regimen known as *houzai* (Matsumoto, Inoue, & Kajii, 1999).

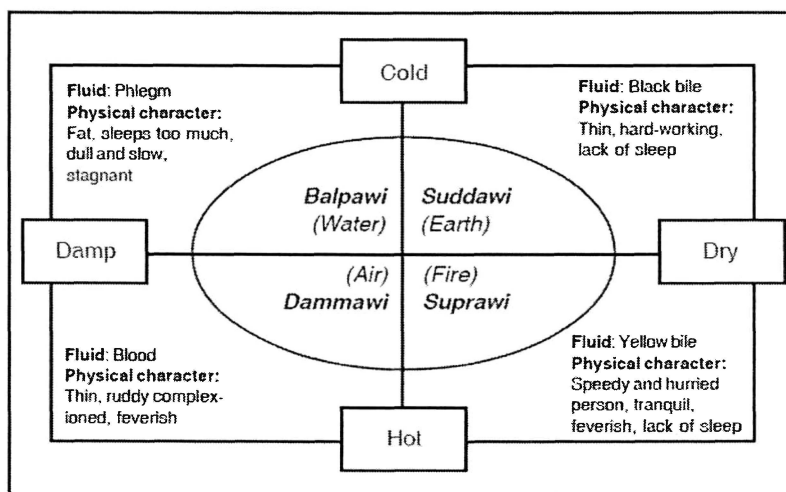


Figure 5: Principle of Malay TM based on Greek medicine (Jamal, 2006)

Under the influence of Unani and Greek Medicine, in the TM of Malay, a person is characterised by his *suprawi* (fire), *suddawi* (earth), *dammawi* (wind) and *balpawi* (water). If he is sickly, he will be treated using natural resources mainly plants accompanied with chants, prayer, massage and *pantang* (abstinence). The *Materia medica* of Malaysia were thought to be written in the 1880's in traditional Jawi due to the influence of Islam, by the learned Malay; *Mujarabat Melayu*, *Tajul Muluk*, *Tajus as Salatin* and *Surat Tib Ubat* (Jamal, 2006). Eventually, the content of one of such text was revealed to J.D. Gimlett, which he later translated with I.H. Burkill providing botanical information, who was then the Director of Singapore Botanic Garden. They published the translated version in 1930 as, "The Medical Book of Malayan Medicine", acknowledging Munshi Abdullah who wrote it in 1860. This led Burkill to compile other publications on ethnobotanical records which subsequently resulting in him publishing an important book which is still being referred to up until now, "Dictionary of Economic Product of the Malay Peninsula" (Mat-Salleh, Latiff, & Nazre, 2000).

Another TM worth mentioning is, Traditional Tibetan Medicine, which is based on the teachings of Sakyamuni Buddha who had lived as a Brahmin prince in India about 2500 years ago. His oral teachings were transcribed into the Oral Tradition Tantra or *bDud-rtzi Snying-po Yan-lag brGyad-pa gSan-ba Man-ngag gi rGyud-bzhi* (The Four Secret Oral Tantras on the Eight Branches of the Essence of Nectar), shortly known as the *rGyud-bzhi*. The text has become the main text and is still used today. However, elements of TCM, Ayurveda, Unani, and some folk medicine from Siberia and Mongolia are evidently present (Steiner, 2003).

In order to differentiate TMs, ancient TMs such as Ayurveda is categorised as codified medical systems for their uniqueness of concept, and other less known TMs as folk medicine. The folk knowledge traditions are more diverse, lacking in formal documentation, more specialised and practical (Payyappallimana, 2009). These are also known as indigenous medicine as African TM (Janzen & Green, 2003), South American TM (Alves, 2009; Cosenza, Somavilla, Fagg, & Brandão, 2013), ethno medicine or bush medicine as Australian Aborigine TM (Devanesen & Maher, 2003), Indonesian *Jamu* (Soedarsono & Sangat-Roemantyo, 2002), or folk medicine such as Thai TM (Brun, 2003).

3. *Materia Medica* as Information Source in Drug Discovery Programme

Drug discovery programme has always been a time consuming process. In a bid to place practicality and cost in perspective, traditional approach has been abandoned in favour of faster

and better methodologies. Innovations have been carried out in the area of efficient isolation, rapid but accurate identification, natural product-like synthesis strategies and HTS bioassays (Balunas & Kinghorn, 2005). Furthermore, the basis of drug discovery which has been 'one drug for one disease' has failed to improve the quality of human's life especially in cancer therapy scenario. In view of plants' multiple effects, drug discovery strategy shifted towards identifying and discovering synergistic drugs which would manipulate biological interactions optimistically (Newman, 2013).

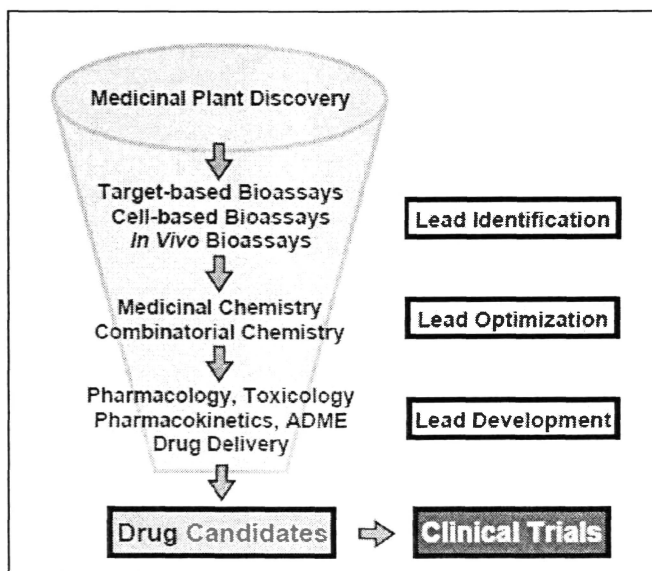


Figure 6: The strategy for biological-activity directed fractionation isolation (BDFI) (Balunas & Kinghorn, 2005)

Currently, in drug discovery programmes of large pharmaceutical companies, the discovery of any medicinal plant which has been identified as potential candidate for lead compound discovery would undergo stages of; identification, optimisation and development before being introduced as drug candidates for clinical trials (Dias et al., 2012).

The advancement of hyphenated techniques have further expanded their analytical applications (Cuthbertson et al., 2013). Consequently, natural products study has expanded into dereplication, online partial identification of compounds, chemical fingerprinting and metabolomic studies (Sarker & Nahar, 2012). These procedures that were once considered unachievable have now become a regular routine (Steinmann & Ganzera, 2011). In China, these kind of studies are well underway and particularly boosting their knowledge and knowhow of TCM (Wu et al., 2013). In Malaysia as well, these techniques are increasingly being applied (Chua et al., 2011).

Total synthesis of natural products has become the answer to solving problems which hinder the progress of certain potential secondary metabolites. Synthesis not only provide sufficient amount of pure compounds for further studies, in fact commercialisation of a drug would depend on the feasibility of its synthesis (Cragg & Newman, 2013). As stated by Professor K.C. Nicolaou of Rice University, Houston, Texas, one of the chemists responsible for the total synthesis of taxol, total synthesis has moved in leaps and bounds throughout the 20th century due to its very significant contributions in drug discovery and development programme (Nicolaou, Vourloumis, Winssinger, & Baran, 2000). In a nutshell, organic synthesis would help in the development of new synthetic technologies in the establishments of total synthesis of natural products and actualisations of mechanism of action for potent biomolecules, hence,

provide advanced materials and technologies for various fields in drug discovery and material science (Figure 7).

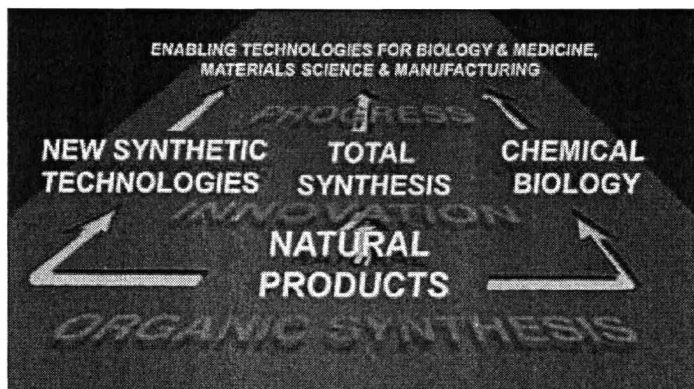


Figure 7: Natural products synthesis
(Nicolaou, Sorensen, & Winssinger, 1998)

4. Sustaining Traditional Knowledge

We have started small and progressed positively. We would like to achieve bigger accomplishments in order to fully utilise our natural resources. Even though, we know the process is long and tedious, we appreciate the satisfaction of acquiring something valuable yet priceless, which has originated from the accumulation of our forefathers' knowledge.

Therefore, human interest in harvesting these potentials is only rationale since the effectiveness of the use of plants in curing human's illnesses and diseases had been reported since the beginning of Man. However, scientific research is required so as to prove its safety and efficacy. On the other hand, these knowledge and experience pooled over time should be respected and guarded.

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