Botanicals for human nutrition and health:
from the Nagoya protocol
to the international cooperation,
the 13th of July 2015, Milano

USE OF BOTANICALS IN AYURVEDIC TRADITION AND THE NEED FOR ORGANIC HERBICULTURE

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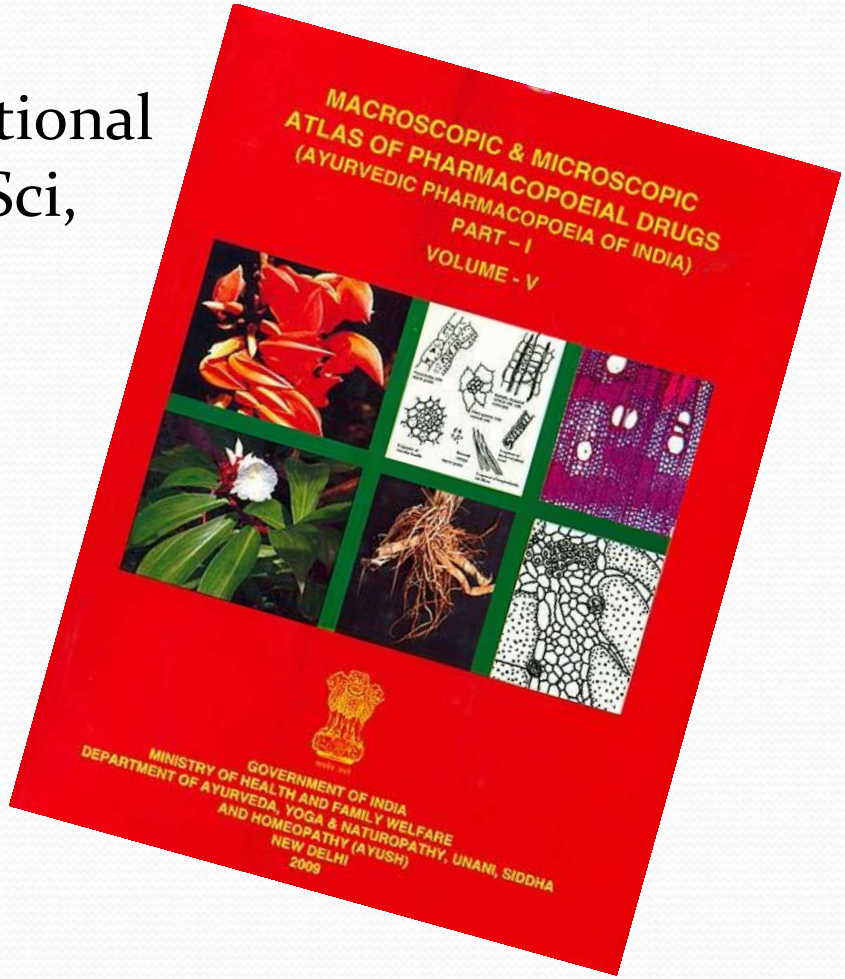
**** International Institute of Herbal Medicine, Lucknow, India**

India-vast repository of medicinal plants used in traditional medicine

- 15.000-17.000 plants recorded
- 7000-7500 plants used in traditional communities (Dev S, Current Sci, 1997, 73: 909)
- 540 plants -Ayurvedic Pharmacopoea of India (8 vol)

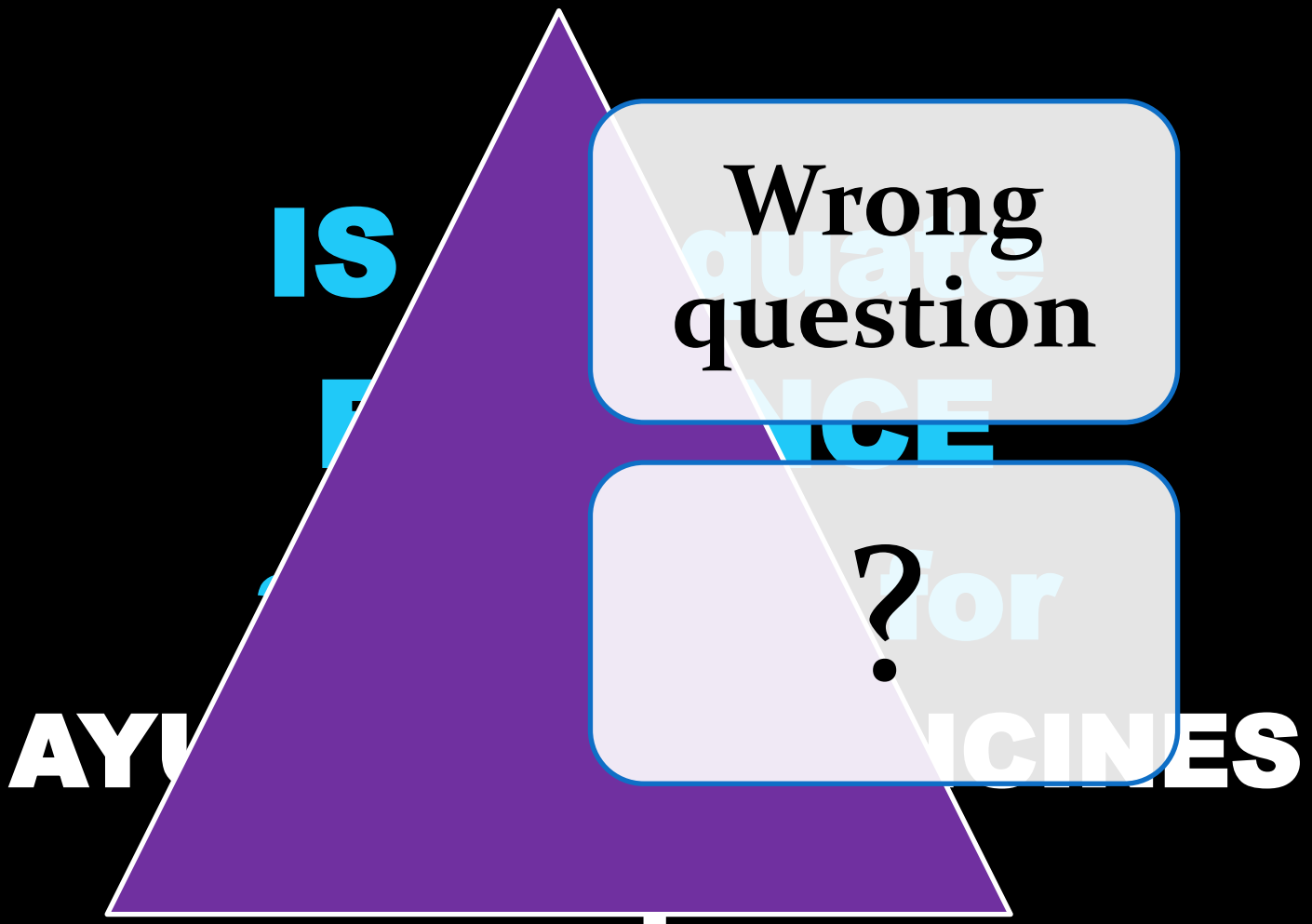


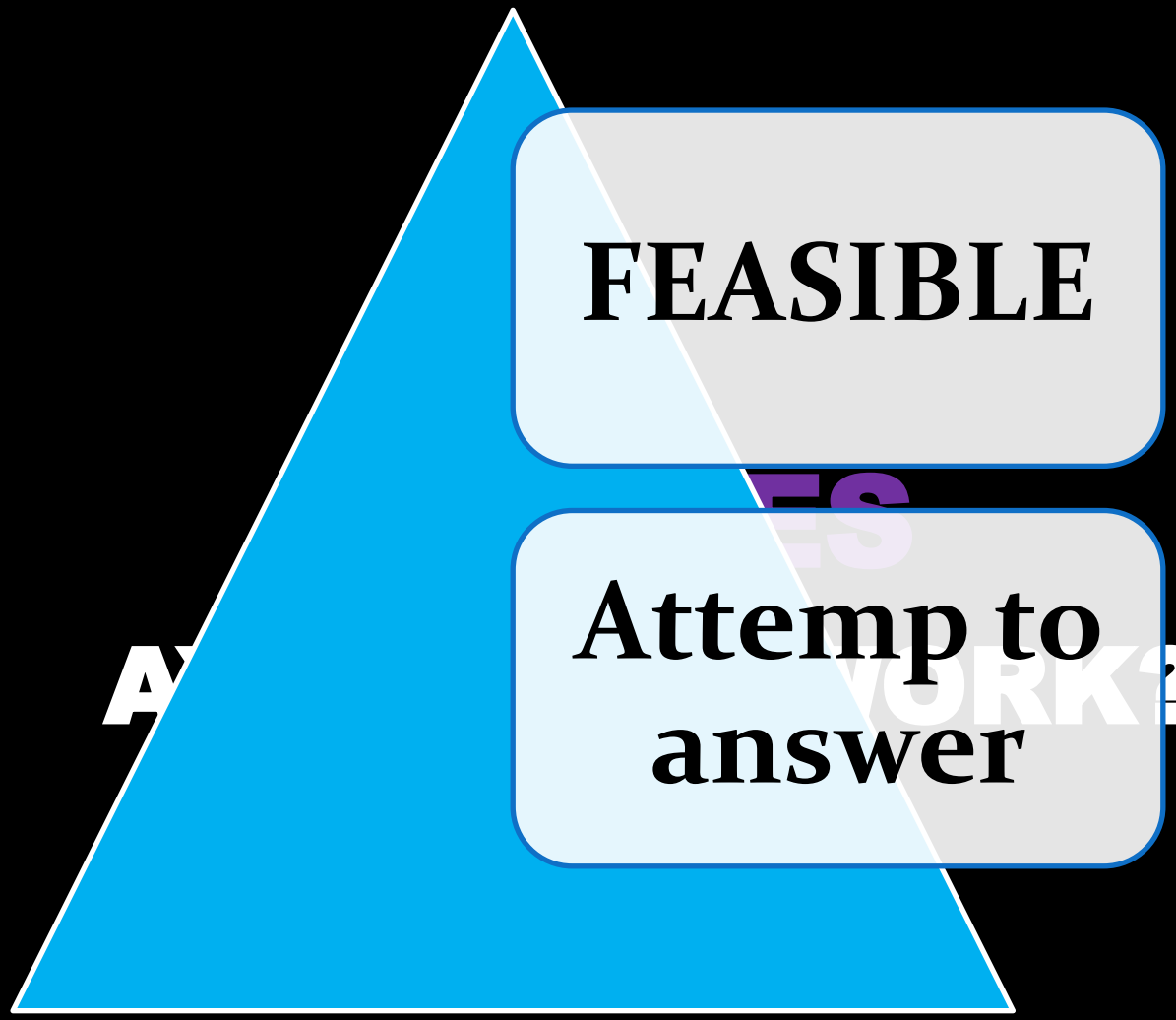
AYURVEDA
or “in pursuit of life knowledge”

AYUS + **VEDA**

(Life) **(Knowledge)**

based on **Atharva veda**, one of 4 vedas (1500-2000 BC)


IS
AYU
Wrong question
?


FEASIBLE
Attemp to answer

Force fitting methodologies that are ill-suited to Ayurveda

(Manohar P.R., Ancient Sci Life 2014;33:195-7)

“Reverse pharmacology“ or "bed to benchside“ approach

Patwartdhan et al, Indian J Exp Biol 2010;48:220-7

- Foundation of reverse pharmacology

Sir Ram Nath Chopra (1882-1973)

Gananath Sen (1877–1945)

- starting with clinical studies that eventually culminates in laboratory studies
- more suitable to Ayurveda

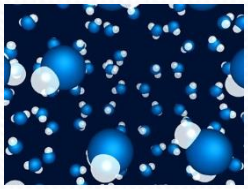
- *Example: Rauwolfia serpentina*

alkaloids

“Reverse pharmacology“

Aggarwal et al, Curr Drug Targets, 2011; 12(11): 1595-653.

Conventional approach

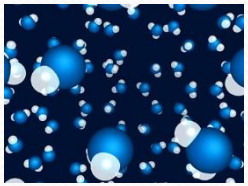


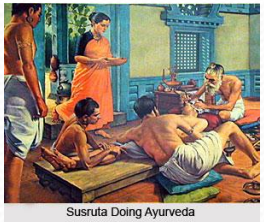
Molecule → Mice → Man

reversing the classical laboratory to clinic practice
to a clinic to laboratory pathway

Molecule or phytocomplex ? ← Mice ← Man

Reverse approach



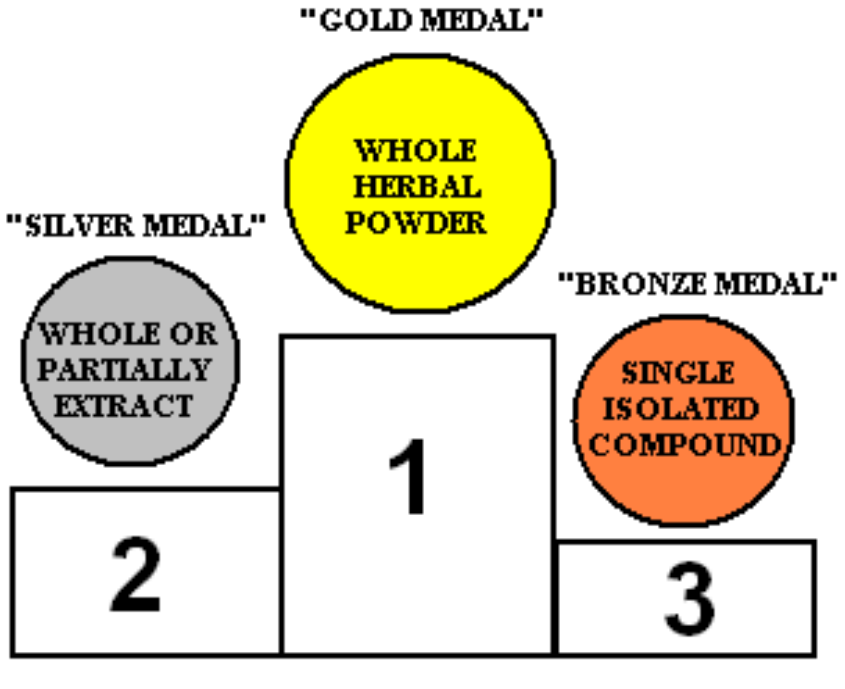

Susruta Doing Ayurveda

Drugs obtained by the reverse pharmacology path

- **Sarpagandha** ***(Rauwolfia serpentina)*****:** alkaloids as antihypertensives
- **Bakuci** ***(Psoralea corylifolia)***: psoralen as skin sensitizer agent in vitiligo
- **Guggul** (***Commiphora mukul***): guggulsterons as hypolipidemic agents
- **Pippali** (***Piperum longum***): piperines as bioavailability enhancers
- **Turmeric** (***Curcuma longa***): curcumines as antiinflammatory agents

Phytocomplex vs. isolated compound
- new paradigm -

- Multiple hits better than single hit (Csemerly, 2005)
- Slight pharmacological effect less harmful than strong one (Csemerly, 2005)
- Partial “perturbations” on a pharmacological network, that mimic physiological scenarios (Spelman, 2006)

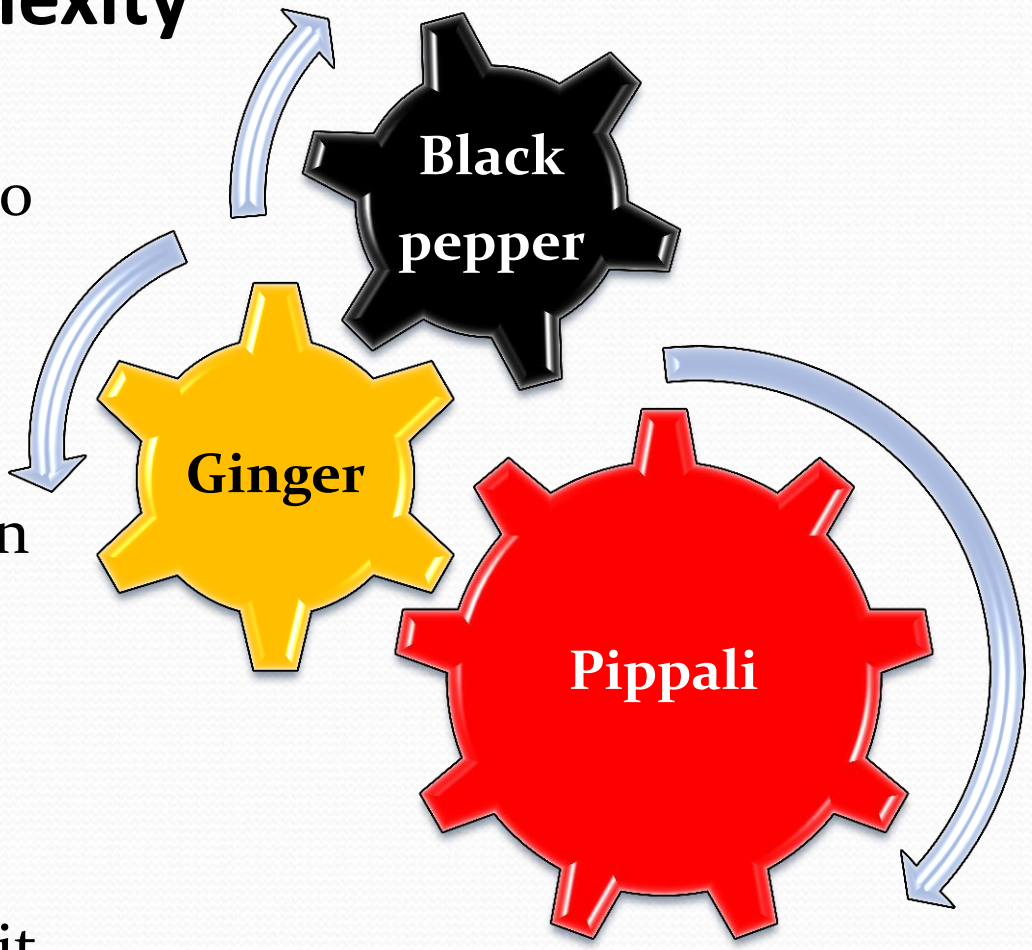


● *Csermely P. et al.: The efficiency of multi-target drugs: the network approach might help drug design, trends , Pharmacol Sci, 26:178-182, 2005*

● *Spelman K. et al.: Modulation of cytokine expression by traditional medicines: a review of herbal immunomodulators, Altern Med Rev, 11(2):128-150, 2006*

The challenge of complexity

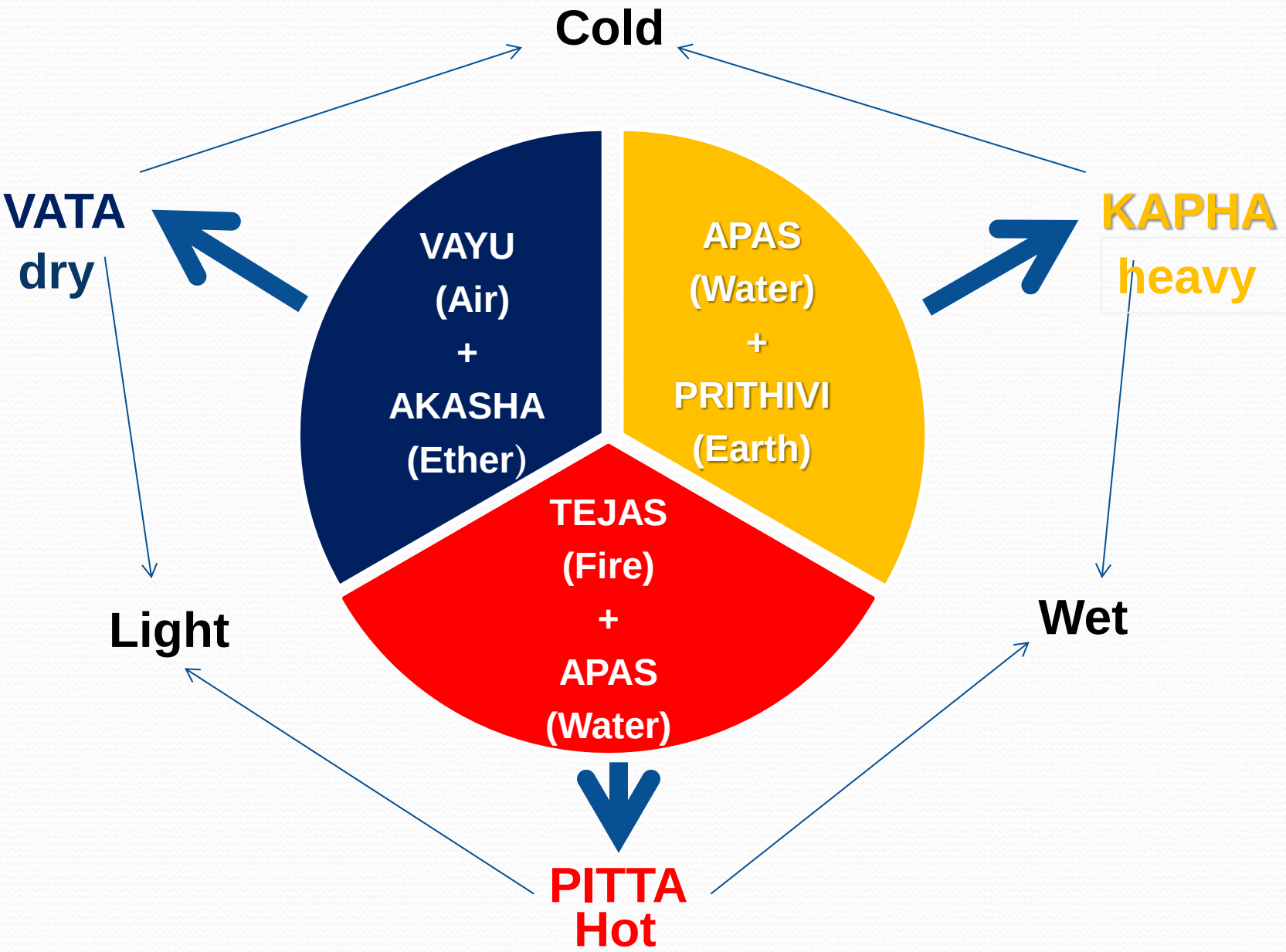
- **Synergy** or playing Robin to its Batman
- Trikatu lesson and finding the active ingredient into an Ayurvedic formulation
- FDA does not require a single active ingredient to be isolated from a herb for it to become a drug (see http://www.fda.gov).



LINKING
TRADITIONAL KNOWLEDGE
WITH
BIOMEDICAL SCIENCE

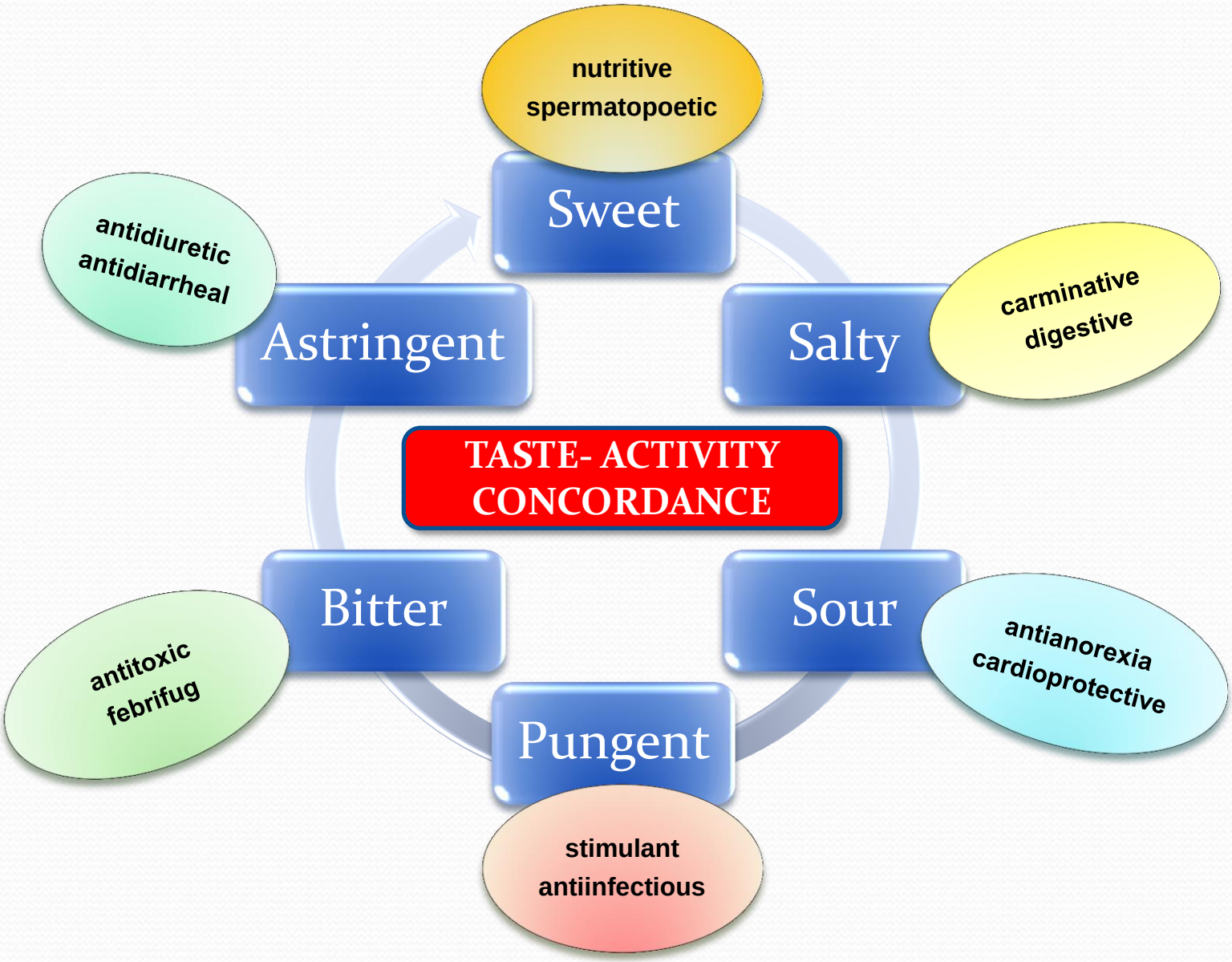
BASIC PRINCIPLES OF AYURVEDA

Patwardhan, B et al., 2005. *Evid. Based. Complement. Alternat. Med*. 2, 465–73



BASIC PRINCIPLES OF AYURVEDA

Ethnopharmacophore descriptors: ***Taste*** *(*sanskrit ***rasa****)*



Contents lists available at ScienceDirect

Journal of Ethnopharmacology

journal homepage: www.elsevier.com/locate/jep

Research paper

Can organoleptic properties explain the differential use of medicinal plants? Evidence from Northeastern Brazil

Patrícia Muniz de Medeiros [a,*], Bárbara Luzia Santos Pinto [a], Viviany Teixeira do Nascimento [b]

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Medicinal plant selection
Brazil

ABSTRACT

Ethnopharmacological relevance: This study examined how people classify plants in terms of their taste and smell, and how those organoleptic properties influence the differential use of medicinal plants for treating different diseases.

Methods: We conducted an ethnobotanical survey of household heads in the community of Sucruiu, located in Barreiras, Bahia, Brazil. The head of each family was questioned concerning their knowledge and use of medicinal plants, as well as the therapeutic indications (TIs), taste, and smell of each plant. We then tested for associations between the therapeutic indications and taste attributes of various plants using the Chi-squared test on a contingency table with Monte Carlo simulations. The same analysis was performed for associations between TIs and smell.

Results: The study participants provided more details when classifying tastes than when classifying smells. We considered only the most cited TIs and attributes, and found significant associations between both taste and therapeutic indications ($p < 0.001$) and smell and therapeutic indications ($p < 0.0001$).

Conclusions: Our results showed that the taste and smell of a plant can influence its differential medicinal use, since plants with certain tastes and smells prevailed in the treatment of distinct diseases. However, our results are valid only for the most popular TIs and organoleptic attributes.

ETHNOPHARMACOPHORE DESCRIPTORS

potency (skr. *virya*) *or* ***HOT*** *-* ***COLD*** *system of properties*

Hot (ushna)	**Cold (shita)**
Warming sensation	**Cooling sensation**
Drying, digesting	**Pacifying, nourishing**
Dizziness, thirst, sweating	**Excess of substance**
THERMOGENESIS ? **INFLAMMATION ?**	**ANABOLISM ?** **CELL GROWTH ?**

Zhongguo Zhong Yao Za Zhi. 2014 Sep;39(17):3353-8.

[Study on discrimination mode of cold and hot properties of traditional Chinese medicines based on biological effects].

[Article in Chinese]

Huang LP, Zhu MF, Yu RY, Du JQ, Liu HN.

Abstract

OBJECTIVE: To observe the effect of **cold** or **hot** properties of traditional Chinese medicines (TCM) on biological effect indexes, and analyze the contribution of variables on **cold** or **hot** properties, in order to preliminarily establish the discrimination mode for the biological effects of **cold** or **hot** properties.

METHOD: Rats were randomly divided into the blank control group, **cold** TCM groups (Coptidis Rhizoma, Scutellariae Radix, Phellodendri Cortex, Gardeniae Fructus, Sophorae Flavescentis Radix and Gentianae Radix) and **hot** TCM groups (Aconiti Lateralis Preparata Radix, Zingiberis Rhizoma, Alpiniae Officinarum Rhizoma, Zanthoxyli Pericarpium, Cinnamomi Cortex and Evodiae Fructus), and orally administered with 10 mL x kg(-1) of corresponding TCM water decoctions for 30 d, twice a

RESULT: According to C&R classification and regression algorithm, SDH activity of livers was the most important **hot** or **cold** property, with the significance closed to 30%. It was followed by triglyceride, liver Na' -K' -ATPase enzyme, muscle glycogen and platelet distribution width, with the accuracy up to 97.39% in models. C5.0 algorithm showed that liver SDH activity was the most important **hot** or **cold** property, with the significance closed to 40%. It was followed by triglyceride, GOT, muscle glycogen and liver Na(+)-K(+)-ATPase enzyme, with the accuracy up to 98.26% in models. The possibilities that Evodiae Fructus is in **hot** property and Scutellariae Radix is in **cold** property were 100. 00% and 77.78% by using both C&R classification and regression algorithm and C5.0 algorithm.

CONCLUSION: The SDH activity of liver is the most important biological effect index to distinguish **cold** and **hot** properties of TCMs. The discrimination pathway or mode of **cold** and **hot** properties is closely related to energy metabolism.

J Ethnopharmacol. 2013 Jul 30;148(3):770-9. doi: 10.1016/j.jep.2013.04.055. Epub 2013 May 20.

ELSEVIER FULL-TEXT ARTICLE

Molecular network and chemical fragment-based characteristics of medicinal herbs with cold and hot properties from Chinese medicine.

Liang F[1], Li L, Wang M, Niu X, Zhan J, He X, Yu C, Jiang M, Lu A.

Author information

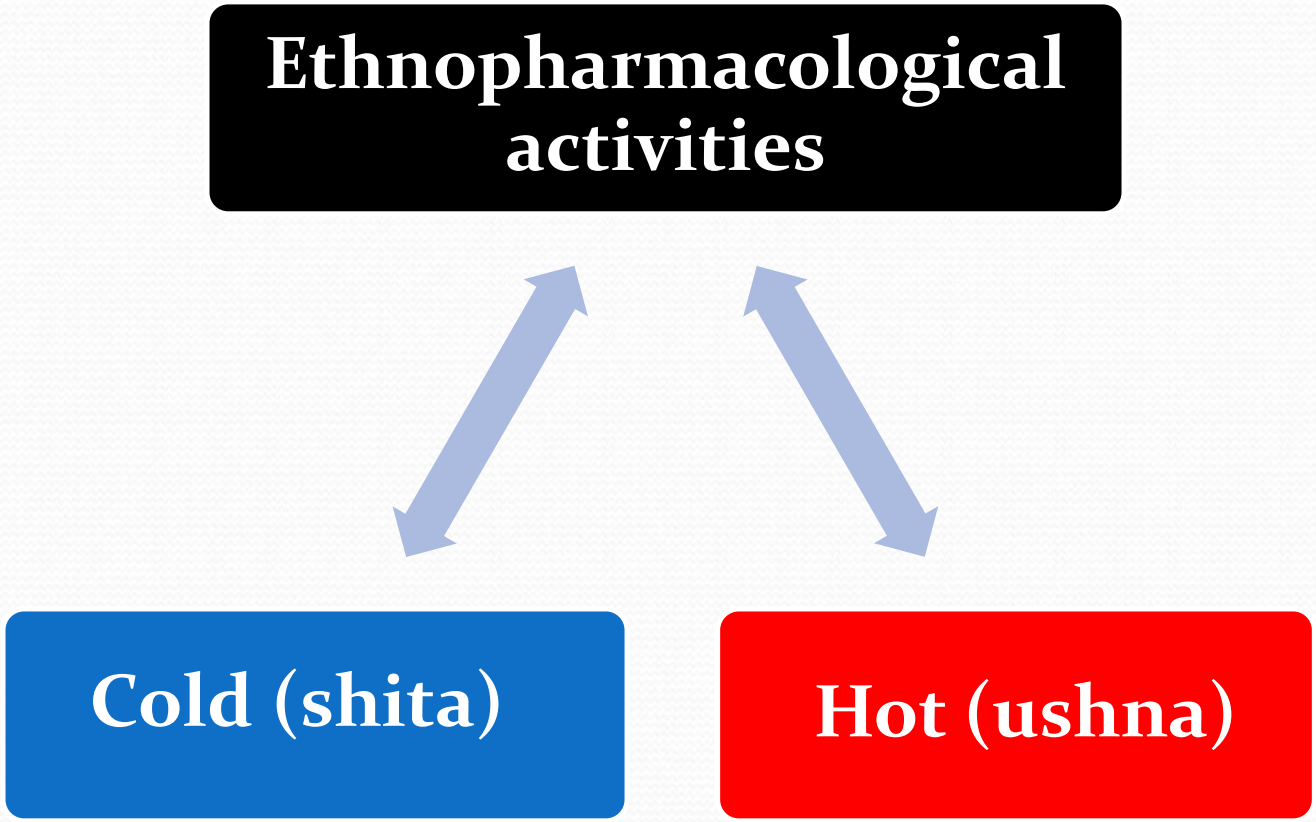
Abstract

ETHNOPHARMACOLOGICAL RELEVANCE: Chinese herbal medicines (HMs) is one of the great herbal systems of the world, which play an important role in current health care system in many countries. In the view of tradition Chinese medicine (TCM) theory, Yin-yang and five-elements theory is the central theory, which is used to explain how the world and body work. Under the guidance of such philosophy, TCM considers that HMs have different properties, which are the important factors for prescribing herbal formulae; such prescriptions are based on TCM pattern classification in clinical practice. The **cold** and **hot** property are commonly defined for HM property identification; however, the biological activities that are related to the HM property remain a mystery because of a lack of appropriate methods. A bioinformatics approach was applied to identify the distinguishing biological activities of HMs that have these **cold** and **hot** properties.

MATERIAL AND METHODS: Twenty HMs with typical **cold** and **hot** properties (10 **cold** and 10 **hot**) were selected based on TCM clinical application records and Chinese pharmacopeia. The active target proteins of each HM were searched in the PubChem database and were analyzed in Ingenuity Pathway Analysis (IPA) platform to find out the HM property-related biological activities. In addition, the main compounds of the HMs were fragmented using a fragment-based approach and were analyzed for the purpose of deciphering the properties.

CONCLUSIONS: Inflammation and immunity regulation are more related to HMs with the **hot** property, and **cold** propertied HMs possess the tendency to impact cell growth, proliferation and development. Integrative bioinformatics analysis and chemical structure analysis are a promising methods for identifying the biological activity of HM properties.

HYPOTHESIS: Is any concordance between ethnopharmacological activities and HOT- COLD properties in Ayurveda?



Associations between HOT-COLD properties and ethnopharmacological actions (EPA)

Fisher exact test- Woolf aproximation

	Ethno-pharmacological activity +	Ethno-pharmacological activity -
Hot /Cold Virya +	**a**	**b**
Hot/ Cold Virya -	**c**	**d**

- 200 total no. of medicinal plants
- 128 ethnopharmacological activities (EPA)

- Legend.
  - **a**- number of plants with a certain virya, which have a certain EPA,
  - **b**- number of plants with a certain virya, which have not that EPA,
  - **c**- number of plants without that certain virya, which have a certain EPA,
  - **d**- number of plants without that certain virya, which have not that certain EPA

CONCLUSIONS
Relevance of HOT- COLD properties in ethnopharmacology

-Hot-cold herbal properties are statistically associated with various ethnopharmacological activities (Preliminary results: hot- 19 associations, cold- 10 associations)

- Hot- cold properties might be used as a tool for **accelerating medicinal plant bioprospecting**

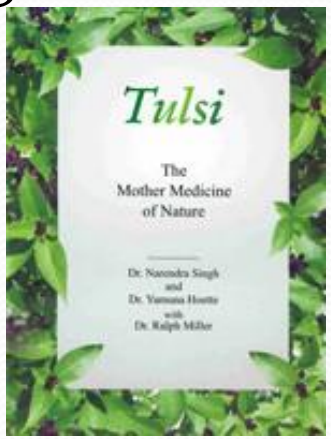
My experience with organic herbiculture in India

- Visiting scientist at IIHM, Lucknow, India, 2006-2007

मेरिलिना को भाए
देसी लड्डू

मेरिलिना को भारत का आयुर्वेद इतना भाया कि रोमानिया से वह यहाँ तक खिंची चली आईं। यहाँ आकर उन्होंने आयुर्वेद के कई गूढ़ रहस्यों को जाना। यहीं उन्होंने जाना कि दवा को कैसे रखना चाहिए। इसके साथ ही उन्हें पसंद आई भारतीय सभ्यता और खान-पान। मेरिलिना से मुलाकात की अमित के. जायसवाल ने।

- Superviser **dr Narendra Singh** (1935-2012)
- Extensive pharmacological and clinical research on Tulsi



TULSI- The queen of herbs
(Ocimum sanctum, fam. Labiatae)

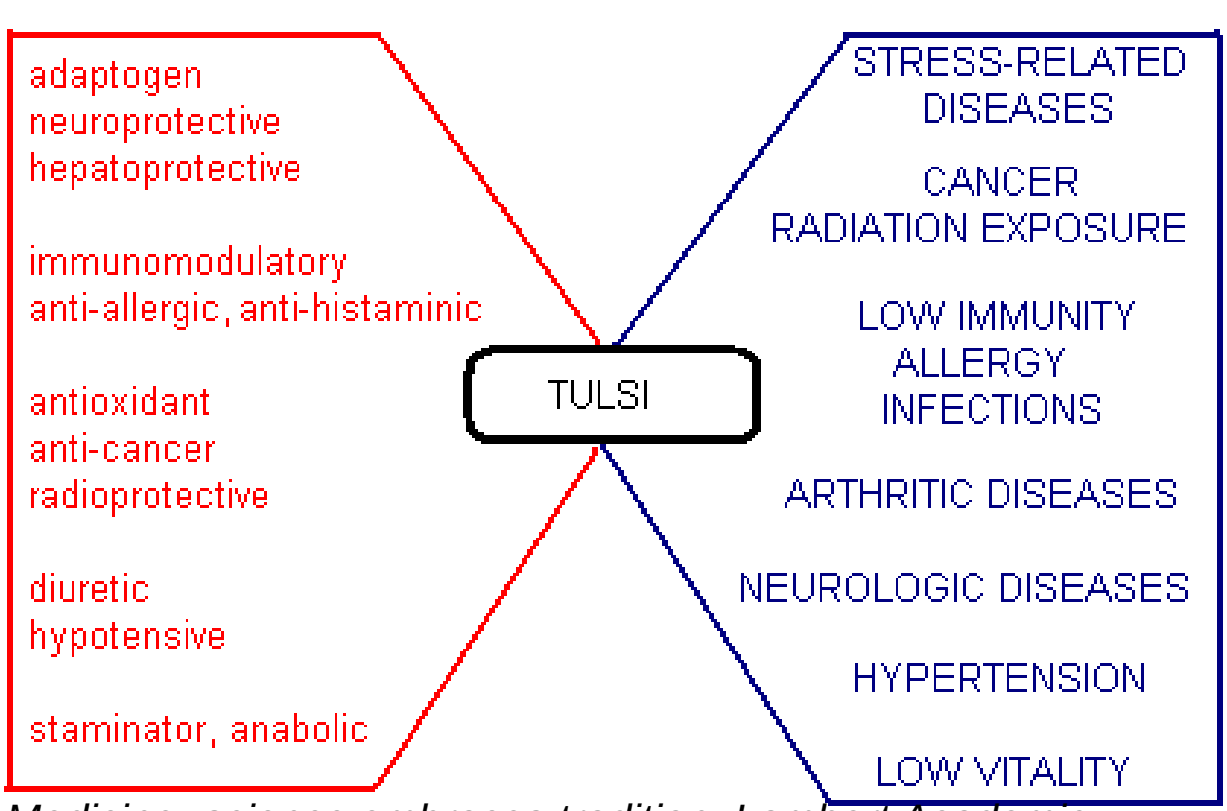
- Ayurvedic pharmacological description
  - Taste: **pungent, bitter**
  - Virya: **hot**
  - Karman
    - **great antiageing (Rasayana)**
    - stomachic, cholagogue
    - diuretic
    - antihelmintic
    - antipyretic
    - analgesic
    - anti-toxic
    - tonic cardiac
    - expels the dosha from the head (shirovirechana)

- Ayurvedic indications
  - respiratory diseases (asthma, bronchites, catarrh),
  - digestive problems (vomiting, slow digestion, anorexia)
  - anuria
  - cardiovascular diseases
  - different kinds of pains (joint pains, painful eye, earache)
  - cutaneous diseases (eg. ringworm, itching)
  - fever, epidemics (influenza, malaria, cholera, etc

Singh N., Gilca M. : Herbal Medicine- science embraces tradition, Lambert Academic Publisher, Germany, 2010

TULSI- The queen of herbs
(Ocimum sanctum, fam. Labiatae)

- **Modern research**
  - **exceptional adaptogen**
  - **exceptional immune emhancer**



Singh N., Gilca M. : Herbal Medicine- science embraces tradition, Lambert Academic Publisher, Germany, 2010

Antistress/Adaptogen Herbs

BOTANICAL NAME	INDIAN NAME	PARTS USED
Ocimum sanctum (Os)	**Tulsi**	**Leaves**
Withania somnifera (Ws) (Indian Ginseng)	**Ashwagandha**	**Roots**
Altingia excelsa (Ae)	**Silaras**	**Roots**
Diospyros peregrina (Dp)	**Kakatundi**	**Whole plant**
Picrorrhiza kurroa (Pk)	**Katuki**	**Roots**
Eleutherococcus senticosus (Es) (Siberian ginseng)- For Comparison		**Roots**
Panax ginseng (Pg)(Korean ginseng) - For Comparison		**Roots**

Bhargava K.P., **Singh N**.: Anti-stress activity in Indian medicinal plants, Jour Res Edu Ind Med, IV(3-4), 27-32, 1985

PLANT EXTRACTS		DURATION OF ANOXIA TOLERANCE (Min, Mean ± S.E.)	
		PRE TREATMENT	POST TREATMENT
1.	Control	122.5 ± 4.0	119.3 ± 4.4
2.	*O. sanctum*	124 ± 4.3	180* ± 4.5
3.	*W. somnifera*	130 ± 3.5	164* ± 5.0
4.	*D. peregrina*	127 ± 4.0	143**± 3.5
5.	*P. kurroa*	128 ± 3.0	143**± 3.0
6.	*E. senticosus*	128 ± 4.0	164* ± 4.2
7.	*P. ginseng*	130 ± 3.5	158* ± 3.0

*p < 0.01, **p < 0.05

Bhargava K.P., **Singh N**.: Anti-stress activity in Indian medicinal plants, Jour Res Edu Ind Med, IV(3-4), 27-32, 1985

My experience with organic herbiculture in India

- Plantation technique developed by Dr. N. Singh (1998), **pioneer of organic herbiculture in India**

- **Organic India Pvt Ltd** : First large cultivation of Tulsi by contracting hundreeds of farmers in the area around dr Narendra Singh's ancestral home in Azamgarh, UP

My experience with organic herbiculture in India:

Organic India Company- Case Study

- All farmers and tribal wildcrafters educated in organic and biodynamic agricultural practices.
- Organic India pay all the fees associated with acquiring the necessary organic certifications for them, and then purchases the harvested crops and herbs at a premium market price
- The farmers rotate between growing crops on their land for Organic India with food crops for themselves:
  - sustainable income
  - improving their own health
  - preserving the natural

  environment.

- **Organic India Nursery in Azamgarh**

- **Prototype: Vrindavan Organic Farm in Lucknow**

BIODYNAMIC METHOD

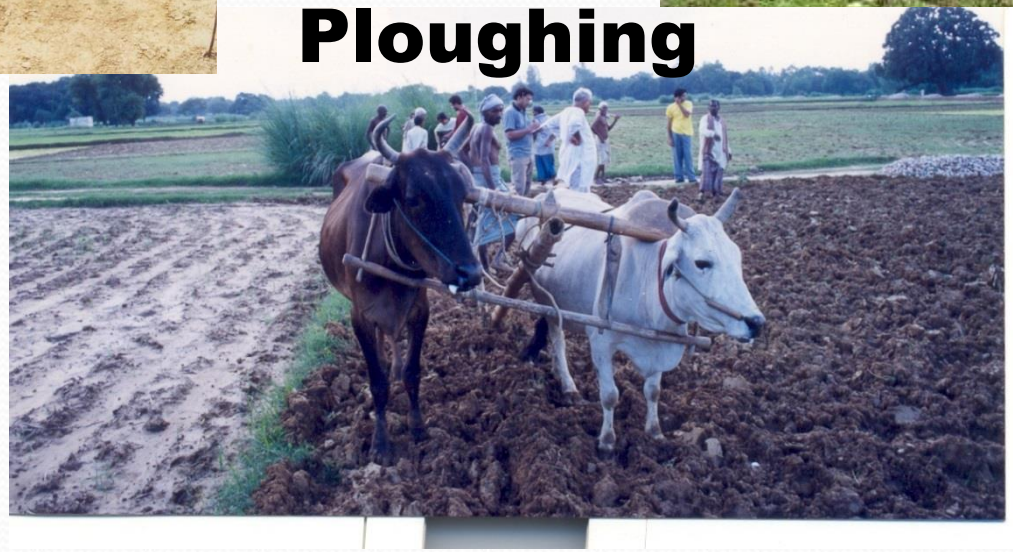
- **bio-, solar rythms**
- **compost vermiculture**
- **green manure**

- **Natural pesticides, insecticides, herbicides**

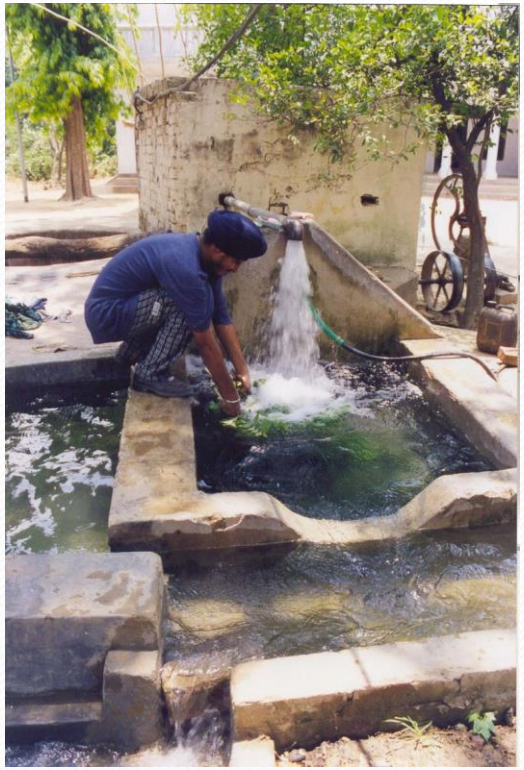
(e.g. *Azadirachta indica* or neem)

Indigenous agricultural tchnologies

Ploughing



Manual harvesting of Tulsi



Washing the herbs in deep clean water of the tube-well

Tulsi organic herbiculture

-first large organic medicinal plant cultivation in India

-great impact on the life of Indian villagers in Azamgarh

Museum of Natural History, Milan

ESTIMATION...

- It is not the strongest and the most ingenious of the drugs that survives. It is the one that is the most adaptable to the dynamic of body physiology, as medicinal plants have been succesfully doing for thousands of years.

THANKS TO:

- Dr Narendra Singh
- Bhavani Lev and Bharat Mitra
- IIHM Team, Lucknow

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