How can Environmental Scientists save the world?

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RYERSON UNIVERSITY

Environmental Applied Science & Management

1

In memory of Tsunami victims

How can Environmental Scientists save the world?

24pC1-06

Chemical Analysis versus Bioassay: How to bring the two schools together for environmental analysis of dioxins and furans

Eric Buan, Ching Lo, Wei Zhang and James Li (2010) Correction of discrepancies in dioxin quantification between immunoassay and gas chromatography–high-resolution mass spectrometry. Anal Bioanal Chem Vol. 398, No 5, pp. 2233-2241.

Environmental standards and guidelines written using GC-HRMS Toxicity Equivalent (TEQ) ≈ Bioassay Equivalent (BEQ)
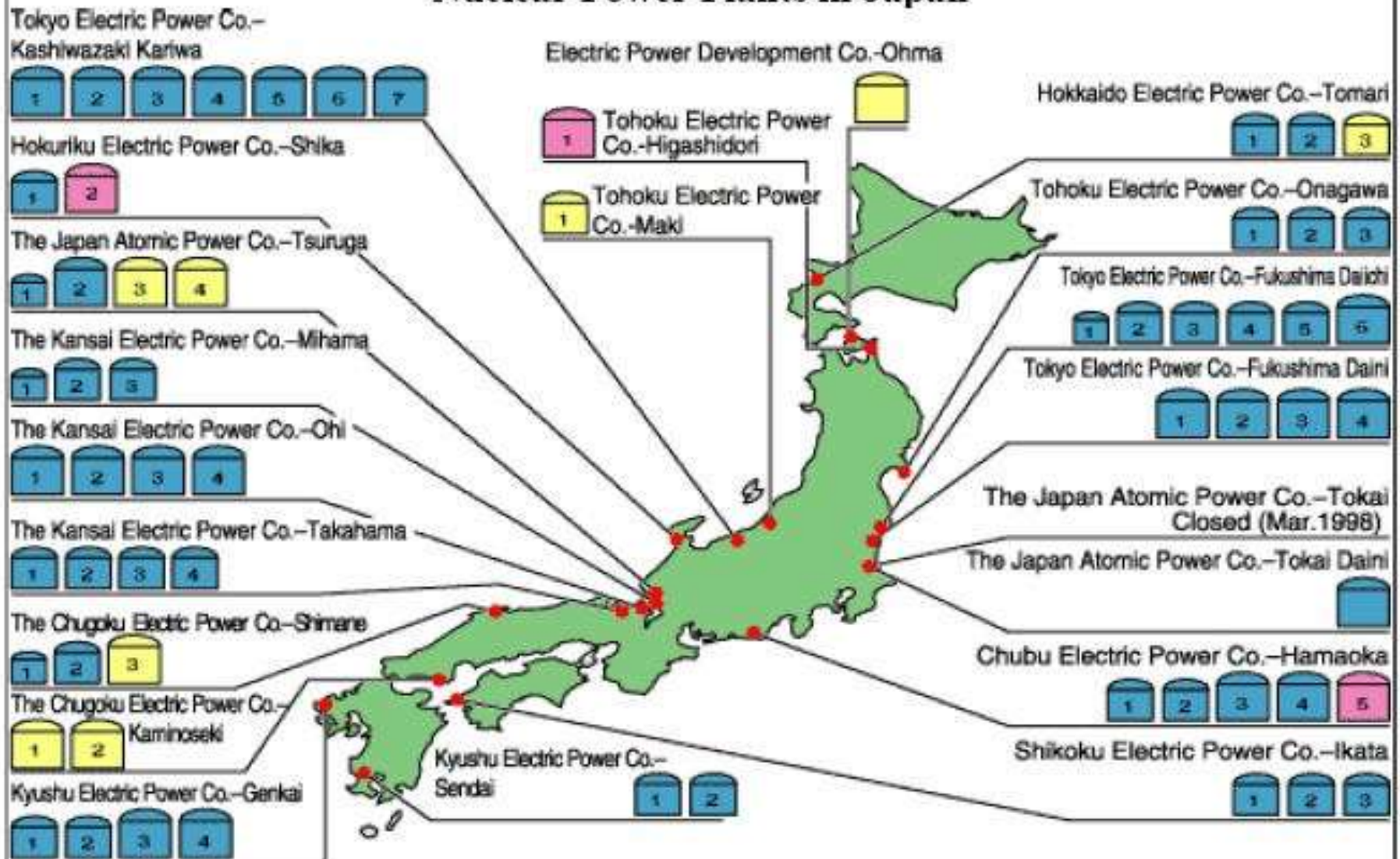
24pC1-07

Chemical analysis versus bioassay for environmental analysis of hazardous organic compounds: when to use what?

In memory of Tsunami victims
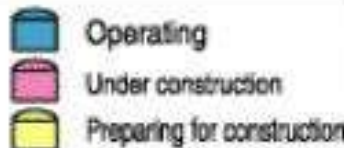How can Environmental Scientists save the world?

Nuclear Power Plants in Japan

Tokyo Electric Power Co.–Kashiwazaki Kariwa
1 2 3 4 5 6 7

Hokuriku Electric Power Co.–Shika
1 2

The Japan Atomic Power Co.–Tsuruga
1 2 3 4

The Kansai Electric Power Co.–Mihama
1 2 3

The Kansai Electric Power Co.–Ohi
1 2 3 4

The Kansai Electric Power Co.–Takahama
1 2 3 4

The Chugoku Electric Power Co.–Shimane
1 2 3

The Chugoku Electric Power Co.–Kaminoseki
1 2

Kyushu Electric Power Co.–Genkai
1 2 3 4

Electric Power Development Co.–Ohma

Tohoku Electric Power Co.-Higashidori
1

Tohoku Electric Power Co.-Maki
1

Kyushu Electric Power Co.–Sendai
1 2

Hokkaido Electric Power Co.–Tomari
1 2 3

Tohoku Electric Power Co.–Onagawa
1 2 3

Tokyo Electric Power Co.–Fukushima Daiichi
1 2 3 4 5

Tokyo Electric Power Co.–Fukushima Daini
1 2 3 4

The Japan Atomic Power Co.–Tokai Closed (Mar.1998)

The Japan Atomic Power Co.–Tokai Daini

Chubu Electric Power Co.–Hamaoka
1 2 3 4 5

Shikoku Electric Power Co.–Ikata
1 2 3

Output scale

Under 500MW | Under 1,000MW | Over 1,000MW

Operating
Under construction
Preparing for construction

	Number of Units	Total Output (MW)
Operational	52	45,742
Under construction	3	3,838
Preparing for construction	8	10,315
Total	63	59,895

How can Environmental Scientists save the world?

Answers:

No, how can we…? Our conventional role is to monitor and report pollution status…how bad things are. Retroactive, after the fact.

Yes, we can…a new role, a new science to influence social values and decision making process. Proactive, value system alternative to money

Critical thinking steps:
Root-causes of global warming

- Humans pursue happiness
- Happiness is an abstract quality
- Humans do not know how to make consistent decisions based on abstract quality
- Decisions are easy when based on quantity, number
- Money (currency) is the only number available and universally recognized
- Consequently, people pursue money in their attempt to pursue happiness
- Money translates into consuming power. Over-consumption demands over-production, creates wastes, depletes natural resources, pollutes the environment and causes global warming (rising sea level, flood, water shortage, food shortage, climate change, diseases…)

A new science to establish a new value system alternative to money

The real solution to change the central value of the dominant civilization is to provide an alternative, quantifiable measurement of happiness, a "Happiness Index"

Evolution of "Happiness Index" first-generation

1972 Bhutan's former King Jigme Singye Wangchuck proposed gross national happiness (GNH) concept to supplement the gross domestic product (GDP) concept {religion + political/social science + economics}

Earth Hall of Fame, Kyoto 2009

Evolution of "Happiness Index" second-generation

2006 a second-generation GNH concept, treating happiness as a socioeconomic development metric, was proposed by Med Jones, the President of International Institute of Management

7-parameters of 2nd-generation GNH by direct survey and statistical measurement of respective matrices

1. **Economic Wellness**: economic metrics such as consumer debt, average income to consumer price index ratio and income distribution
2. **Environmental Wellness**: environmental metrics such as pollution, noise and traffic
3. **Physical Wellness**: physical health metrics such as severe illnesses
4. **Mental Wellness**: mental health metrics such as usage of antidepressants and rise or decline of psychotherapy patients
5. **Workplace Wellness**: labor metrics such as jobless claims, job change, workplace complaints and lawsuits
6. **Social Wellness**: social metrics such as discrimination, safety, divorce rates, complaints of domestic conflicts and family lawsuits, public lawsuits, crime rates
7. **Political Wellness**: political metrics such as the quality of local democracy, individual freedom, and foreign conflicts

Preliminary GNH Rank

1. Denmark
2. Finland
3. Norway
4. Sweden
4. Holland
6. Costa Rica
6. New Zealand
8. Canada
8. Israel
8. Australia
8. Switzerland
14. USA
17. Britain
44. France
70. Taiwan
81. Hong Kong
125. China

Shortcomings of the 2006 2nd-generation "Gross National Happiness"

1. The questionnaires type of measurements are highly subjective, opinionated and culturally influenced.

2. The holistic result does not challenge and empower the individual participants surveyed.

2010 a third-generation medical solution is hereby proposed

To quantify happiness using reliable and reproducible laboratory analysis of human body metabolites combined with physiological and psychological measurements

Ching Lo (2010) Global Warming: Realities, Root-cause Analysis, and a Happy Solution. eBook ISBN: 978-0-9867943-1-5. *Green Think Tank Organization, Ontario, Canada.* http://www.amazon.com/Global-Warming-Realities-Root-cause-ebook/dp/tags-on-product/B003XKNDY4

http://www.amazon.com/Global-Warming-Realities-Root-cause-ebook/dp/tags-on-product/B003XKNDY4

Categories/Scale of Happiness Test Subjects
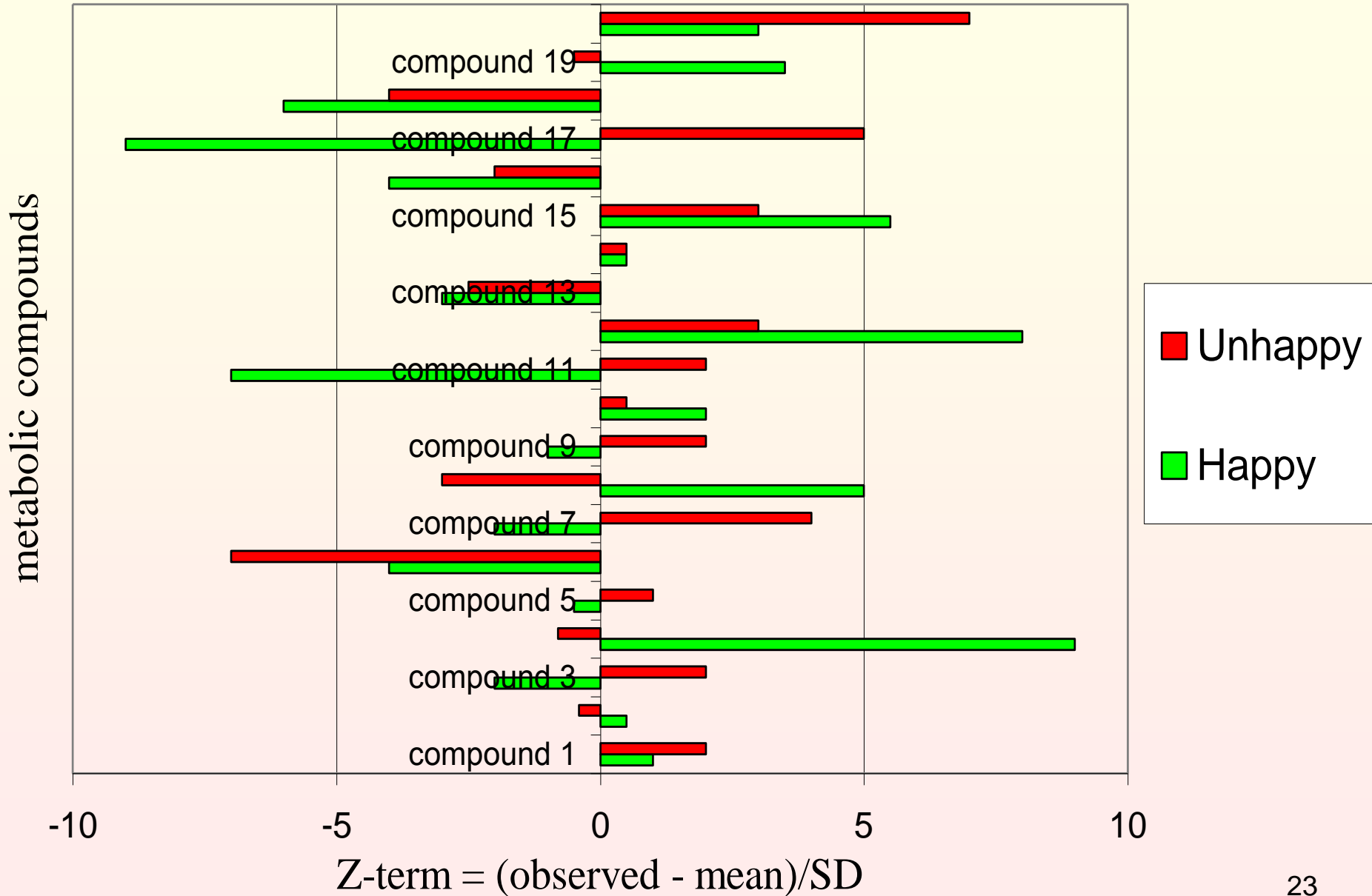
10. Spiritual

9. Rich retired

8. Optimists

7. Celebrities

6. Financier

5. Average Joe

4. Poor people

3. Manic

2. Suicidal

1. War vet

Identical twins

Happiness/Stressor Measurements

Non-invasive techniques

1. Subjective Evaluation
    1. Psychological self assessment

2. Objective Evaluation
    1. Questionnaires assessment by social circle
    2. Lie detector – heart beat, skin conductivity, perspiration, respiration.
    3. Nuclear magnetic resonance imaging (MRI), CT scans
    4. Infrared Spectrum

(Invasive) techniques

1. Metabolomics

DNA
Genomics

25 thousand Genes

RNA
Transcriptomics
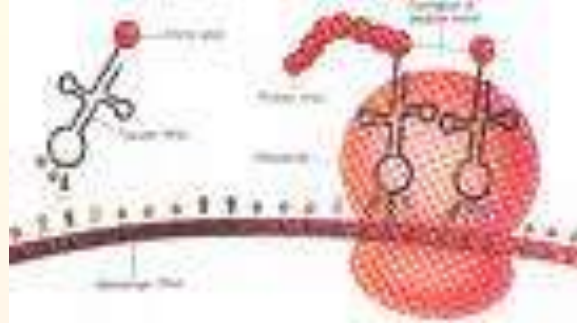
100 thousand Transcripsts

Proteins
Proteomics

1million Proteins

Metabolites
Metabolomics

<2,000 compounds

20
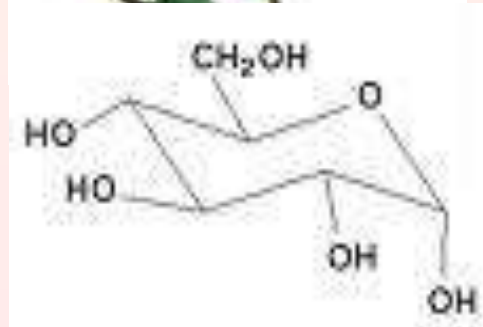
Metabolomics Lab

Subject Categories

10. Spiritual
9. Rich retired
8. Optimists
7. Celebrities
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5. Average Joe
4. Poor people
3. Manic
2. Suicidal
1. War vet

Identical twins

Hypothetical Metabolomic Profiles

metabolic compounds

compound 19
compound 17
compound 15
compound 13
compound 11
compound 9
compound 7
compound 5
compound 3
compound 1

Unhappy
Happy

Z-term = (observed - mean)/SD

-10   -5   0   5   10

large molecule feature extraction software can detect and deconvolute the intact proteins followed by multivariate statistical analysis software to provide clustering and Principal Component Analysis

Four different strains of the same bacteria species distinguishable by proteomics/metabolomics

A1, A2 *Salmonella typhimurium*

A39, A40 *Salmonella Heidelburg*
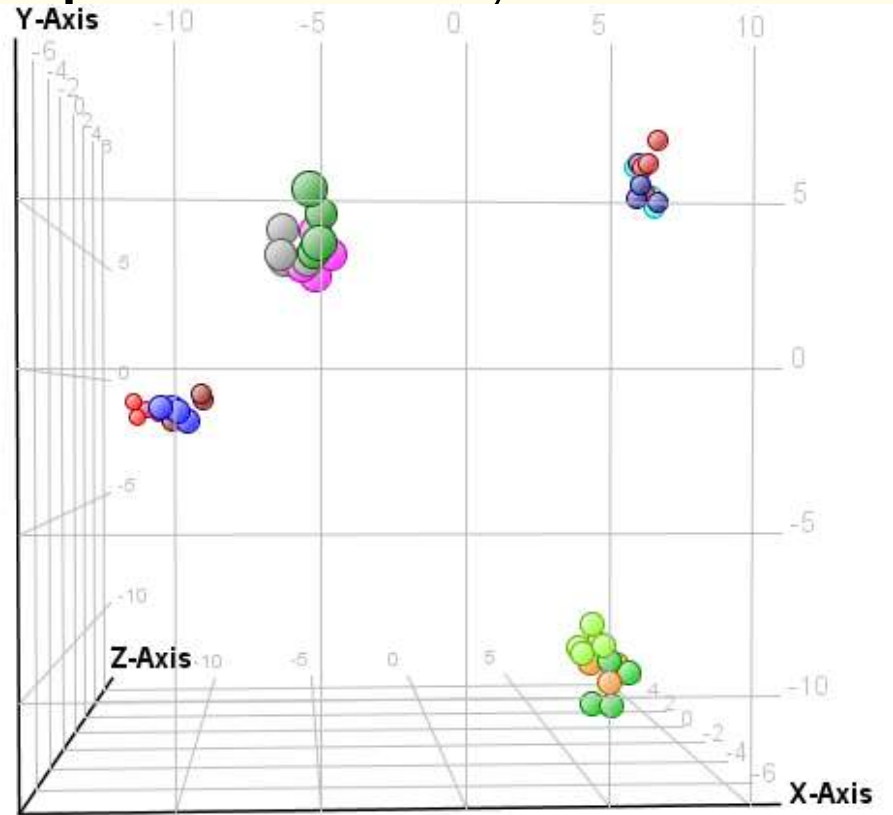
X, Y and Z Axis represent deconvoluted protein masses, summed abundances of all the charge states reflecting those masses, and corresponding retention times

How can Environmental Scientists save the world?

James Lovelock

- ### Mass spectrometry scientist
  - 1957deviced the electron capture detector for GC. Its use led to the discovery of pesticide residues in the natural environment, and to Rachel Carson's book, The Silent Spring, which started the environmental movement.
  - GC-ECD discover and measure the abundance of PCBs, chlorofluorcarbons and nitrous oxide in the atmosphere.
  - GC-ECD has made possible a system of atmospheric and oceanic tracer technology; perfluorocarbons

  analysis follow the movement of air masses

  across continents and oceans

- ### Gaia: a new look at life on Earth, 1979

Sustainability with limited resources
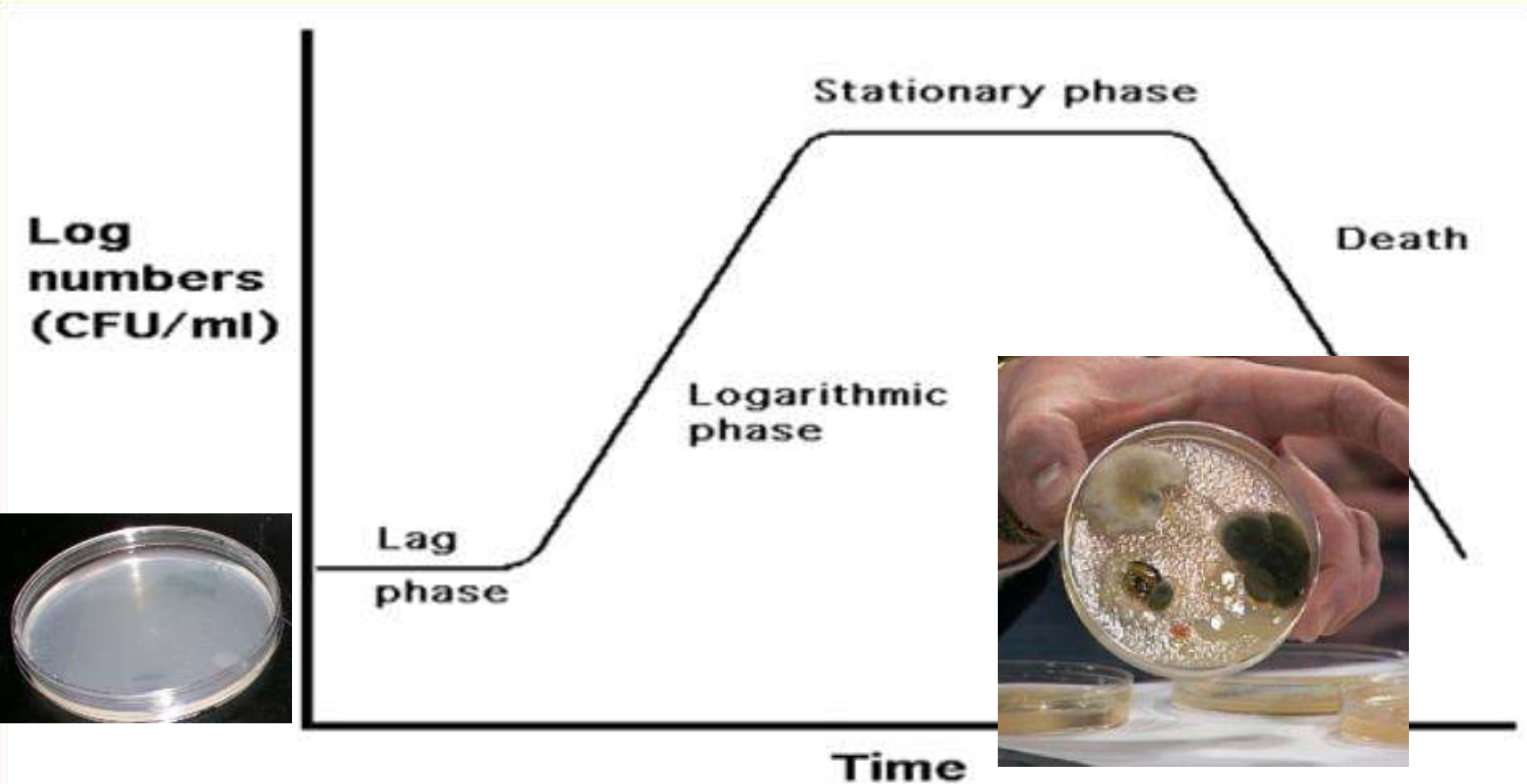
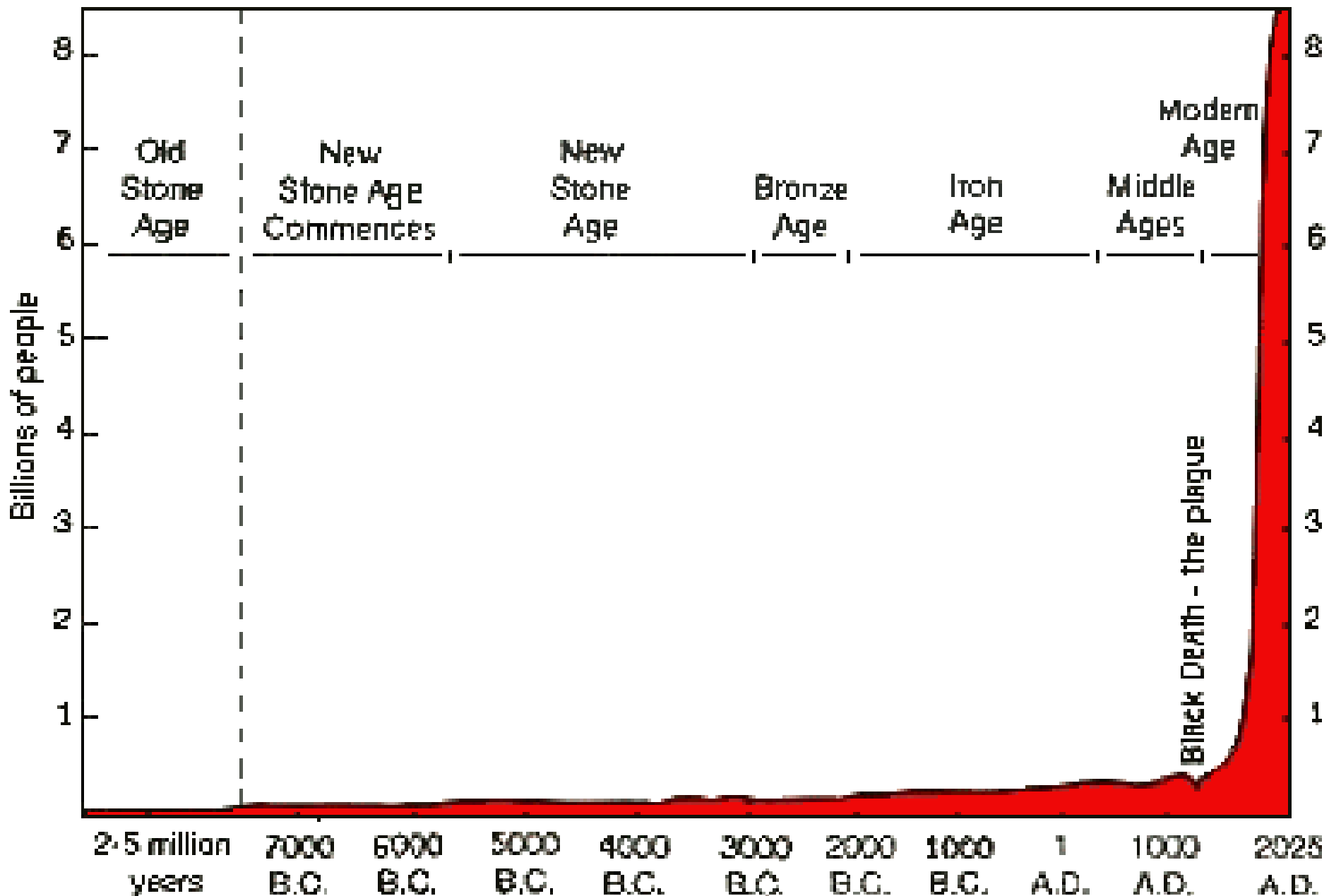Hypothetical bacterial growth curve

luxurious growth is not sustainable

Sustainability with limited resources

Lungs (of a smoker)

Cancer
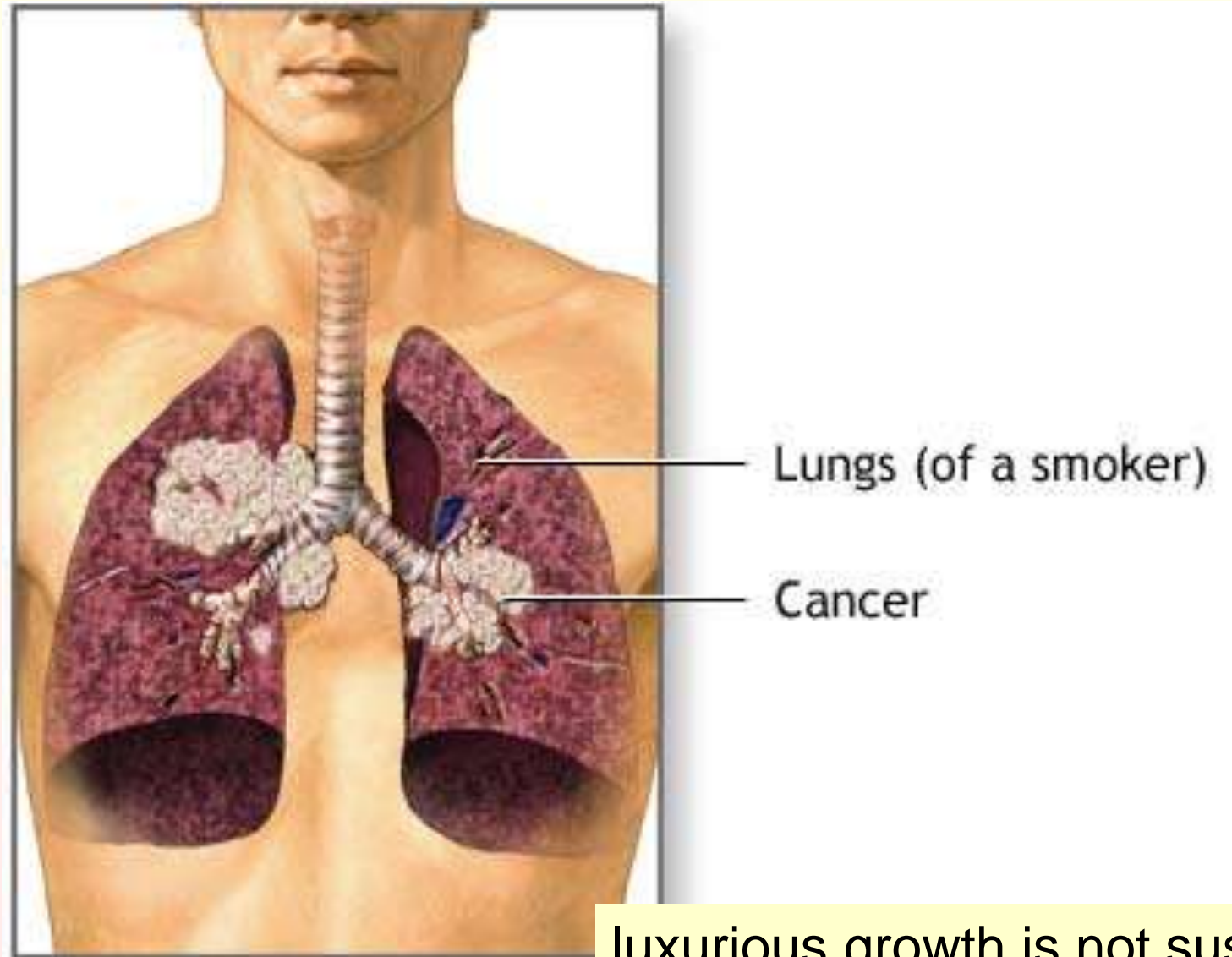
luxurious growth is not sustainable

World Population Growth Through History

Billions of people

| Old Stone Age | New Stone Age Commences | New Stone Age | Bronze Age | Iron Age | Middle Ages | Modern Age |

Black Death - the plague

2·5 million years | 7000 B.C. | 6000 B.C. | 5000 B.C. | 4000 B.C. | 3000 B.C. | 2000 B.C. | 1000 B.C. | 1 A.D. | 1000 A.D. | 2025 A.D.

How can Environmental Scientists save the world?
{Science + "religion"}

Could Earth Really be a Single Organism?

James Lovelock

Number of Years Required to Add One Billion People to the Population of the Earth with Current Projections into the Future

	Date Achieved	Years Required
First Billion	1800	All of Human History
Second	1930	130
Third	1960	30
Fourth	1974	14
Fifth	1987	13
Sixth	1998	11
Seventh	2009	11
Eighth	2021	11
Ninth	2035	14
Tenth	2054	19
Eleventh	2093	39
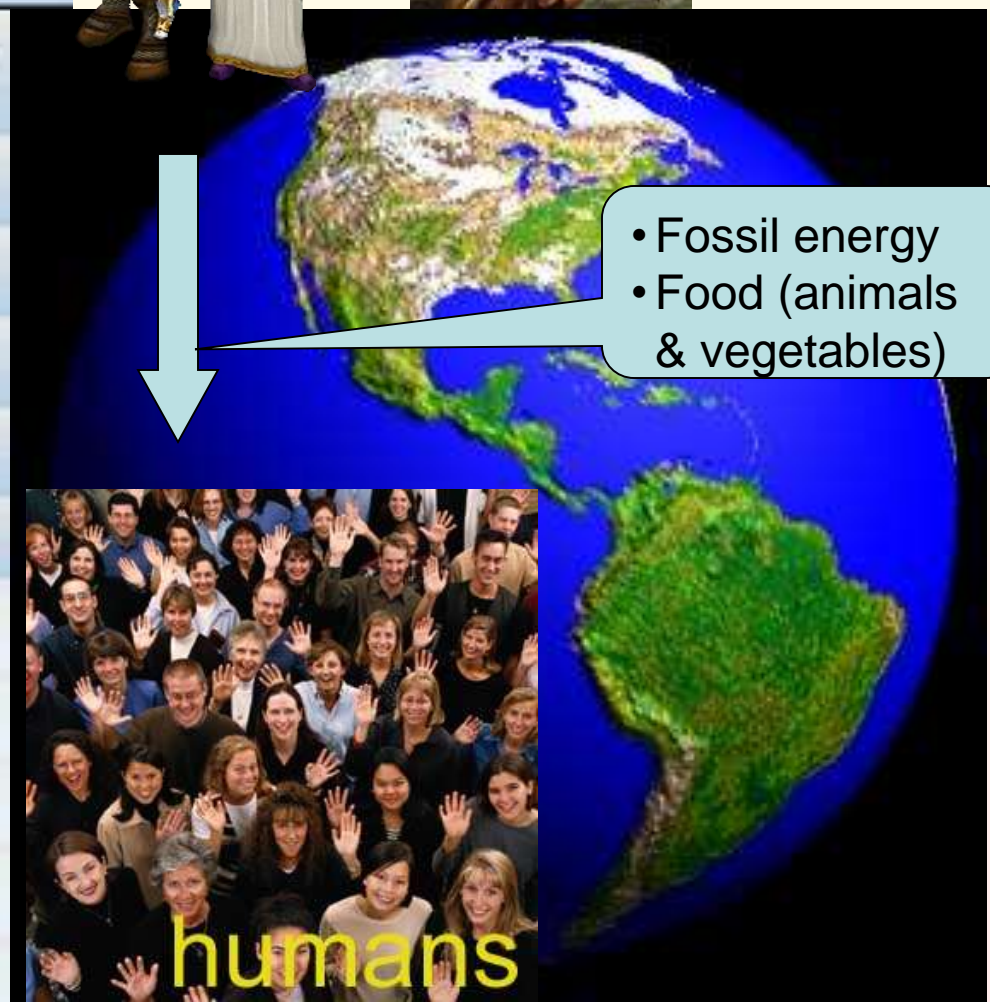
- Fossil energy
- Food (animals & vegetables)

humans

Unprecedented Sustainability Challenges

- Solar energy sustains <1 billion humans
- Pre-industrial revolution up to 2 billions
- Population ~double in past 50 years to 6.9B
- Technology allows transform world energy and biomass into human biomass
- Half the world is living on < $2 a day
- 20% of the global population is consuming 86% of the world's goods
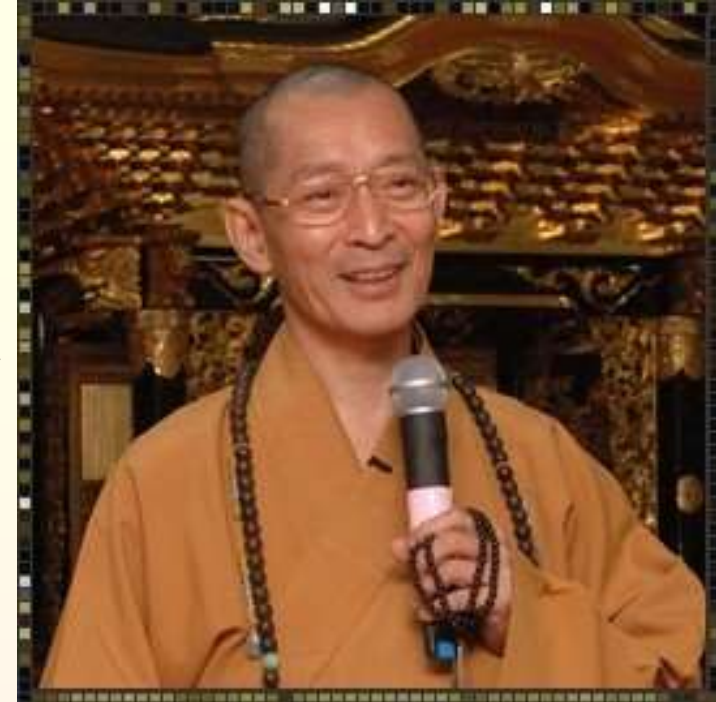
Global warming root-cause analysis
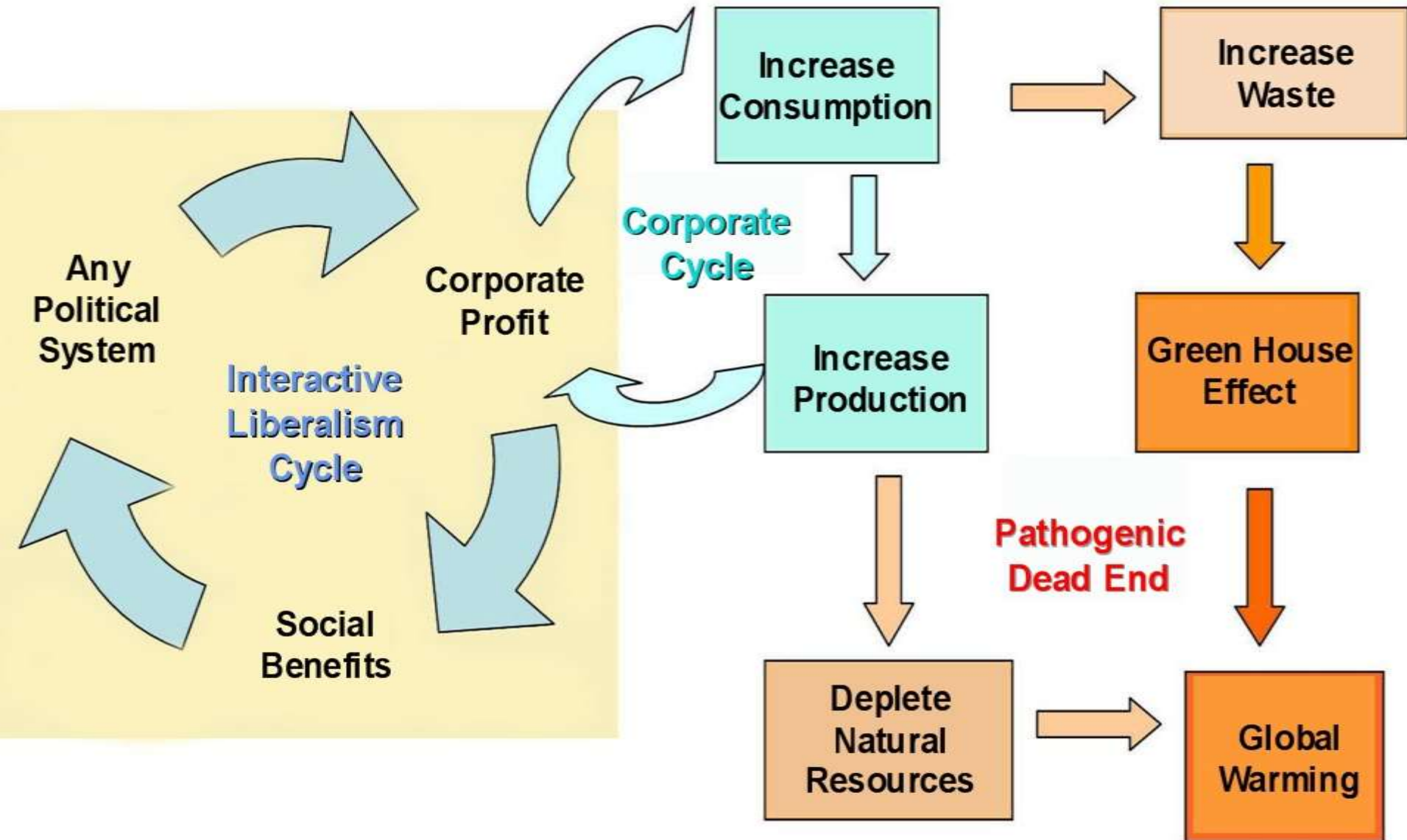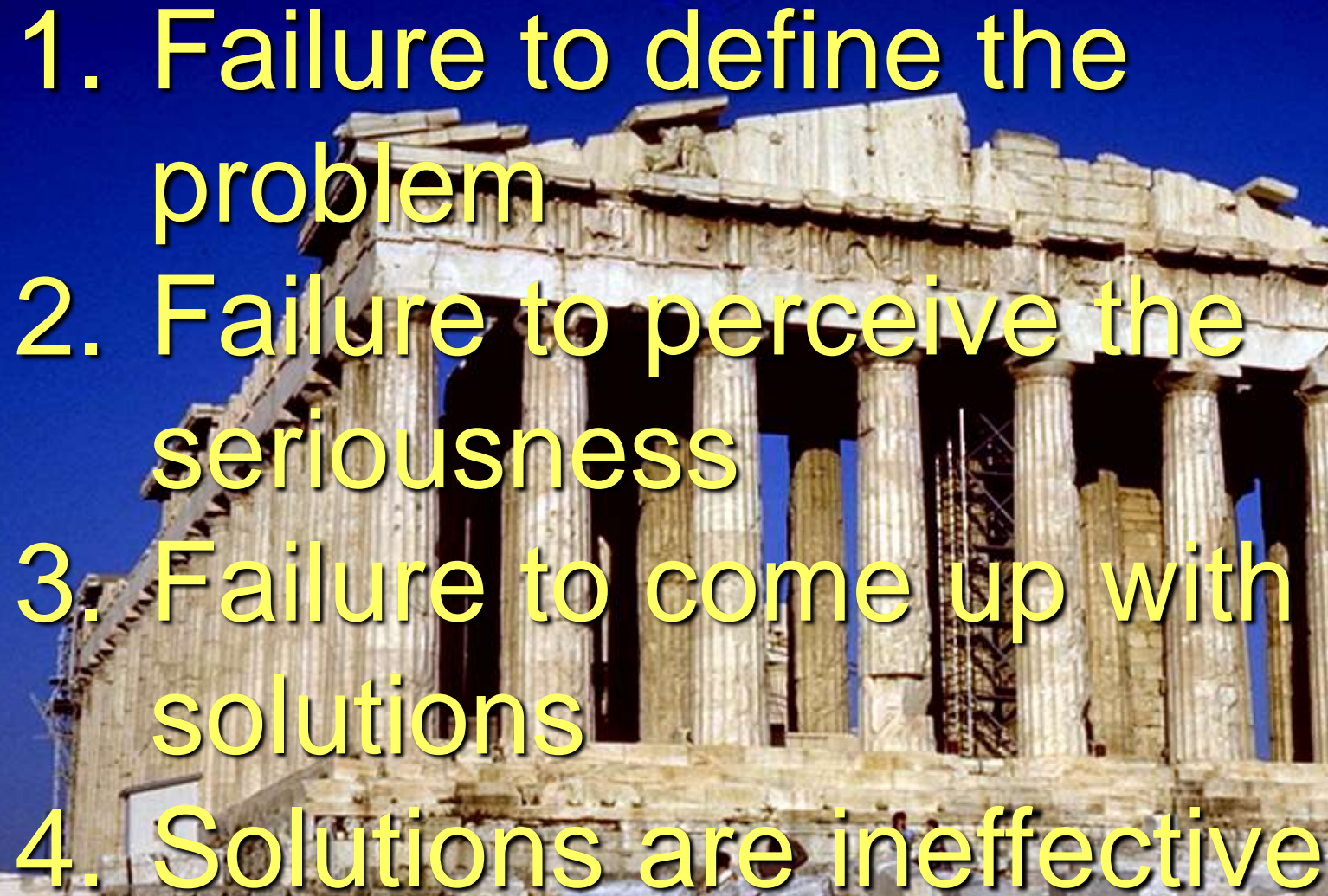
Ven. Haiyun Jimeng
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Da Huayen Monastery Taiwan
大華嚴寺
{religion + social/political science + economics}

Honorary Director & Visiting Professor, Shaanxi
   Normal University, Centre for Religious Studies,
   Institute of Huayen Studies, PR China.
Invited Research Fellow, Chinese Academy of
   Social Sciences, Shaanxi Normal University, Centre
   for Buddhist Studies, PR China

Four symptoms of civilization collapse

1. Failure to define the problem
2. Failure to perceive the seriousness
3. Failure to come up with solutions
4. Solutions are ineffective

Central Value System of the dominant civilization

Happiness Index幸福指數

- **Is:**
  - Objective
  - Neutral
  - Informative
  - Incentive
- **Is not:**
  - Confrontational
  - Dogmatic

Function of the Happiness Index

- **Will:**
  - Measure the well being of society.
  - Entice and guide policy makers.
  - Redefine quality of life.
  - Help individuals to make lifestyle choices in the short and long term.
  - Be a powerful alternative to the mighty dollar. and other economic indexes.
- **Will not:**
  - Be tradable.
  - Be falsify.

Advantages of the 3rd-generation Happiness Index

1. The measurement methodology is entirely objective, scientific, quantifiable, based on established physiological, psychological and medical technology.
2. The index is both national and individual.
3. It offers a value system alternative to money for the fundamental decision-making process of the human mind. The Pursue of money causes Environmental Disasters.
4. It does not rely on changing behaviour by education, persuasion, morality or legislation
5. {Nirvana research and validation brings Science and religion together rather than antagonistic. This is evolution of human collective consciousness.}

Conclusions Yes, we can…

1. Third-generation approach to create quantifiable "Happiness Index" is technically feasible

2. {Scientific approach to religion

3. Spiritual value system to change materialistic social values

4. Religious nourishments to fulfill human needs}

5. Save the planet: Happiness Index → change value system → decision-making process → human behaviour

Acknowledgements

- Organizers of ICAS2011
- Green Think Tank staff and volunteers
- Audience

THE 11TH HOUR

TURN MANKIND'S DARKEST HOUR INTO ITS FINEST

RYERSON UNIVERSITY