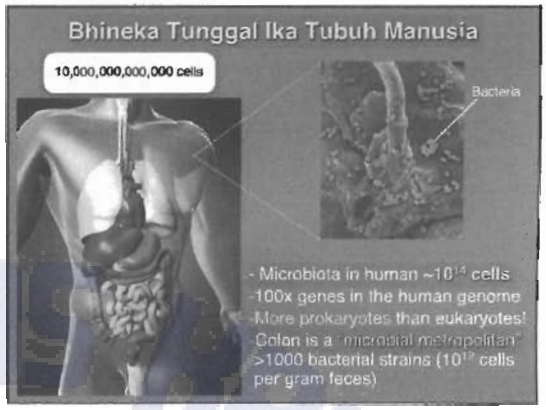
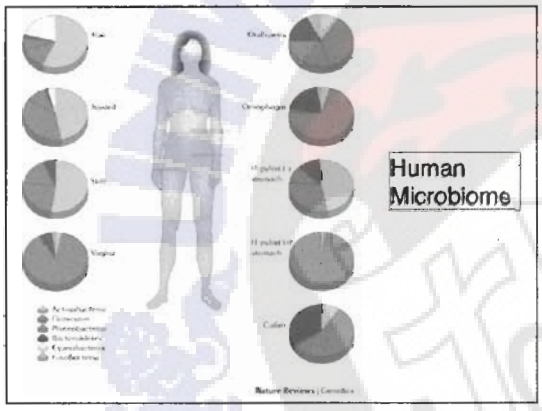
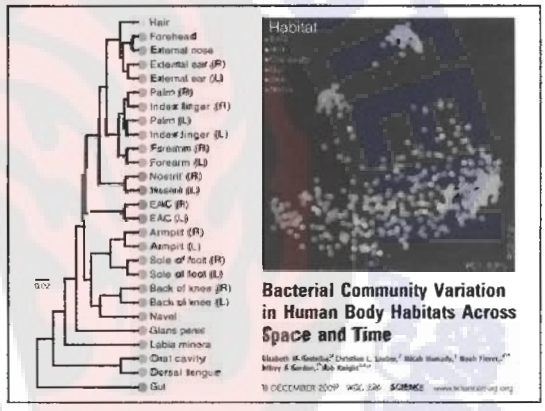
Mikrobiom Manusia dan Pangan Fermentasi: Analisis Metagenom Tempe Indonesia

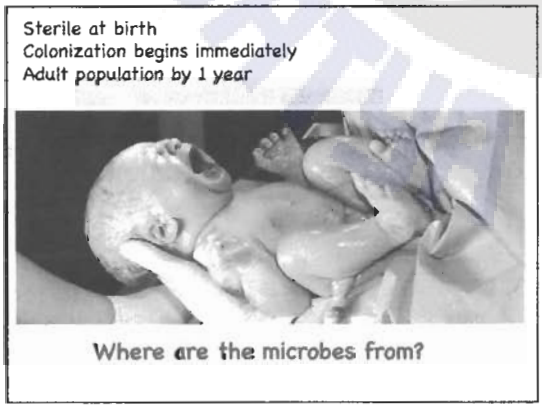
Antonius Suwanto
Departemen Biologi, FMIPA
Institut Pertanian Bogor
E-mail: asuwanto@indo.net.id

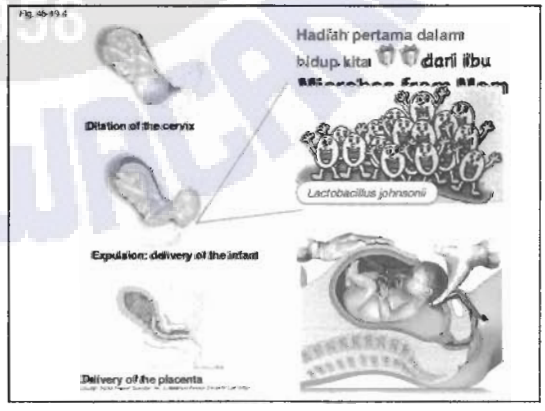
Bhineka Tunggal Ika Tubuh Manusia

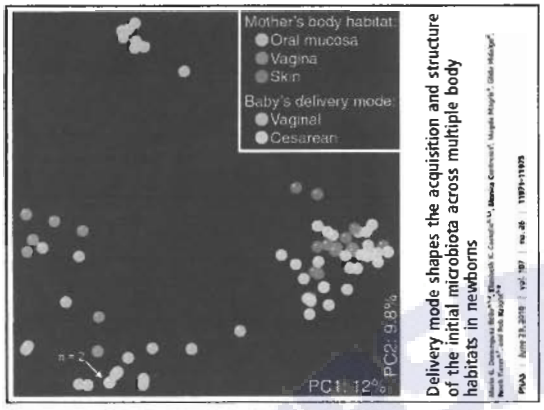


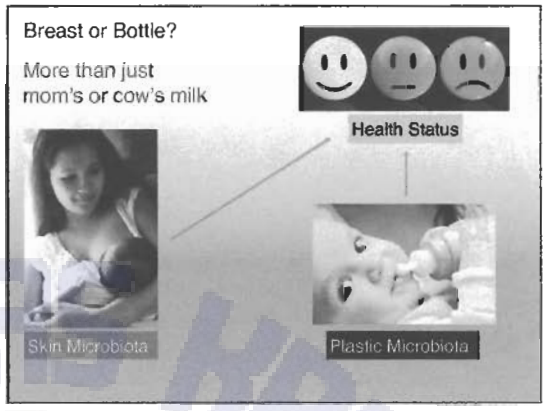


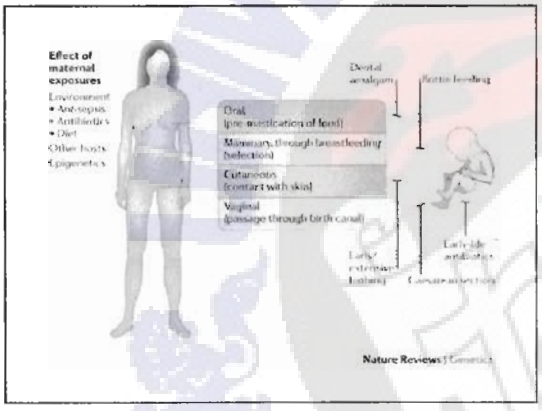


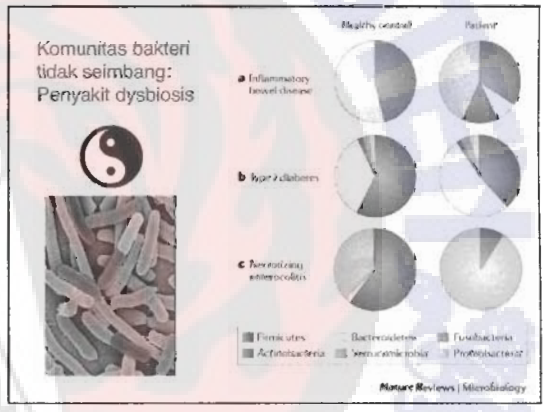


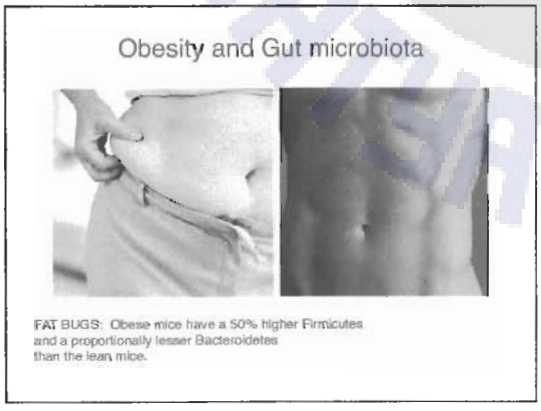



Mother's body habitat:
Oral mucosa
Vagina
Skin
Baby's delivery mode:
Vaginal
Cesarean
PC1: 12%
PC2: 9.8%
Delivery mode shapes the acquisition and structure of the initial microbiota across multiple body habitats in newborns

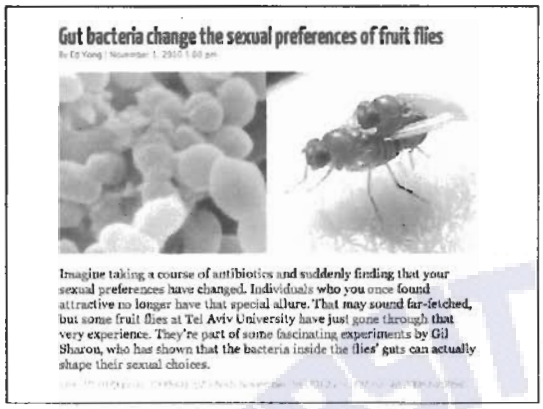

Breast or Bottle?
More than just mom's or cow's milk
Health Status
Skin Microbiota
Plastic Microbiota

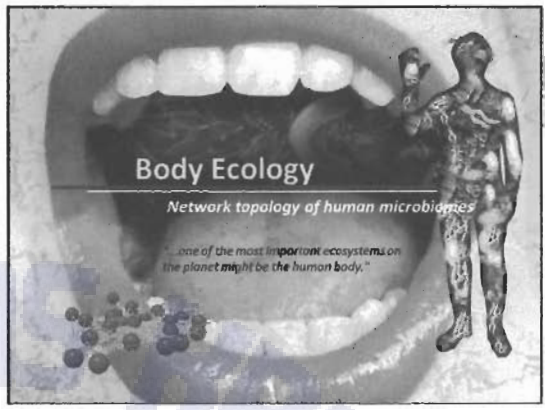

Effect of maternal exposures
Oral
Mammary, through breastfeeding
Cutaneous
Vaginal
Nature Reviews

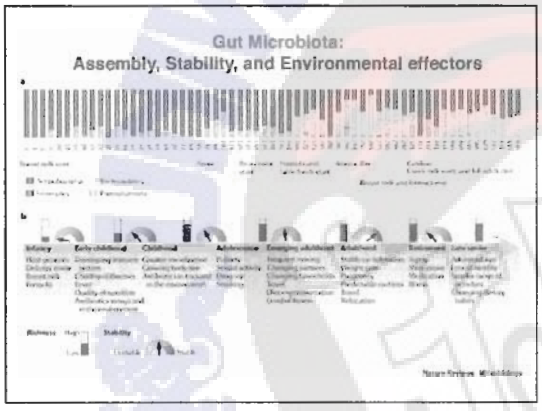

Komunitas bakteri tidak seimbang:
Penyakit dysbiosis
Nature Reviews | Microbiology


Obesity and Gut microbiota
FAT BUGS: Obese mice have a 50% higher Firmicutes and a proportionally lesser Bacteroidetes than the lean mice.


Gut Bacteria In Autistic Children Different From Non-Autistic Children
The Huffington Post UK
React > Amazing Inspiring Funny Scary Hot Crazy Important Weird
Follow >

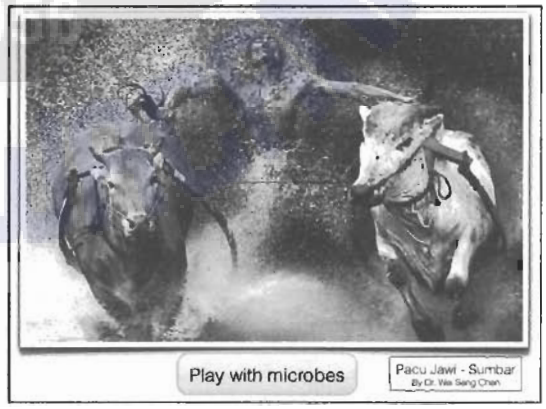

Gut bacteria change the sexual preferences of fruit flies
Imagine taking a course of antibiotics and suddenly finding that your sexual preferences have changed. Individuals who you once found attractive no longer have that special allure. That may sound far-fetched, but some fruit flies at Tel Aviv University have just gone through that very experience. They're part of some fascinating experiments by Gil Sharon, who has shown that the bacteria inside the flies' guts can actually shape their sexual choices.

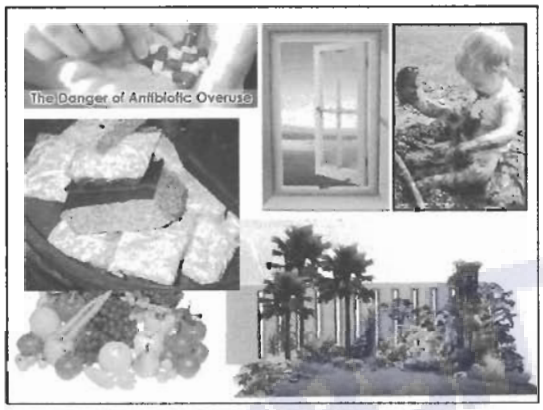

Body Ecology
Network topology of human microbiomes
"...one of the most important ecosystems on the planet might be the human body."

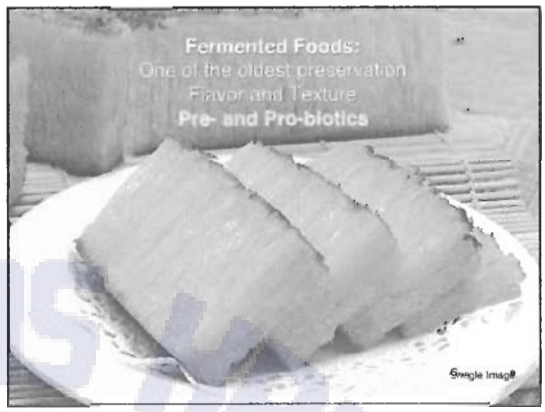

Gut Microbiota:
Assembly, Stability, and Environmental effectors

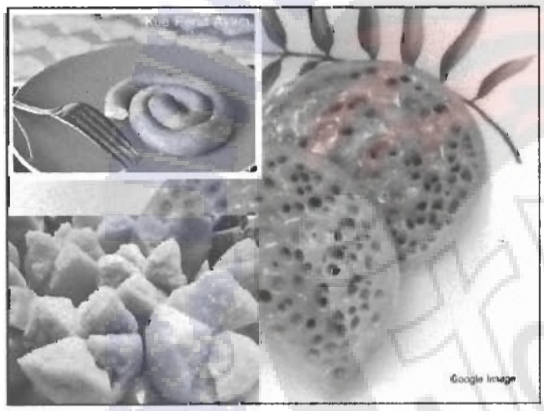

Human Microbiome
Protection from infections
Provide some vitamins/hormones
Immunity
Overall health and fitness

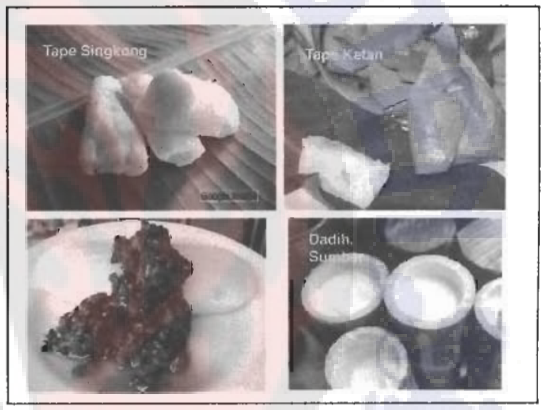

How to enhance
microbial diversity

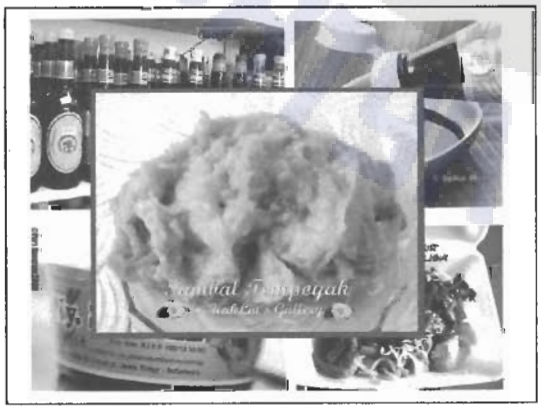

Play with microbes
Pacu Jawi - Sumbar
By Dr. Wei Seng Chen


The Danger of Antibiotic Overuse


Fermented Foods:
One of the oldest preservation
Flavor and Texture
Pre- and Pro-biotics

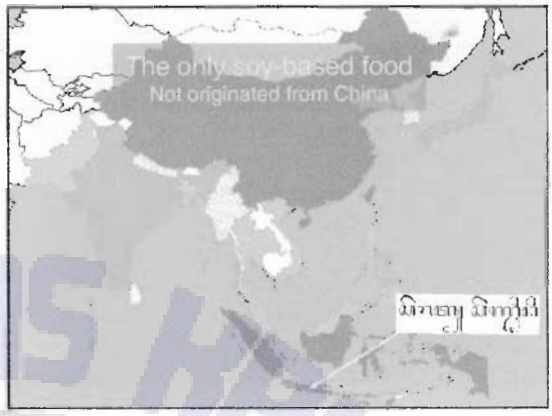

Google Image

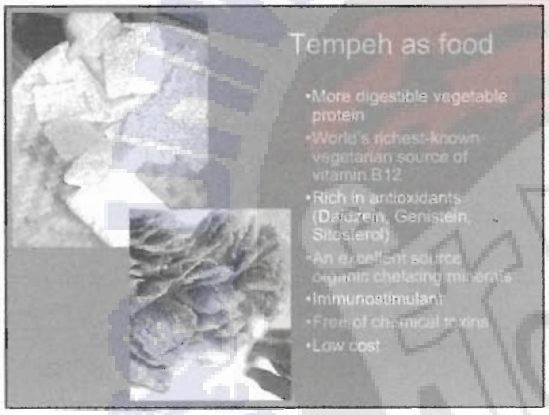

Tape Singkong
Tape Ketan
Dadih,

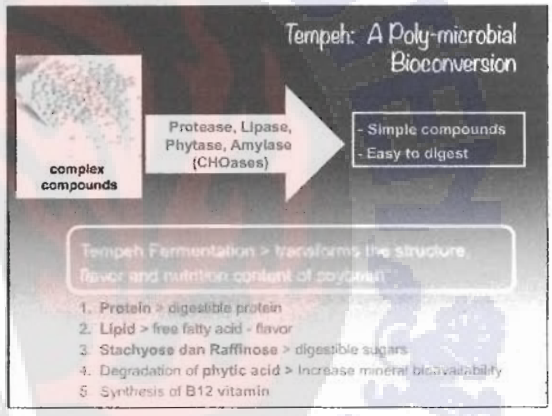


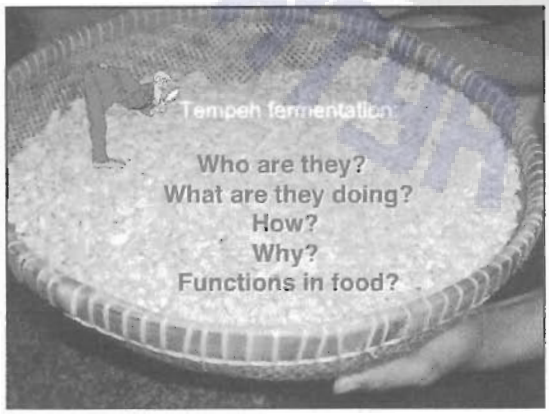

Satu-satunya makanan di dunia yang menggunakan Neurospora (kapang pembusuk roti), dan Bandung adalah ibukota penghasil makanan ini
Oncom

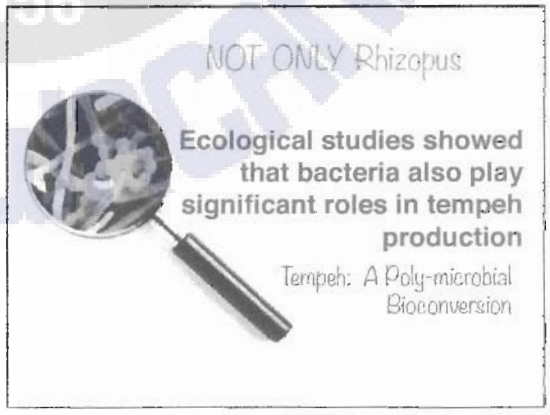

TEMPE = Tempeh
An integral part of Indonesian culture, esp. for Javanese and Balinese


The only soy-based food
Not originated from China


Tempeh as food
•More digestible vegetable protein
•World's richest-known vegetarian source of vitamin B12
•Rich in antioxidants (Daidzein, Genistein, Sitosterol)
•An excellent source organic chelating minerals
•Immunostimulant
•Free of chemical toxins
•Low cost


Tempeh: A Poly-microbial Bioconversion
complex compounds
Protease, Lipase, Phytase, Amylase (CHOases)
- Simple compounds
- Easy to digest
Tempeh Fermentation > transforms the structure, flavor and nutrition content of soybean
1. Protein > digestible protein
2. Lipid > free fatty acid - flavor
3. Stachyose dan Raffinose > digestible sugars
4. Degradation of phytic acid > Increase mineral bioavailability
5. Synthesis of B12 vitamin


Tempeh fermentation
Who are they?
What are they doing?
How?
Why?
Functions in food?


NOT ONLY Rhizopus
Ecological studies showed that bacteria also play significant roles in tempeh production
Tempeh: A Poly-microbial Bioconversion

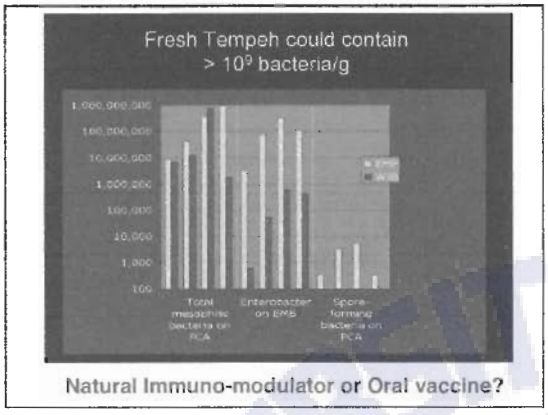
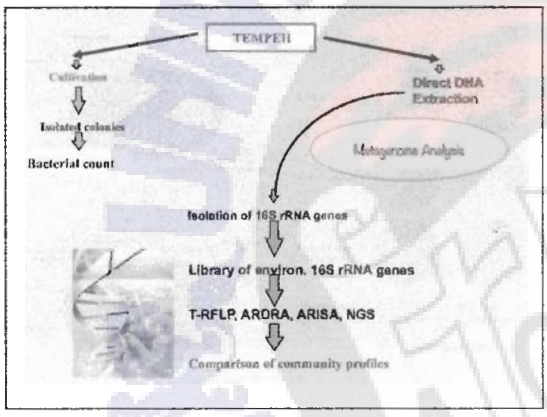
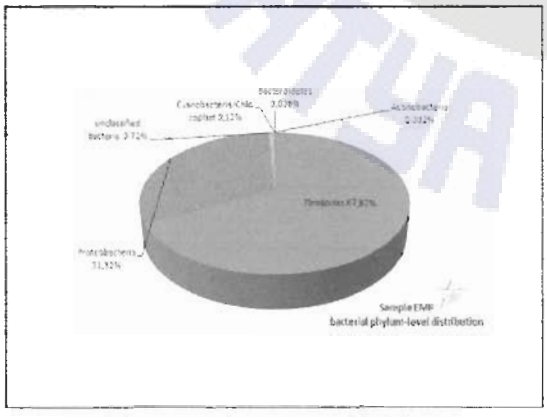
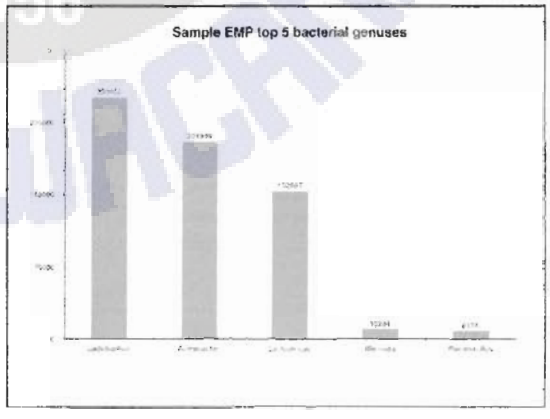

Fresh Tempeh could contain
> 10^9 bacteria/g
Natural Immuno-modulator or Oral vaccine?

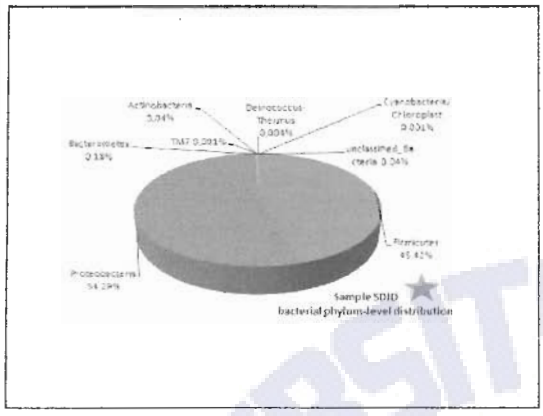

Plate Count: Standard Microbiology Procedure
Microbes in nature rarely live in isolation and
Most of them were not cultivable

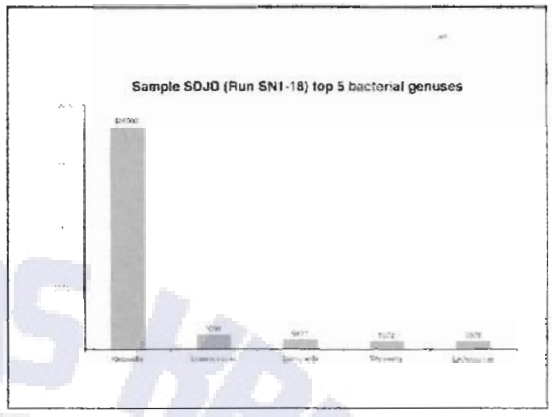

TEMPEH
Cultivation
Isolated colonies
Bacterial count
Direct DNA Extraction
Metagenome Analysis
Isolation of 16S rRNA genes
Library of environ. 16S rRNA genes
T-RFLP, ARDRA, ARISA, NGS
Comparison of community profiles

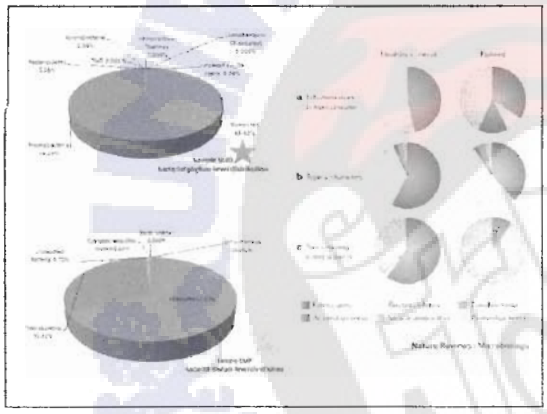

NGS for Tempeh
Semi conductor sequencing
• Ion Torrent 316 Chips with 200 bp sequencing kit
• Generated 2.4 million raw reads with variable lengths
• Data processing: Fastq file. Read length and quality filters; classified using Ribosomal Database Projects (RDP) – Multiclassifier tool
• MG-RAST

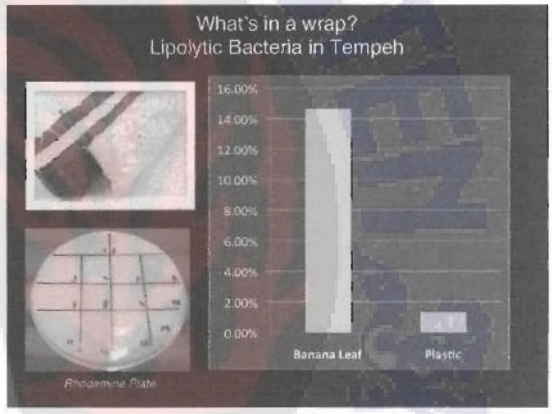


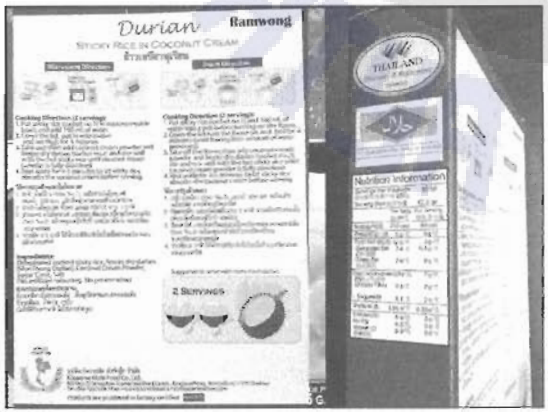

Sample EMP top 5 bacterial genuses

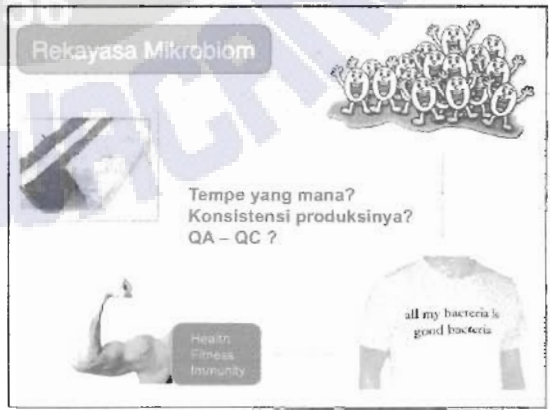

Actinobacteria 3.04%
Deinococcus-Thermus 0.004%
Cyanobacteria/Chloroplast 0.004%
TM7 0.091%
unclassified_bacteria 0.04%
Bacteroidetes 0.33%
Firmicutes 45.42%
Proteobacteria 54.29%
Sample SDJD
bacterial phylum-level distribution

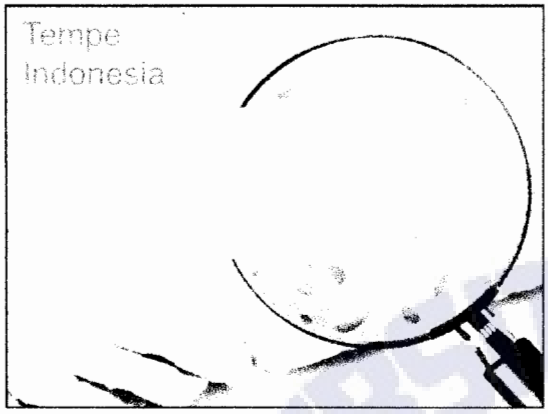

Sample SDJD (Run SN1-18) top 5 bacterial genuses



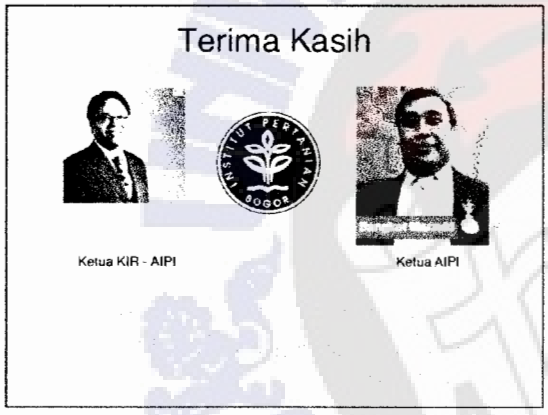

What's in a wrap?
Lipolytic Bacteria in Tempeh
16.00%
14.00%
12.00%
10.00%
8.00%
6.00%
4.00%
2.00%
0.00%
Banana Leaf
Plastic
Rhodamine Plate

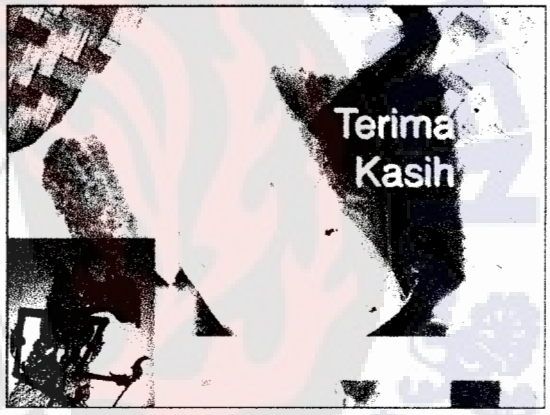

Durian
Ramwong
THAILAND
Nutrition Information
2 SERVINGS


Rekayasa Mikrobiom
Tempe yang mana?
Konsistensi produksinya?
QA – QC ?
Health
Fitness
Immunity
all my bacteria is
good bacteria


Tempe
Indonesia


Terima
Cecilia Seumahu
Univ Pattimura
Ambon
Tati Barus
Unika Atma Jaya
Jakarta
Nurul Aini
PT Laborindo
Sarana, Jakarta


Terima Kasih
Ketua KIR - AIPI
Ketua AIPI


Terima
Kasih

LEMBAR PERTANYAAN
SEMINAR NASIONAL MIKROBIOLOGI FB-UKSW
SALATIGA, 24 JUNI 2014

Nama : Retno Wulandari, (Fakultas Teknologi-Univ. Atma Jaya, Yogyakarta
Ditujukan kepada : Prof. Dr. Antonius Suwanto

Pertanyaan :

1. Bagaimana pendapat Bapak mengenai isu bahwa produk kedelai berfermentasi justru menjadi pemicu pertumbuhan pada sel-sel kanker, seperti pada kanker payudara, servix. Apa yang salah dan mekanisme apa yang terjadi ?

2. Bagaimana jika pembungkus tempe menggunakan bio-edible film apakah dapat sedikit membantu menjaga mikrobia baik yang ada di dalamnya disbanding dengan menggunakan bahan plastik ?

LEMBAR PERTANYAAN
SEMINAR NASIONAL MIKROBIOLOGI FB-UKSW
SALATIGA, 24 JUNI 2014

Nama : Jacqueline Hayu Sri Lestari
Ditujukan kepada : Prof. Dr. Antonius Suwanto

Pertanyaan :

1. Bagaimana perbedaan antara tempe kedelai local dan import ? mana lebih baik, terutama dengan issue bahwa kedelai import adalah kedelai hasil GMD, sedangkan dengan GMD gen pada kedelai lebih dapat dikontrol ?

2. Bagaimana pula dengan diversifikasi pangan local misalnya pembuatan tempe dari kedelai hitam ? Apakah hal ini menimbulkan perbedaan yang signifikan pada keanekaragaman mikrobia pada tempe tersebut ?

LEMBAR PERTANYAAN
SEMINAR NASIONAL MIKROBIOLOGI FB-UKSW
SALATIGA, 24 JUNI 2014

Nama : Richard d. Anggada
Ditujukan kepada : Prof. Dr. Antonius Suwanto

Pertanyaan :

1. Apa ada cara masak/pengolahan terbaik untuk merusak makanan khususnya tempe untuk mendapatkan manfaat maksimal dari mikroba ?

2. Apa ada hubungan antara orang jalanan (gepeng orang gila) dengan antibody yang berasal dari mikroorganisme ?

3. Oncom ----> tempe bosok ? pengaruh dimana ? karena Salatiga tidak bisa bikin oncom

LEMBAR PERTANYAAN
SEMINAR NASIONAL MIKROBIOLOGI FB-UKSW
SALATIGA, 24 JUNI 2014

Nama : Lovely E.Lelatobur (412012014@student.uksw.edu)
Ditujukan kepada : Prof. Dr. Antonius Suwanto

Pertanyaan :

1. Mengapa proses pembuatan tempe yang Bapak katakana di Amerika berbeda dengan di Indonesia ? Apakah karena teknik pembuatannya yang berbeda ? Padahal bahannya sama yaitu kedelai

2. Seperti yang telah dikatakan bahwa ada beragam jenis bakteri didalam tempe yang beberapa diantaranya merupakan penghasil vitamin B12. Apakah ada range waktu selama fermentasi antara kadar vitamin B12 dengan macam bakteri yang ada ?

LEMBAR PERTANYAAN
SEMINAR NASIONAL MIKROBIOLOGI FB-UKSW
SALATIGA, 24 JUNI 2014

Nama : Catherine Tiara (cath.kath@gmail.com)
Ditujukan kepada : Prof. Dr. Antonius Suwanto

Pertanyaan :

1. Apakah mungkin untuk dilakukan metagenome analysis menggunakan peralatan standar laboratorium molekuler ?
   Jika iya, seguencing dilakukan untuk total genomic atau fragmen tertentu genom ? Bagaimana (latar belakang : begitu beragam pangan hasil fermentasi di Indonesia selain tempe, untuk dipaparkan/dikaji secara metagenome analysis, keragaman mikroba-nya) metode tersebut dilakukan ?

2.