

### The Story of Soil – Microbiomes

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### Insights From The Microbial World

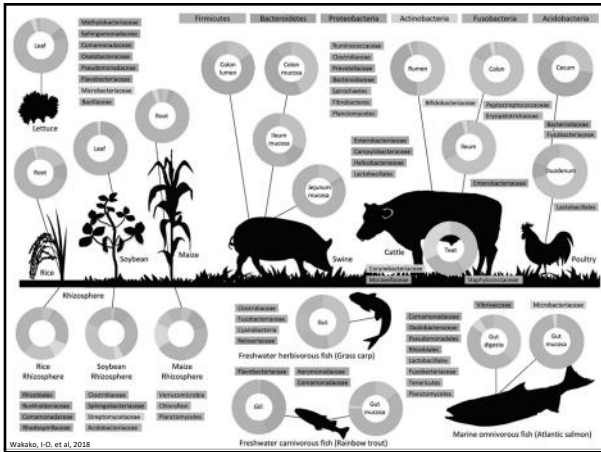
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### MICROBIOMES

- specialized communities of microbes in and on host organism
- they dovetail with host cells and genes
- transformative in acquiring, processing, and creating nutrients for host

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### Microbes, Roots, Guts, & Soil

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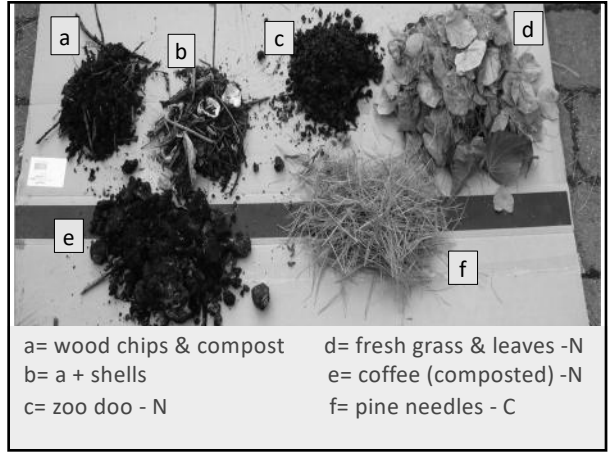
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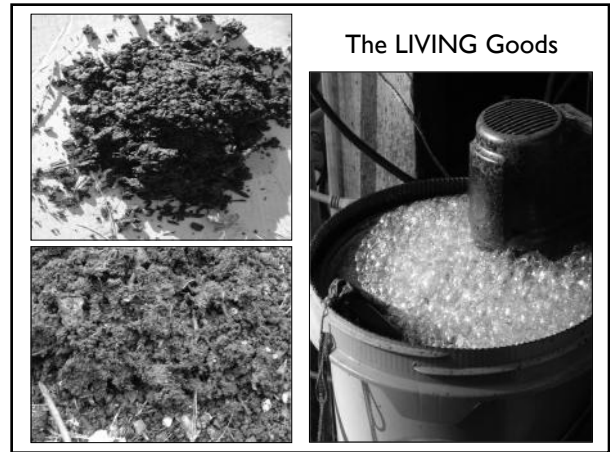
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**Mesofauna**

Barely visible,  
around 1 mm

21



**Springtails**

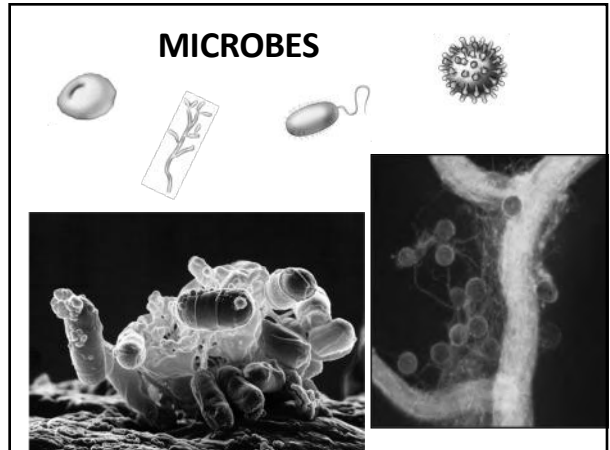
mostly  
decomposers

22



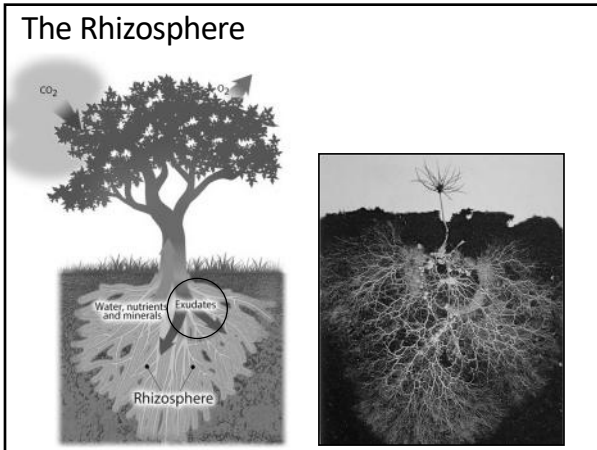
Oribatid  
mite  
grazer on  
dead plants

23

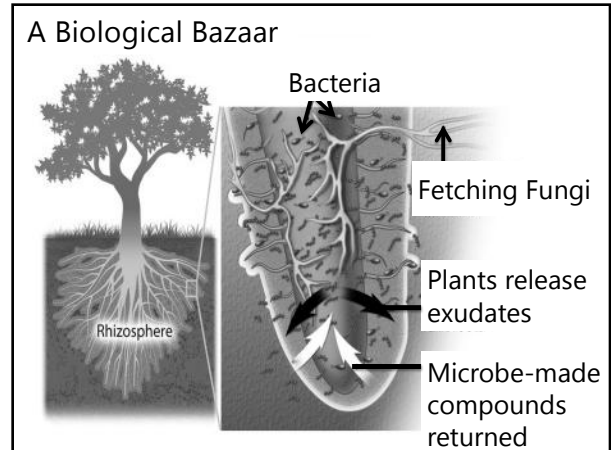


**MICROBES**

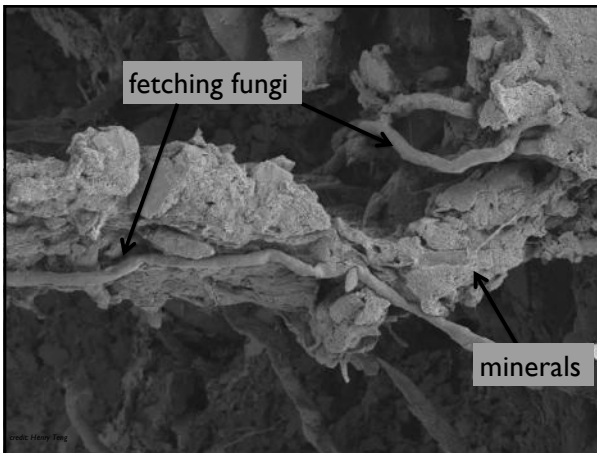
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### Regulation and function of root exudates

DAYAKAR V. BADRI & JORGE M. VIVANCO  
 Centre for Rhizosphere Biology and Department of Horticulture and LA, Colorado State University, Fort Collins, CO 80523, USA

**Table 1.** Classes of compounds released in plant root exudates

Class of compounds	Single components <sup>a</sup>
Carbohydrates	Arabinose, glucose, galactose, fructose, sucrose, pentose, rhamnose, raffinose, ribose, xylose and mannitol
Amino acids	All 20 proteinogenic amino acids, 1-hydroxyproline, homoserine, methionine, aminobutyric acid
Organic acids	Acetic acid, succinic acid, L-aspartic acid, malic acid, L-glutamic acid, salicylic acid, shikimic acid, isocitric acid, chlorogenic acid, sinapic acid, caffeic acid, p-hydroxybenzoic acid, gallic acid, tartaric acid, ferulic acid, protocatechuic acid, p-coumaric acid, murgic acid, oxalic acid, citric acid, p-coumaric acid
Flavonols	Naringenin, kaempferol, quercetin, myricetin, naringin, rutin, genistein, strigolactone and their substitutes with sugars
Lignins	Catechol, benzoic acid, nicotinic acid, pterogluclitol, cinnamic acid, gallic acid, ferulic acid, syringic acid, sinapoyl aldehyde, chlorogenic acid, coumaric acid, vanillin, sinapyl alcohol, quinic acid, pyrogallotanic acid
Coumarins	Benzoic acid, coumaric acid, ferulic acid, gallic acid, ferulic acid, syringic acid, sinapoyl aldehyde, chlorogenic acid, coumaric acid, vanillin, sinapyl alcohol, quinic acid, pyrogallotanic acid
Umbelliferone	Benzoic acid, coumaric acid, ferulic acid, gallic acid, ferulic acid, syringic acid, sinapoyl aldehyde, chlorogenic acid, coumaric acid, vanillin, sinapyl alcohol, quinic acid, pyrogallotanic acid
Aurones	Benzoic acid, coumaric acid, ferulic acid, gallic acid, ferulic acid, syringic acid, sinapoyl aldehyde, chlorogenic acid, coumaric acid, vanillin, sinapyl alcohol, quinic acid, pyrogallotanic acid
Glycosinolates	Cyclohexanone, desaphogonin, desaphogonitrin, desaphogonolactin, desaphogonolactin
Anthocyanins	Cyanidin, delphinidin, pelargonidin and their substitutes with sugar molecules
Indole compounds	Indole-3-acetic acid, brassinin, brassin, methyl indole-3-carboxylate, castalein glucoside
Fatty acids	Linoleic acid, oleic acid, palmitic acid, stearic acid
Sterols	Campesterol, stigmasterol, stigmasterol
Allonones	Juglone, sorgolone, 5,7,8-trihydroxy-3',5'-dimethoxyflavone, DIMBOA, DIBOA
Proteins and enzymes	PR proteins, lectins, proteases, acid phosphatases, peroxidases, hydrolases, lipase

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Proteins and enzymes	PR proteins, lectins, proteases, acid phosphatases, peroxidases, hydrolases, lipase

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**MEALS FOR MICROBES!!**

**Carbs**

**Phytochemicals**

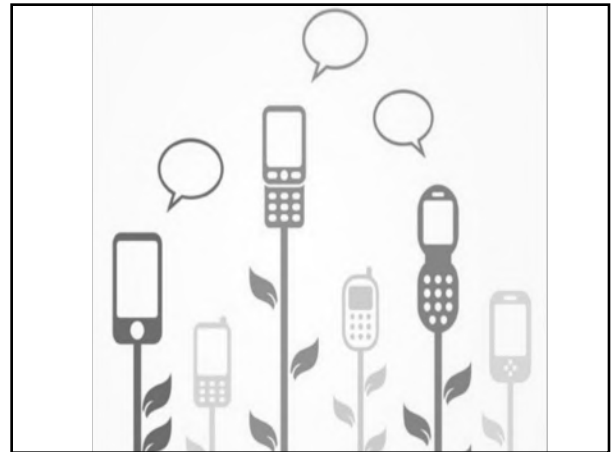
**Fats**

**Proteins**

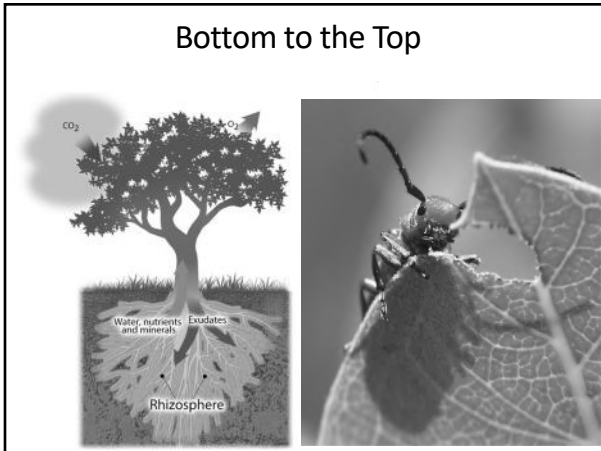
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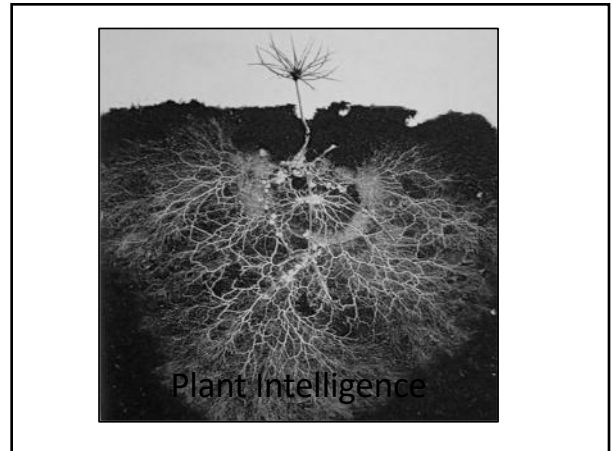
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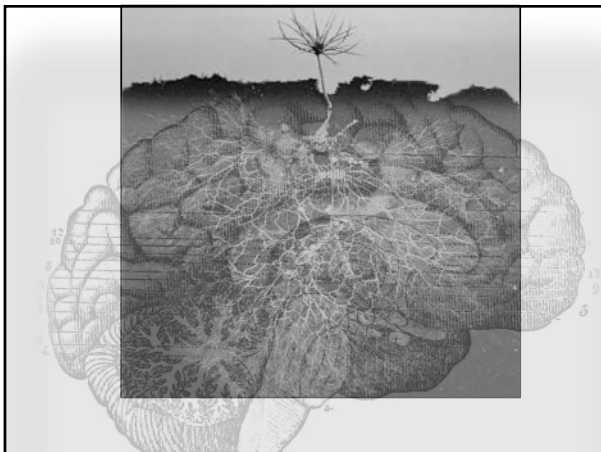
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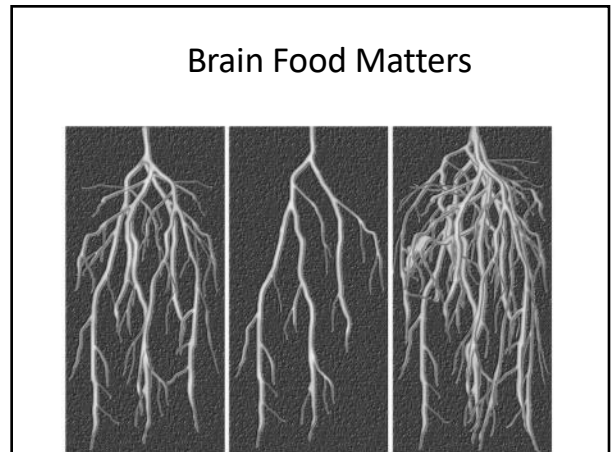
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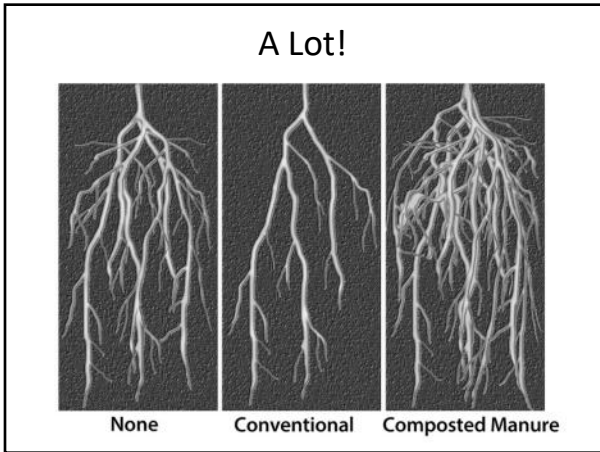
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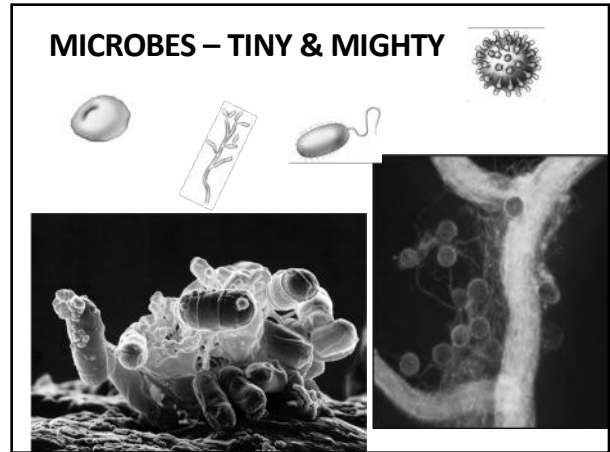
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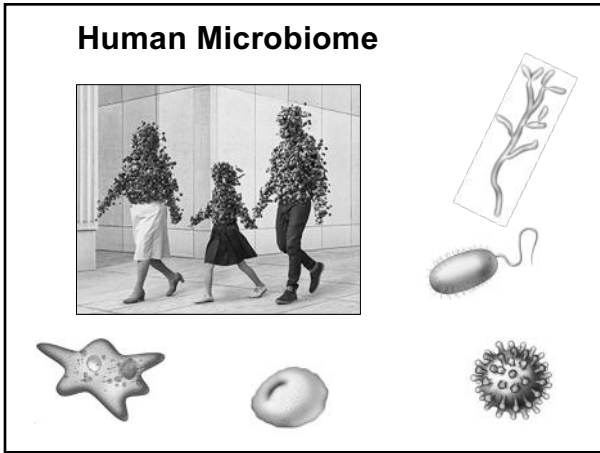
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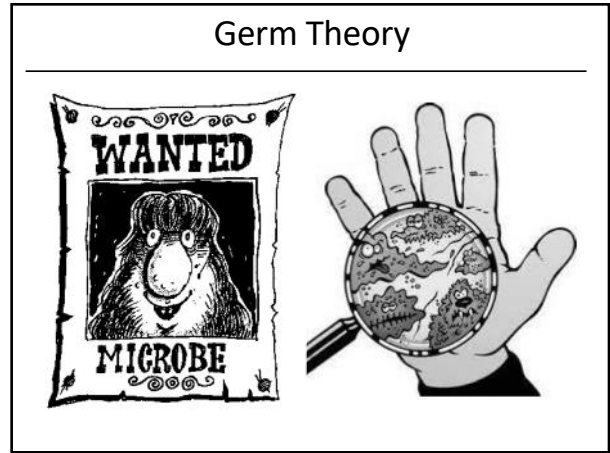
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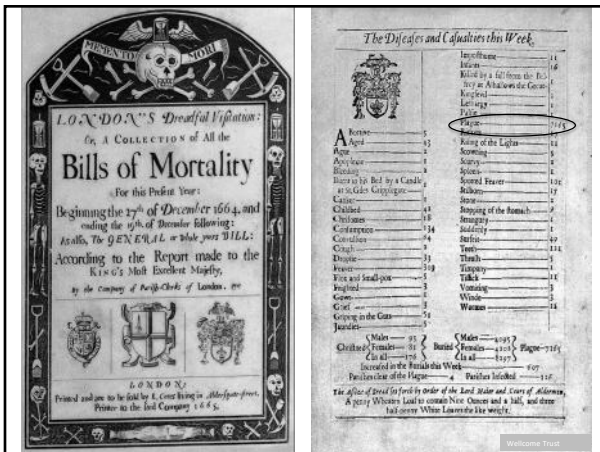
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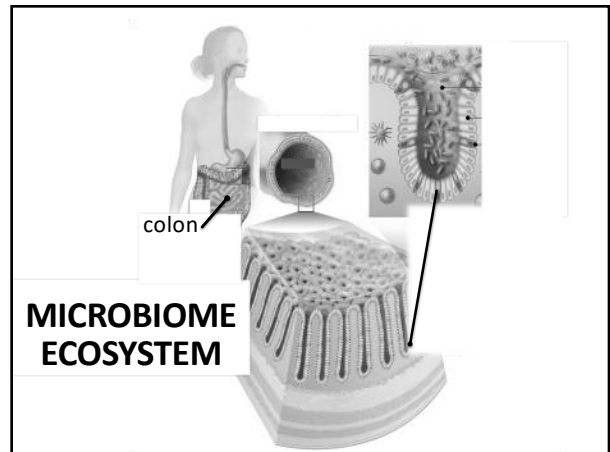
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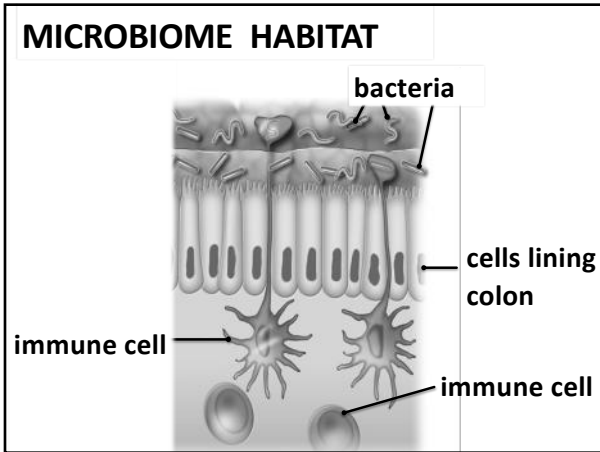
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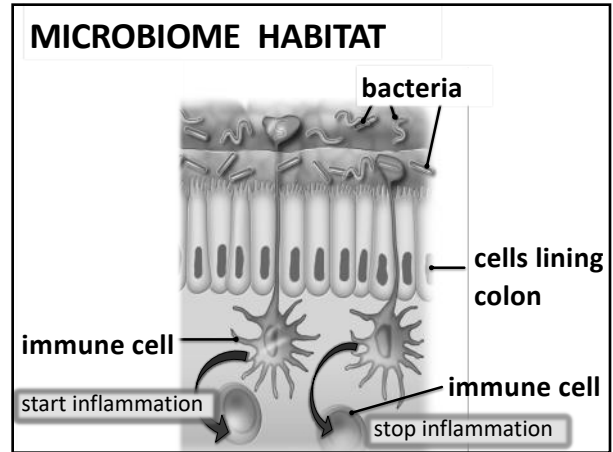
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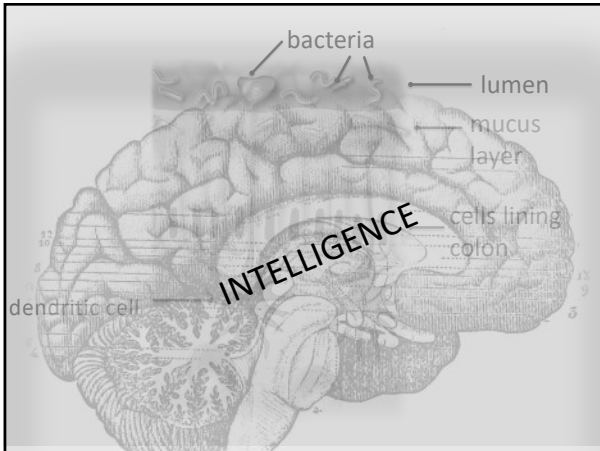
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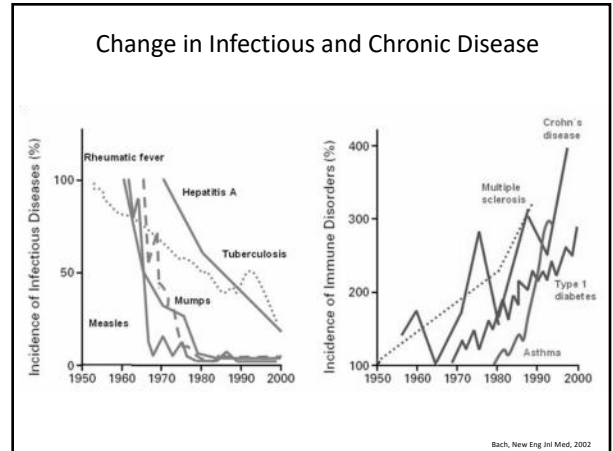
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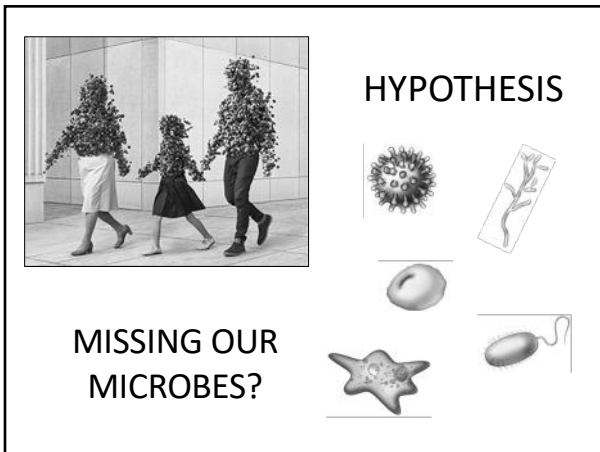
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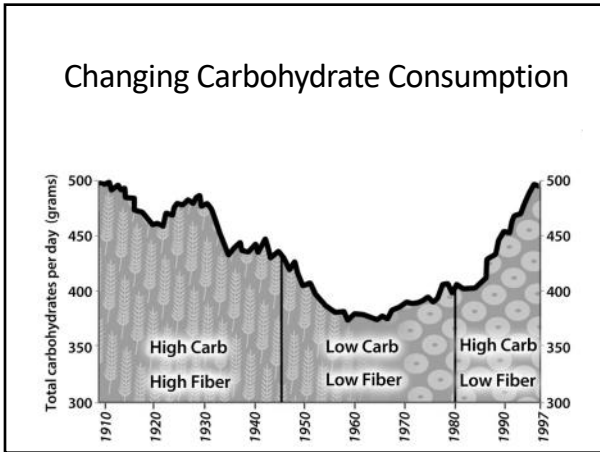


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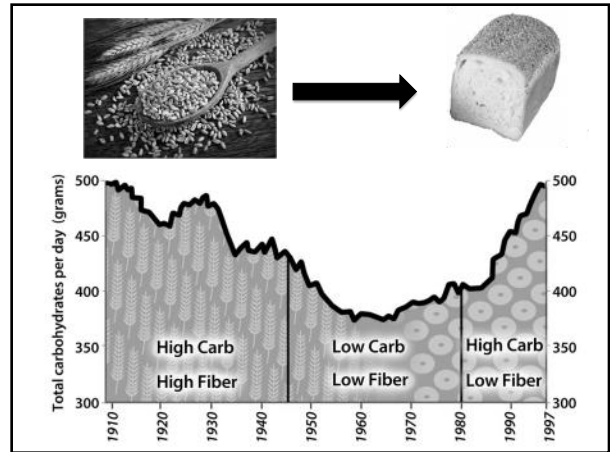


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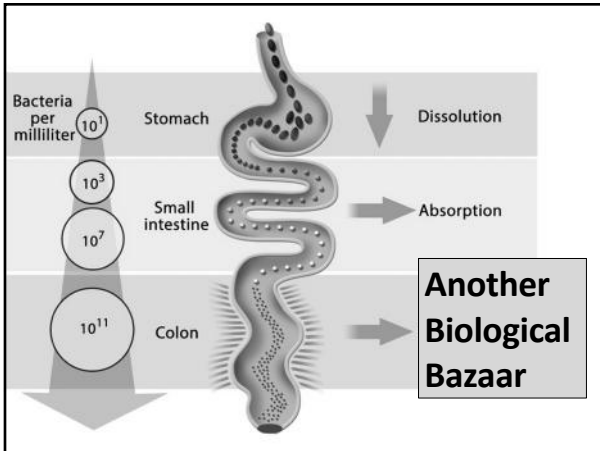




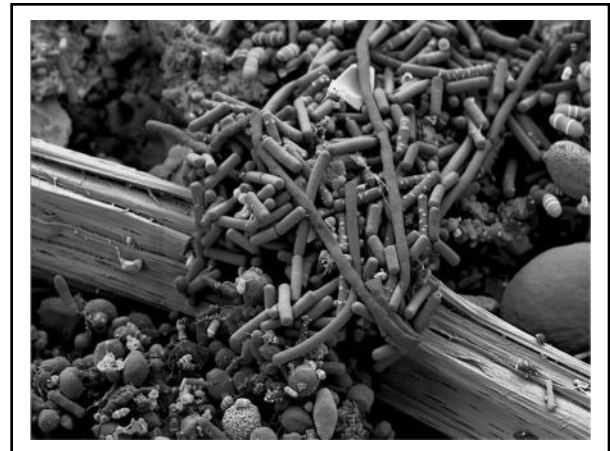
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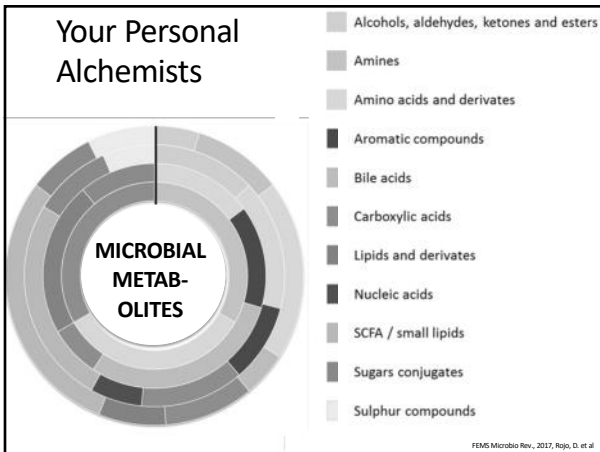
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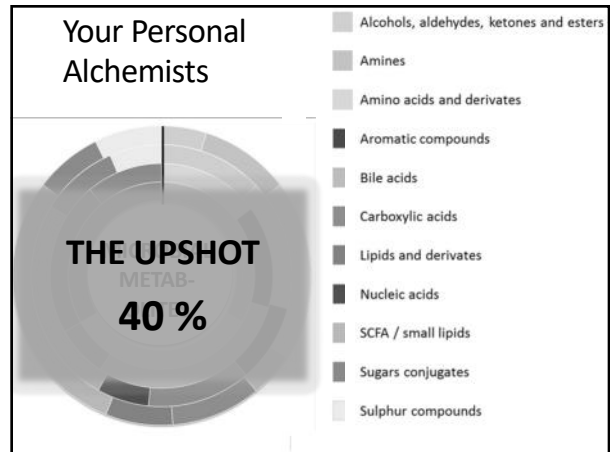
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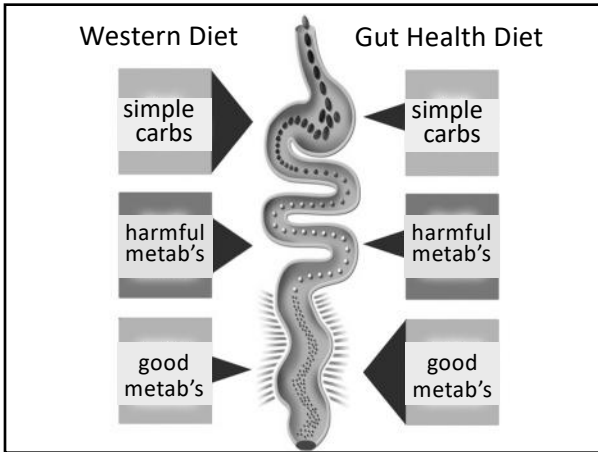
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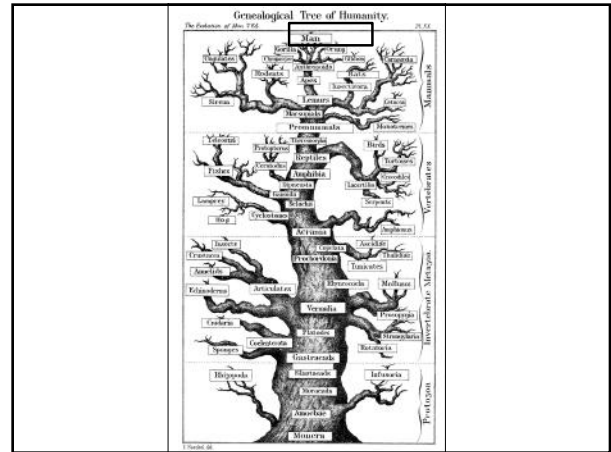
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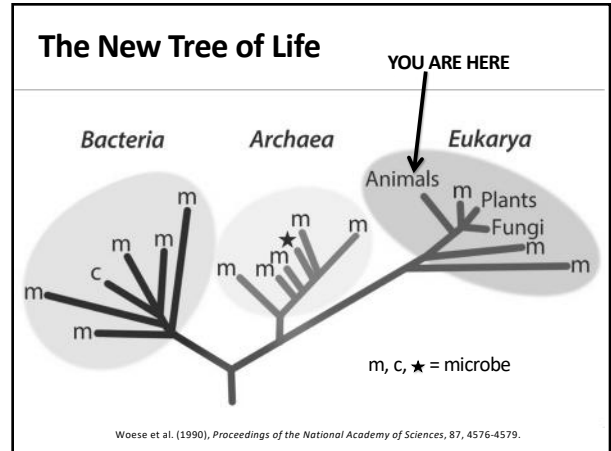
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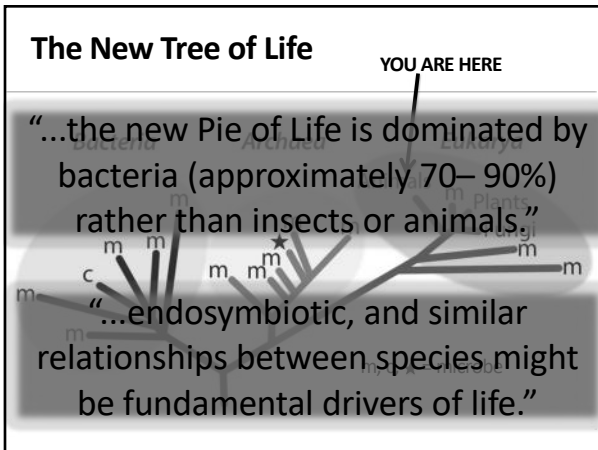
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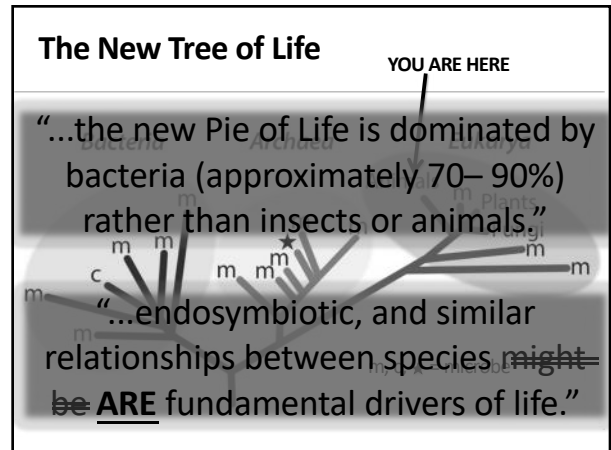
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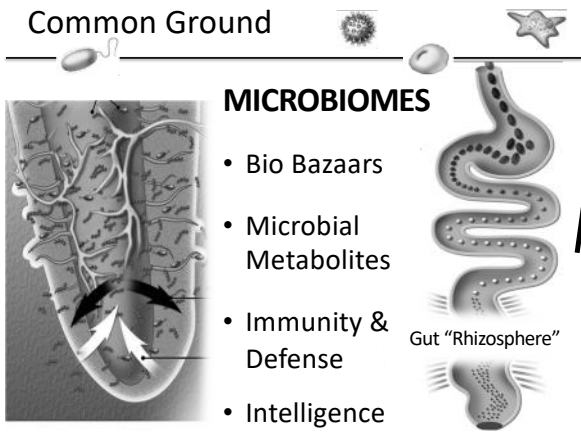


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Common Ground



**MICROBIOMES**

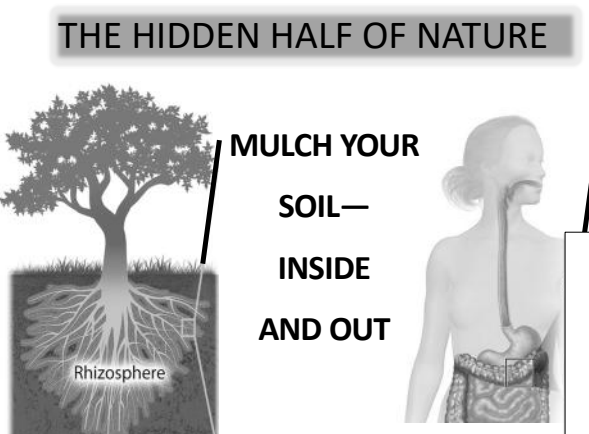
- Bio Bazaars
- Microbial Metabolites
- Immunity & Defense
- Intelligence

Gut "Rhizosphere"

The diagram shows a human gut on the left and a soil profile on the right, both containing various microorganisms. A central vertical line connects the two, with arrows pointing to the text 'Gut "Rhizosphere"'. Above the diagram are icons of a microorganism, a star, and a leaf.

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**THE HIDDEN HALF OF NATURE**




**MULCH YOUR SOIL— INSIDE AND OUT**

Rhizosphere

The diagram features a tree on the left with its roots in the soil, and a human silhouette on the right showing internal organs. A vertical line connects the tree's roots to the human's gut. The word 'Rhizosphere' is written in the soil. The text 'THE HIDDEN HALF OF NATURE' is in a grey box at the top, and 'MULCH YOUR SOIL— INSIDE AND OUT' is in a grey box in the middle.

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**The Problem**

**The Insight**

**The How-To**

**The Stakes**

The diagram shows four book covers: 'dirt: The Erosion of Civilizations' (top left), 'GROWING A REVOLUTION: BRINGING OUR SOIL BACK TO LIFE' (bottom left), 'WHAT YOUR FOOD ATE: HOW HEALTHY OUR LAND AND OUR HEALTH' (bottom right), and 'THE HIDDEN HALF OF NATURE: THE MICROBIOMES' (top right). A horizontal line is drawn above the covers. A vertical line connects 'The Problem' to 'The How-To'. A vertical line connects 'The Insight' to 'The Stakes'. A vertical line connects 'The Problem' to 'The Stakes'.

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