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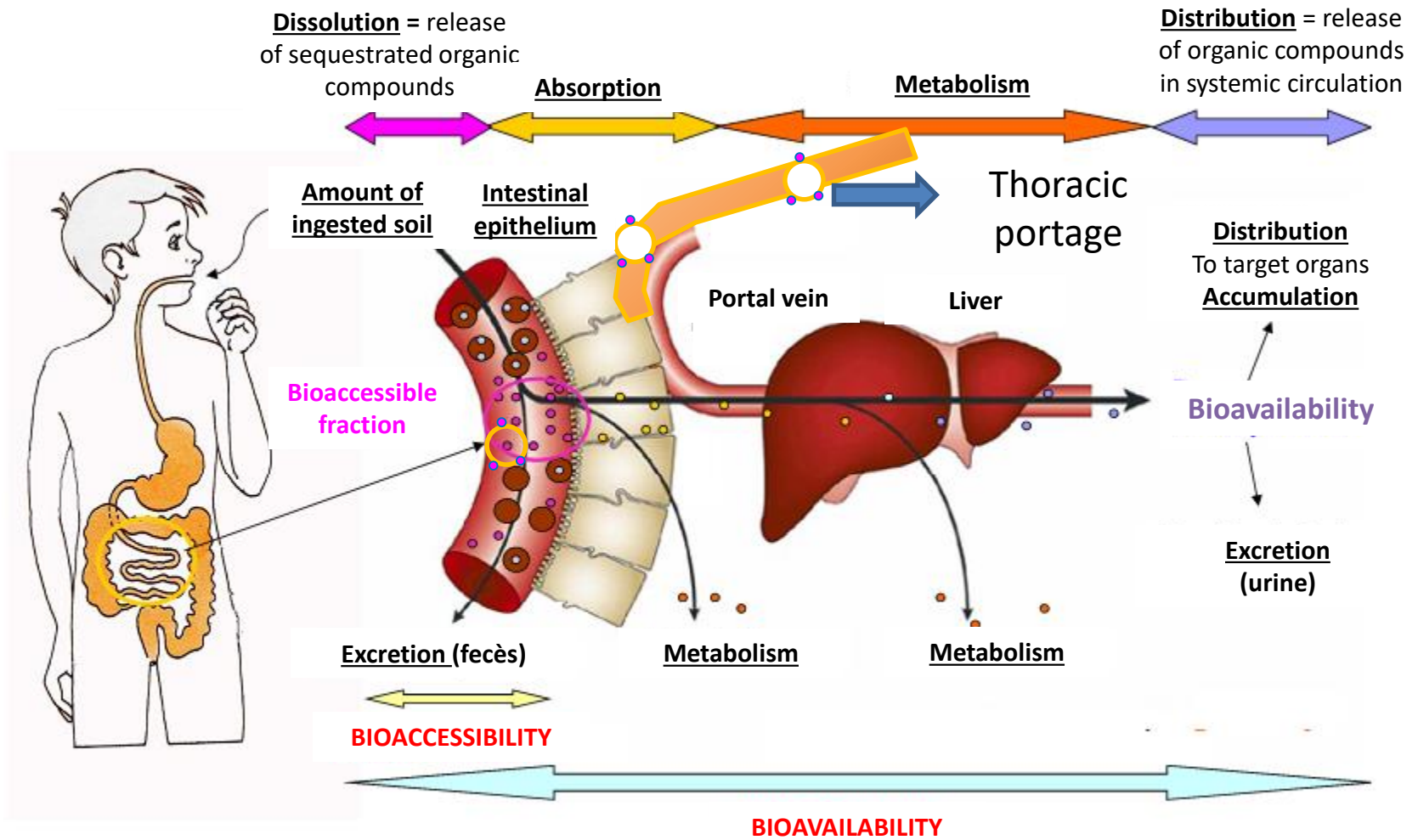
**EXPOSURE ASSESSMENT OF SEQUESTERED ORGANIC COMPOUNDS IN
POLLUTED SITES AND SOILS: USE OF A JUVENILE ANIMAL MODEL TO
ESTIMATE THEIR RELATIVE BIOAVAILABILITY.**

MATTHIEU DELANNOY, AGNÈS FOURNIER, GUIDO RYCHEN, CYRIL FEIDT.

11TH JULY 2013 – SEGh LECTURE - TOULOUSE

I- EXPOSURE ASSESSMENT AND RELATIVE BIOAVAILABILITY

I.1- Place of bioavailability in exposure assessment



● Ingested soil particles

○ Ingested toxic substance

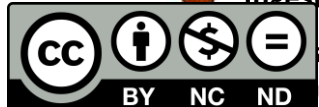
● Dissolved toxic substance

○ Fraction of substance

● Metabolized fraction of substance

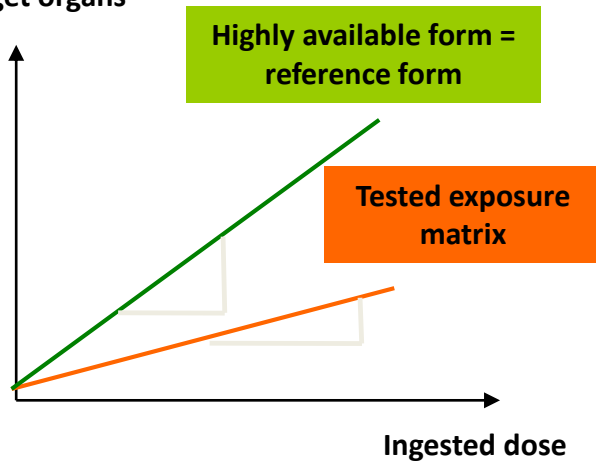
○ toxic

● Bioavailable fraction of toxic substance



I.2- Relative bioavailability and comparison of exposure media

Concentrations in target organs



BR = slope ratio

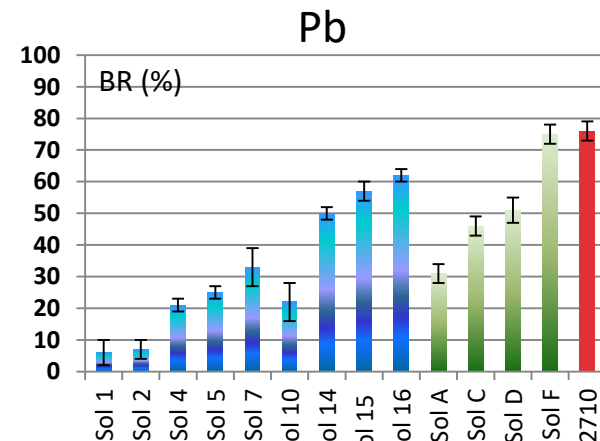
Use in order to validate bioaccessibility methodology.

Validity criteria

- same dose-response pattern between exposure and reference media
- Assessment of relative bioavailability inside linearity domain of the dose response pattern

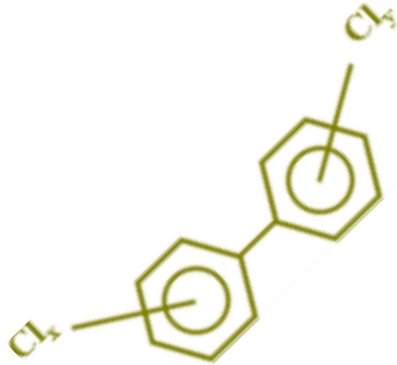
Interests

- Based upon biological effects, target organs specialized in accumulation, metabolism, excretion of compounds
- Used by sanitary agencies



II- SOIL INGESTION AND ASSESSMENT OF ORAL-EXPOSURE TO NDL-PCBs

1.2- Population at risk and NDL-PCBs hazard



- **Family of 209 congeners**
- **Bioaccumulative and ubiquitous (POPs)**
- **7 PCBs frequently retrieved in environmental matrices and foodstuff are basis of regulatory approaches**
 - PCB 28; PCB 52; PCB 101; PCB 118; PCB 136; PCB 153; PCB 180
- **2 different toxicity profiles: Dioxin like and non-dioxin-like**

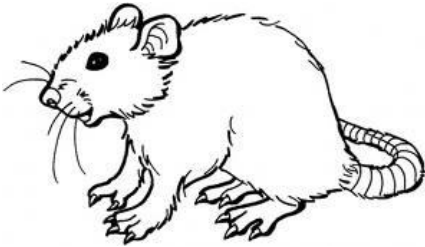
Children (1-3 years) = population at risk



- **Children behavior: *hand to mouth***
 - **Vulnerability**
 - Immature metabolism
 - Development phase
- ⇒ **Increased exposure and sensitivity to toxicity impairments.**

US-EPA (2011) : 200 mg/j of soil and/or dusts for children (0 à 6 years).

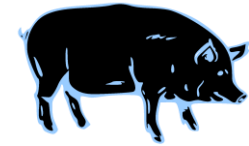
II.2- Animal model for children animal exposure.



- Manipulation advantage
- Absorption mechanisms differs than those of human
- Coprophagia and intestinal and gastric pH differs to.



- Ethical consideration concerning manipulations of primates. Closest model to human.



- Adequate model of digestive tract of children.
- Slow development .
- Few coprophagia.
- Appropriate model according to environmental agencies. (USEPA, 2007)

II.3- Soil and retention of NDL-PCBs.



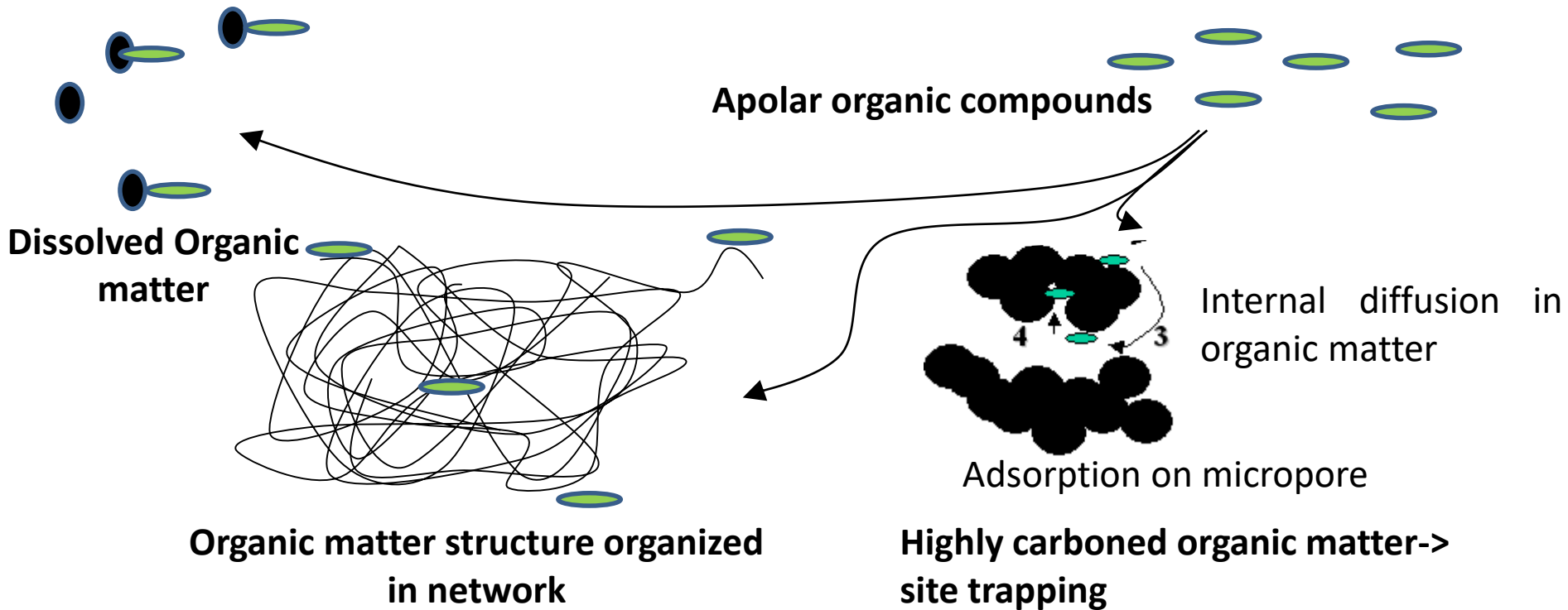
Characteristics of soil ↔ retention of NDL-PCBs through digestive process

-Determine **variation factors of bioavailability of NDL-PCBs contaminated soils.**

-Impact of these variation factors on NDL-PCBs relative bioavailability
-Useful of these variation factors in risk assessment

III- HYPOTHESIS AND OBJECTIVES OF THE STUDY

III.1- Importance of organic matter – *schematic retention of organic compounds.*



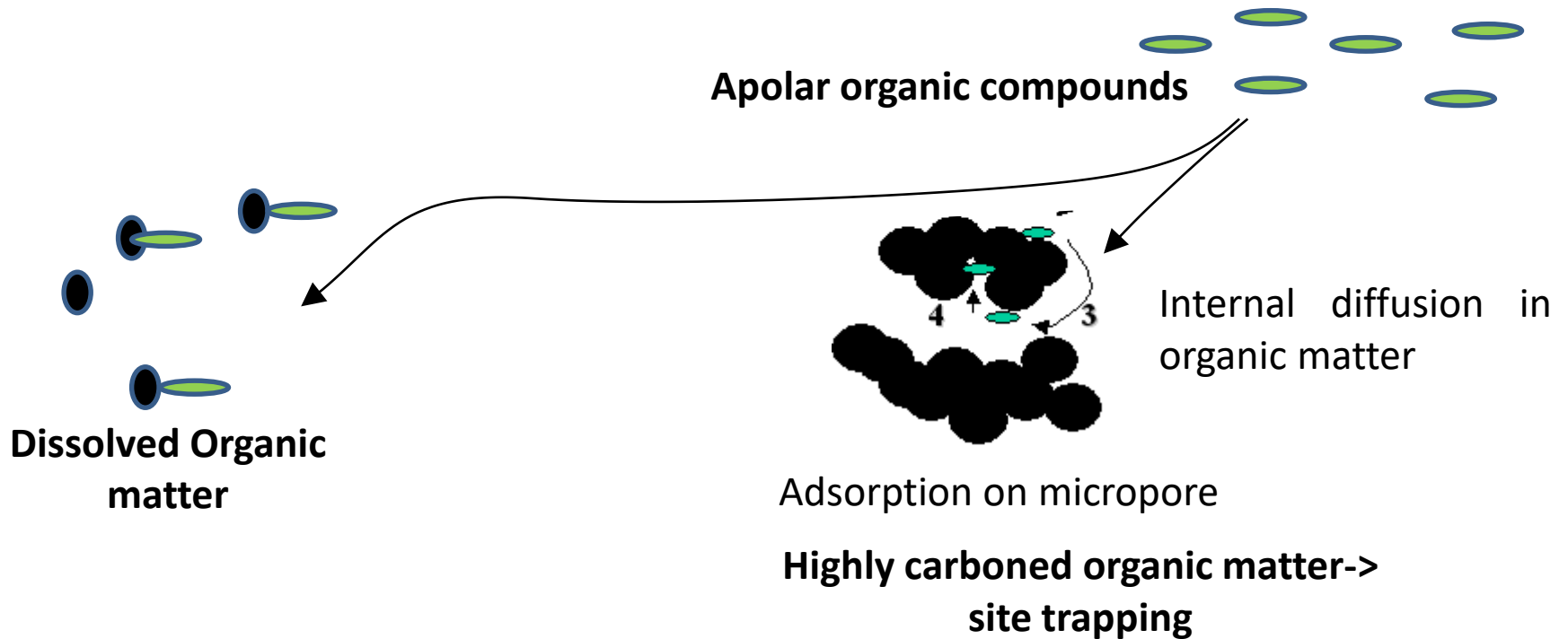
condensation

Condensation of organic matter and behavior models of organic matter retention



Lack of *in vivo* data to perform an exposure assessment

III.2- Importance of organic matter – *schematic retention of organic compounds.*



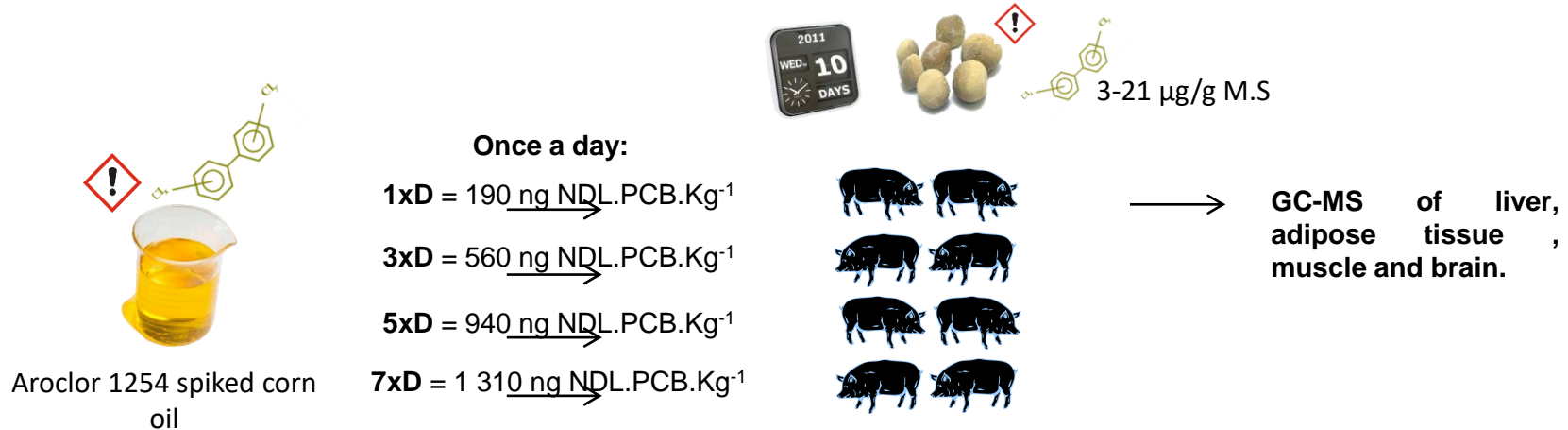
Weak retention of ND-L-PCBs

Important retention of ND-L-PCBs

IV- ASSESSMENT OF LINEARITY

IV.1- Assessment of linearity of dose-reponse pattern

MATERIAL AND METHODS



4 groups (n=2) of castrated weaned piglets were exposed during 10 days;

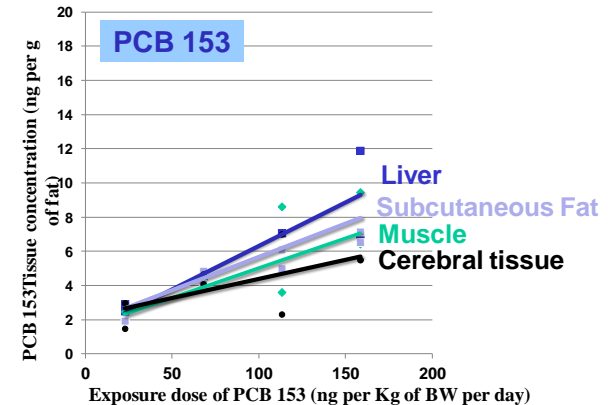
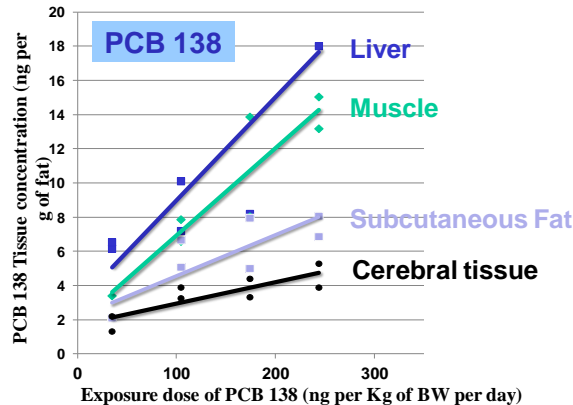
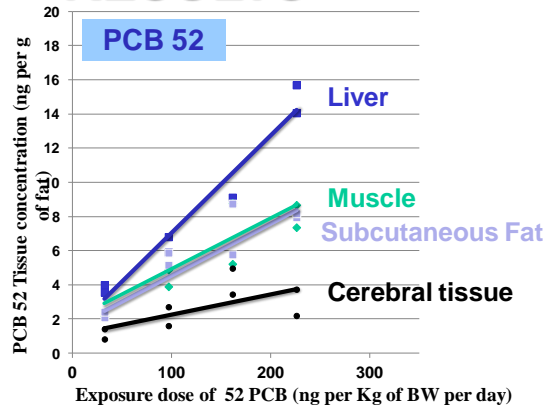
Biological matrices were selected :

- Adipose tissue** : lipophilic and bioaccumulative characteristics of NDL-PCBs.
- Liver** : metabolism.
- Brain** : neurological toxicity of NDL-PCBs

Sample : Highly perfused and importance in body weight

IV.2- Assessment of linearity of dose-reponse pattern

RESULTS



| | | PCB 52 | PCB 138 | PCB 153 |
|------------------|-------------------------------|--------|---------|---------|
| Liver | slope (y/x .10 ²) | 57,0 | 51,0 | 60,3 |
| | R ² | 0,96 | 0,78 | 0,80 |
| | p | 0,001 | 0,001 | 0,009 |
| Subcutaneous fat | slope(y/x .10 ²) | 29,7 | 24,0 | 34,9 |
| | R ² | 0,83 | 0,83 | 0,91 |
| | p | 0,002 | 0,001 | 0,000 |
| Muscle | slope(y/x .10 ²) | 30,5 | 39,1 | 51,1 |
| | R ² | 0,76 | 0,71 | 0,92 |
| | p | 0,010 | 0,005 | 0,049 |
| Cerebral Tissue | slope(y/x .10 ²) | 1,18 | 1,26 | 51,1 |
| | R ² | 0,43 | 0,71 | 0,43 |
| | p | N.S. | 0,009 | N.S. |

- Similar responses were obtained from all studied congener
- **Linear regression is significant for liver, muscle and adipose tissue.**
- Higher concentrations were obtained in liver.
- Cerebral tissue doesn't provide a significantly relationship

→ **La linéarité de la relation dose-réponse semble significative pour le tissu adipeux, musculaire et hépatique.** Le niveau de concentration faible dans le tissu cérébral n'a pas permis de montrer la linéarité de la relation dans ce tissu.

V- IMPACT OF ORGANIC MATTER CONDENSATION ON RELATIVE BIOAVAILABILITY OF NDL-PCBS CONTAMINATED SOILS.

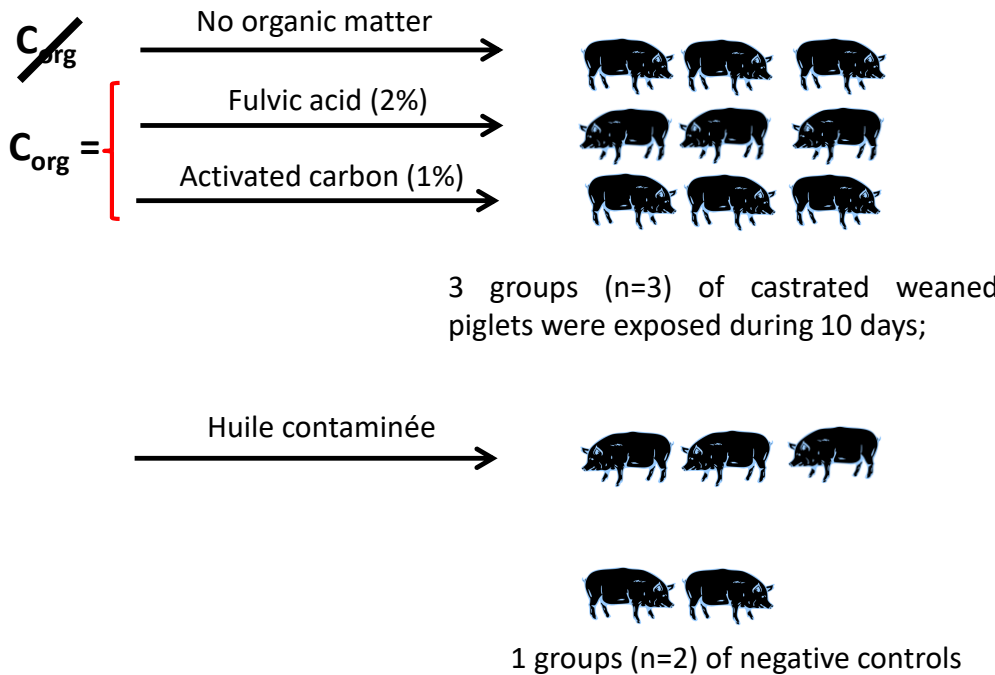
MATERIAL ET METHODS



Artificial soil: 19,2µg of Aroclor 1254/g of D.M.



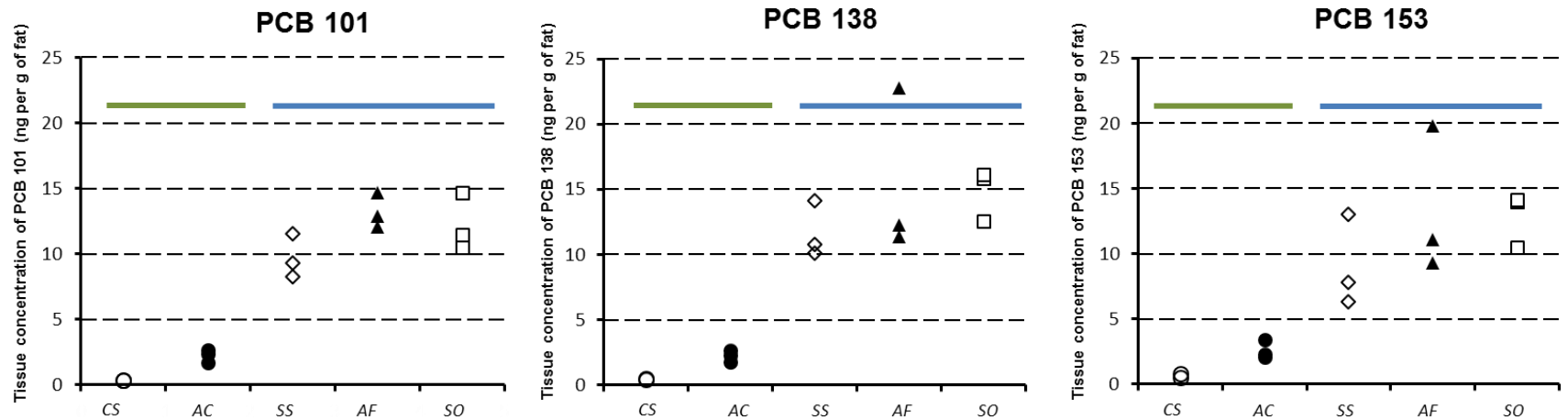
Spiked corn : 19,2µg of Aroclor 1254/g



GC-MS of liver, adipose tissue, muscle and brain.

V.2- IMPACT OF ORGANIC MATTER CONDENSATION ON RELATIVE BIOAVAILABILITY OF NDL-PCBs CONTAMINATED SOILS.

RESULTS



- Soil containing 1% of activated carbon presents a clear decrease of bioavailability Le sol contenant 1% de charbon actif **présente une nette diminution** de la biodisponibilité par rapport aux autres sols.
- Fulvic acid amendment doesn't seem to modify relative bioavailability of NDL-PCBs comparatively to standard soil

MERCI POUR VOTRE ATTENTION