

# *Chemical World*

## Toxicologist Serrine Lau: Investigating Molecular Crime Scenes

# *Serrine Lau is a toxin detective*

*Lau investigates how our bodies interact with poisonous chemicals.*



Toxicologists study how

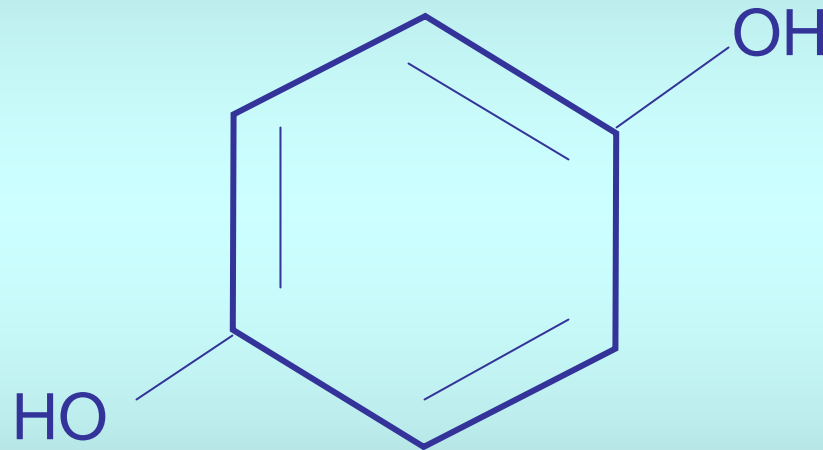
- People process chemicals
- DNA interacts with chemicals
- Genetic differences affect risk of disease from chemical exposure

*Question:*

Which toxic chemical is in cigarette smoke?

# *Answer: Polyphenol*

Found in cigarette smoke, car exhaust, photo developing solutions, some cosmetic depigmentation creams



Hydroquinone is a polyphenol that yields toxic byproducts in the body.

# *Are All Environmental Chemicals Dangerous?*

No. Even organic foods grown without pesticides are swimming in natural chemicals.

*What natural chemical given to pregnant women decreases the risk of birth defects?*

*Answer: Folic Acid*



# *Using a Mouse Model to Study Toxins*

To avoid exposing people to harmful chemicals, Lau uses rodents to study the interplay of genes and polyphenols.

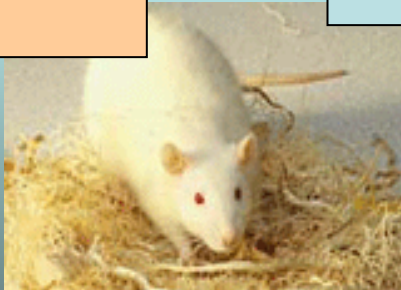
Mice are good toxicology models because

- Humans, mice, and rats share 90% of the same genes
- Humans and mice share many of the same enzymes needed to metabolize food, drugs, and chemicals

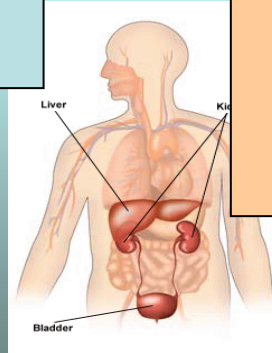


# Modeling Metabolism: Chemical Travels

**1. Use rodents to model metabolism, the sum of all chemical and physical changes in the body.**



**2. Study how specific chemicals break down and “cycle” through the body to form materials for tissues or organs.**

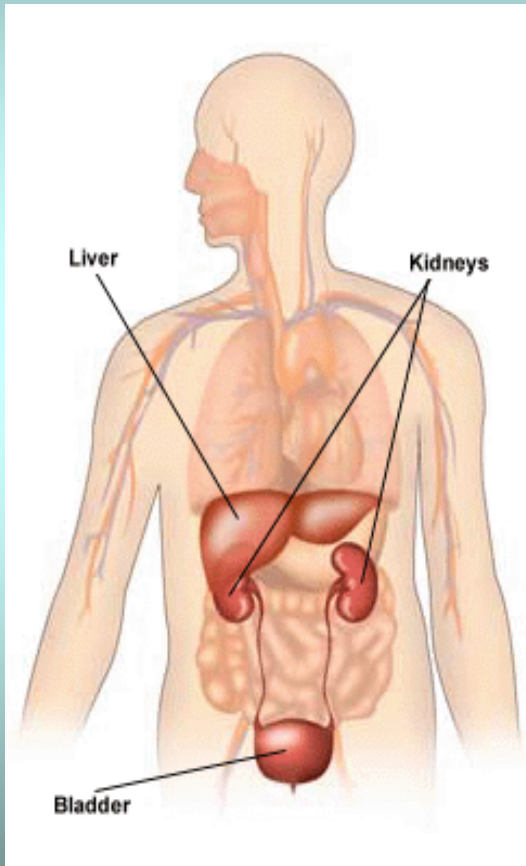


**3. Determine which body regions chemicals “target” on their journey. How do they leave the body?**

# Damage Report: Liver, Kidneys, Bladder

Three organs are major targets of toxic chemicals:

- The liver processes many chemicals entering the body through the mouth, nose, skin, or bloodstream
- The kidneys process the metabolites for excretion
- The bladder is “the last stop” for many processed chemicals and may be damaged by high levels of exposure



# DNA Differences Can Influence Risk

Our DNA affects:

1. How we metabolize polyphenols and other chemicals

What do toxicogeneticists study?

2. The function of proteins the genes encode

Which functions do proteins have in processing chemicals?

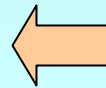
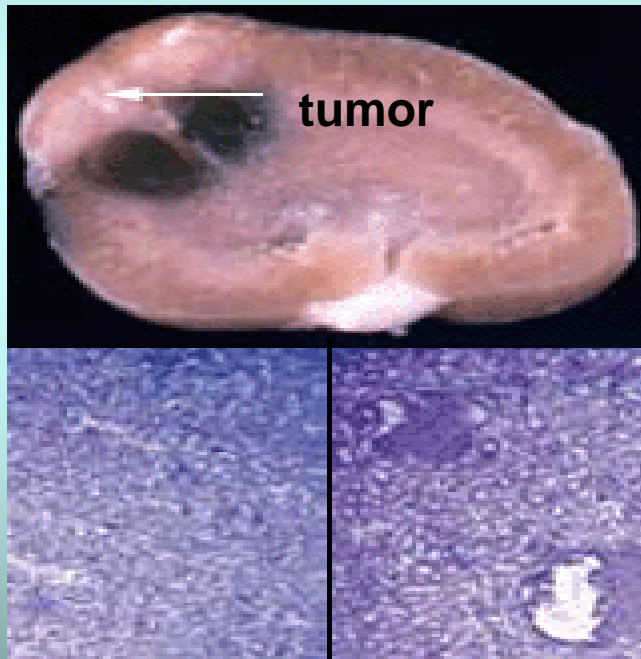
3. Individual risk of contracting disease from chemical exposure

Can you name a gene that has been linked to kidney cancer?



# Lau Links Genes to the Crime Scene

Lau is isolating genes that may increase the susceptibility of mice to chemically induced kidney cancers.



Eker rats develop tumors when their kidneys metabolize toxic hydroquinone.

Some humans have a similar gene, which may increase their susceptibility to kidney cancer.

# Lau's Findings



1. A gene directs the production of tumor suppressor protein
2. When this protein is lacking, cells lose an important safeguard against tumors
3. In some humans susceptible to kidney cancer, the tumor suppressor protein **doesn't work properly**

# *Research Applications*

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What is toxicogenomics, and how can it speed the development of new medicines?