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I.C. DEVELOPMENTAL BIOLOGY AND TOXICOLOGY

Module: Developmental Biology

Module: Toxicology (2 CFU)



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PHARMACY · MEDICINE · PUBLIC HEALTH

The History of Toxicology

From ancient poisons to modern patient safety



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THE FIELD

What toxicology asks

Toxicology studies harmful effects of chemical, biological, and physical agents.

What causes harm—and how do dose, route, body, and conditions shape it?



Chemistry

What enters the body?



Medicine

What does it do to organs?



Law

What evidence can establish harm?



Public health

How can exposure be prevented?

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Ancient knowledge: poison, antidote, and power

Long before toxicology became a discipline, people learned by watching exposure and effect.

Knowledge of harmful substances was practical—and political.



Plants and venoms

Poisonous plants, animal venoms, and minerals were recognized through repeated experience.



Antidotes

Countermeasures emerged from observation: dilution, binding, emesis, and plant-based remedies.



Power

Poison knowledge shaped hunting, warfare, medicine, and political intrigue.

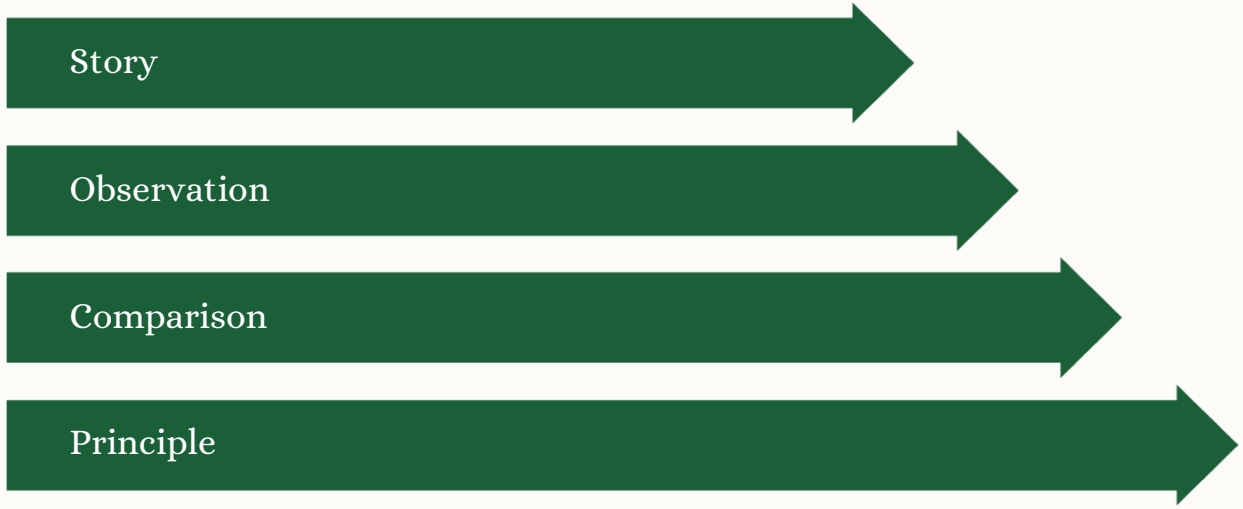
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A CHANGE IN METHOD

From observation to principle

Early medical traditions accumulated detailed observations about substances, symptoms, and remedies. Over time, explanations began to move away from supernatural causes and toward patterns that could be compared, tested, and recorded.

The crucial shift was methodological: exposure became something to investigate.



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A FOUNDATIONAL IDEA

Dose matters.

“The dose makes the poison.”

Paracelsus’s principle remains a starting point for toxicology: toxicity depends on quantity and conditions—not only on the name of a substance.

Axiom 1: The Dose Makes the Poison

All things are poisonous, only the dose makes it non-poisonous.
— Paracelsus, 1564

	Beneficial Dose	Toxic Dose
Aspirin	300 – 1,000 mg	1,000 – 30,000 mg
Vitamin A	5,000 units/day	50,000 units/day
Oxygen	20% (Atmospheric Air)	50 – 80% (Hyperoxic Air)

Every chemical—synthetic or natural—has the capacity to be toxic.
Toxicology is the science of balancing risks versus benefits.

Gemini Notebook



EVIDENCE ENTERS THE COURTROOM

The birth of forensic toxicology

01

Poisoning becomes a question of proof

Suspicion alone could no longer carry the case.

02

XIX Mathieu Orfila systematizes detection

Nineteenth-century chemistry brought laboratory methods into investigations.

03

Evidence links substance to harm

Samples, reactions, symptoms, and circumstances had to be interpreted together.

Forensic toxicology joined chemical analysis to medical and legal reasoning.

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THE RISK LANDSCAPE EXPANDS

Industrialization changes the risk landscape

As production scaled, exposure moved beyond the isolated poisoning. Toxicology had to address workers, medicines, air, water, food, **environment** and entire communities.



Industry

New chemicals created new occupational exposures.



Pharmaceuticals

Therapeutic substances required benefit–risk judgment.



Pollution

Diffuse exposure made population surveillance essential.

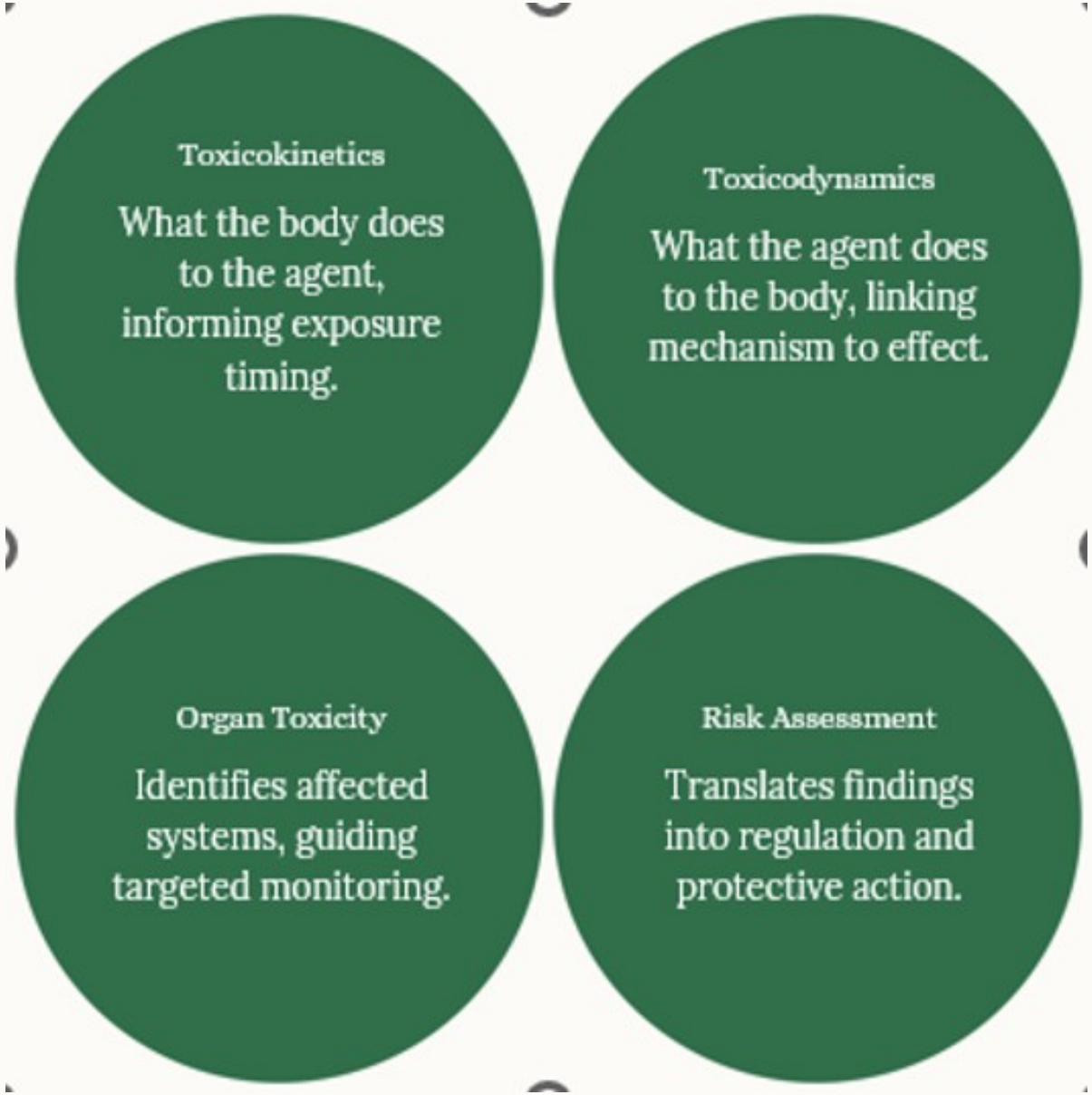
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THE MODERN FIELD

Modern toxicology: mechanisms and regulation

Today, toxicology connects what an agent does in the body with how exposure is measured, managed, and prevented.

Mechanism explains harm; regulation turns evidence into action.



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THE THROUGH-LINE

Context shapes harm.

The history of toxicology is a history of learning to ask better questions about exposure, evidence, and prevention.

Why the history still matters

Drug safety

Exposure prevention

Antidotes

Pharmacovigilance

For clinicians, the question is never only "is it toxic?" It is "to whom, how much, by which route, and what can we do next?"

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The science of Toxicology helps people make informed decisions and balance RISKS vs. BENEFITS

