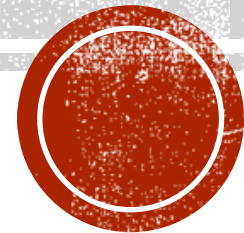


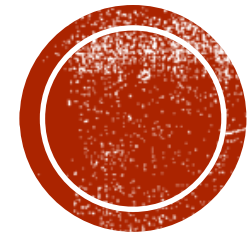
DISSOLUTION: UNVEILING THE SCIENCE OF RATE AND ITS SIGNIFICANCE IN OPTIMIZING DRUG FORMULATIONS

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Bernhardt Professor of Pharmaceutical Sciences
PharmD./MBA Program Coordinator
Southwestern Oklahoma State University, USA



WHAT IS
OKLAHOMA
KNOW FOR?

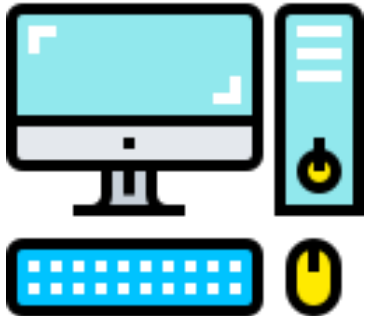
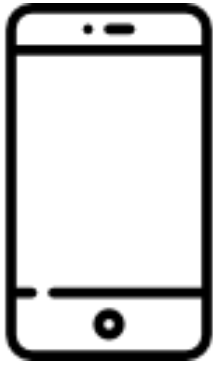
TORNADOS



My Reason to Visit Mumbai

Mithibai Vada pao





THE POWER AND IMPORTANCE OF RATE

Cellphones

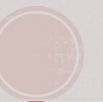
- 2000, 93.6-1.44 **Kbps**
- 2009, 5-50 **Mbps**,
- 2019, 10 **Gbps**

Cars

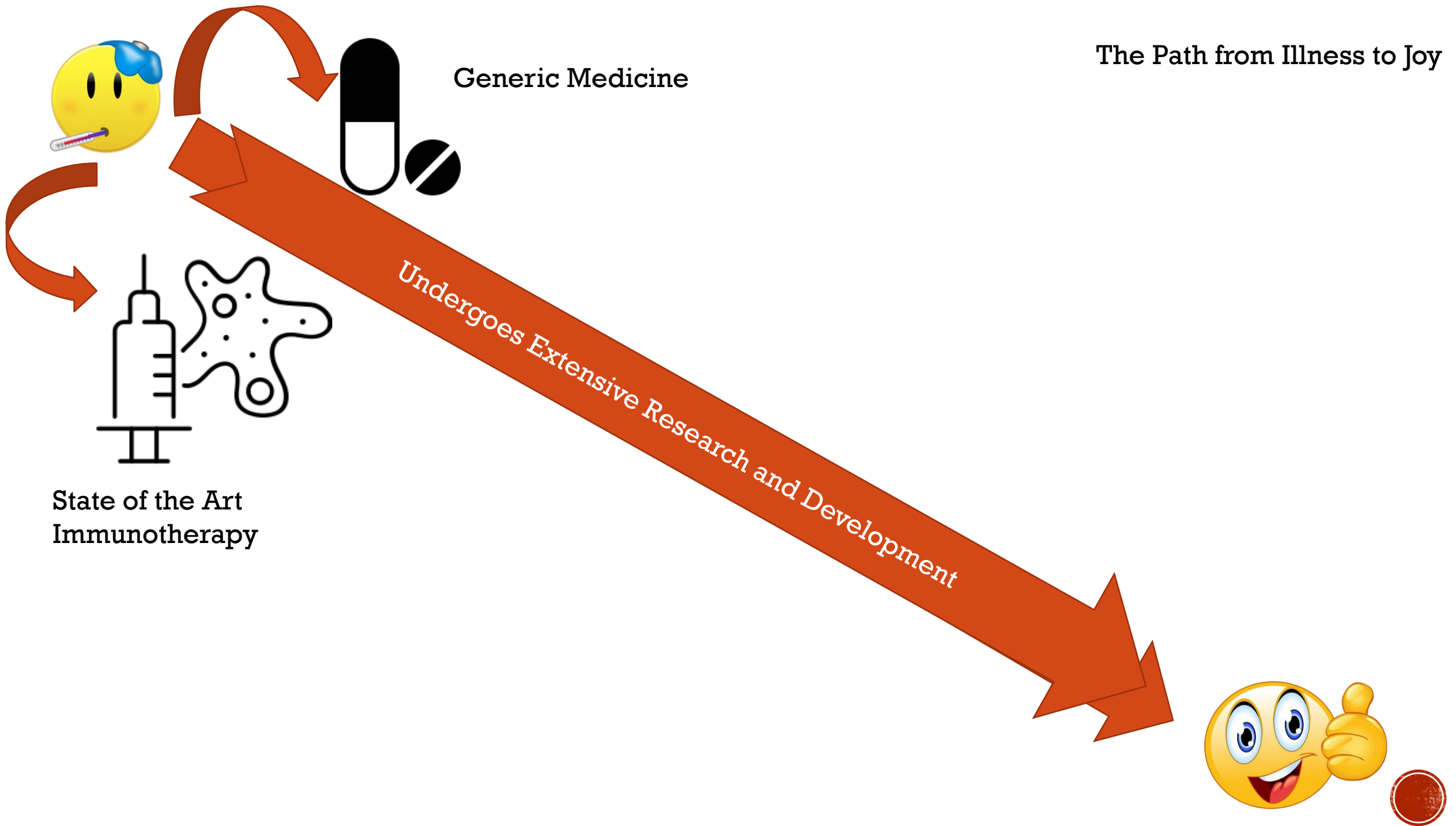
- 1900: **30-60 mph**
- 1920: 80-100 mph
- Modern Cars: 200 mph, hyper cars > **250 mph**

Computers

- 1980: 1-3.58 **MHz**
- 1990: 200 MHz to 1 GHz
- Modern: > **5 GHz**



The Path from Illness to Joy

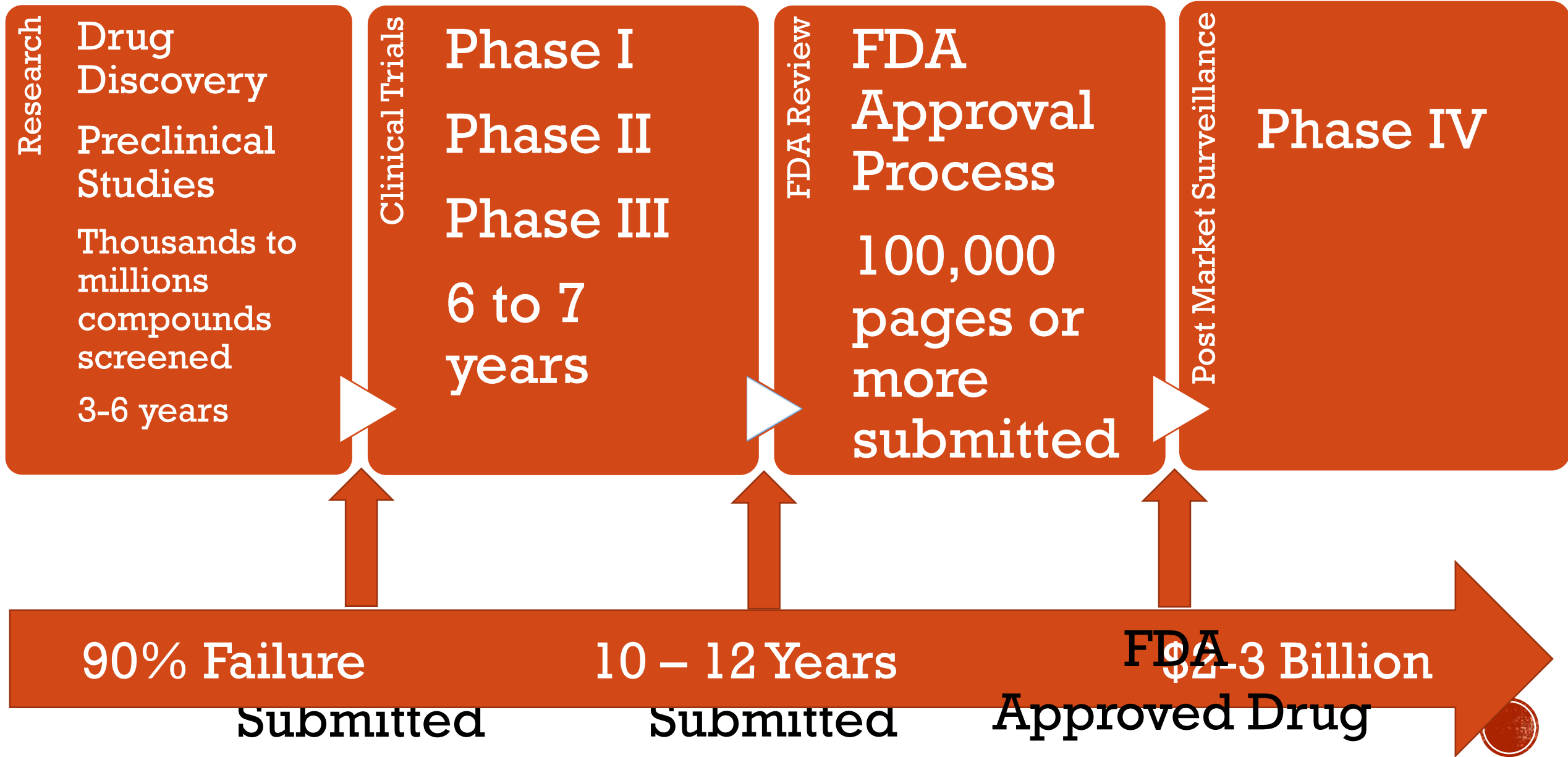


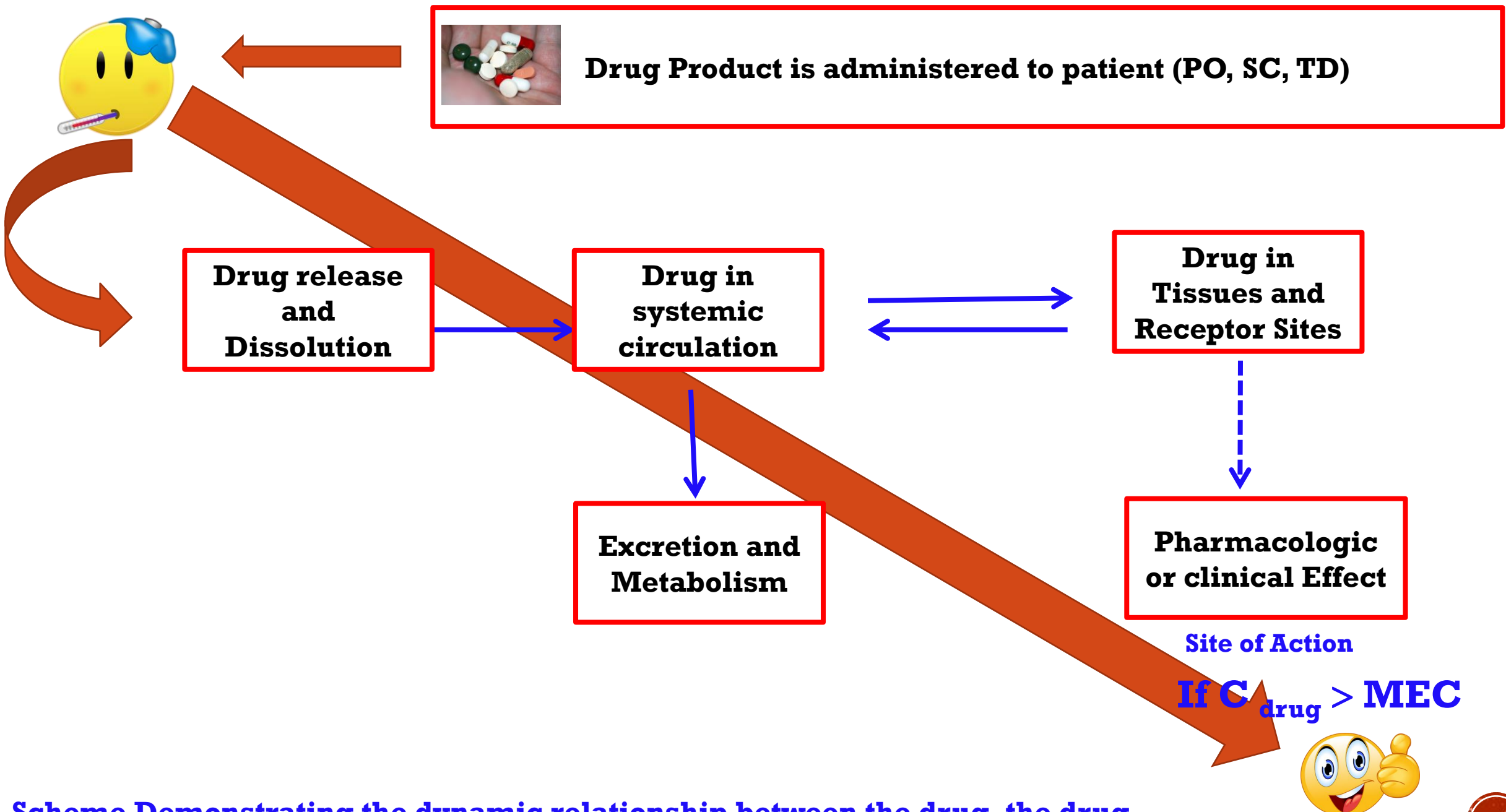
Generic Medicine

State of the Art
Immunotherapy

Undergoes Extensive Research and Development

The Journey of a Drug From Lab to Clinic

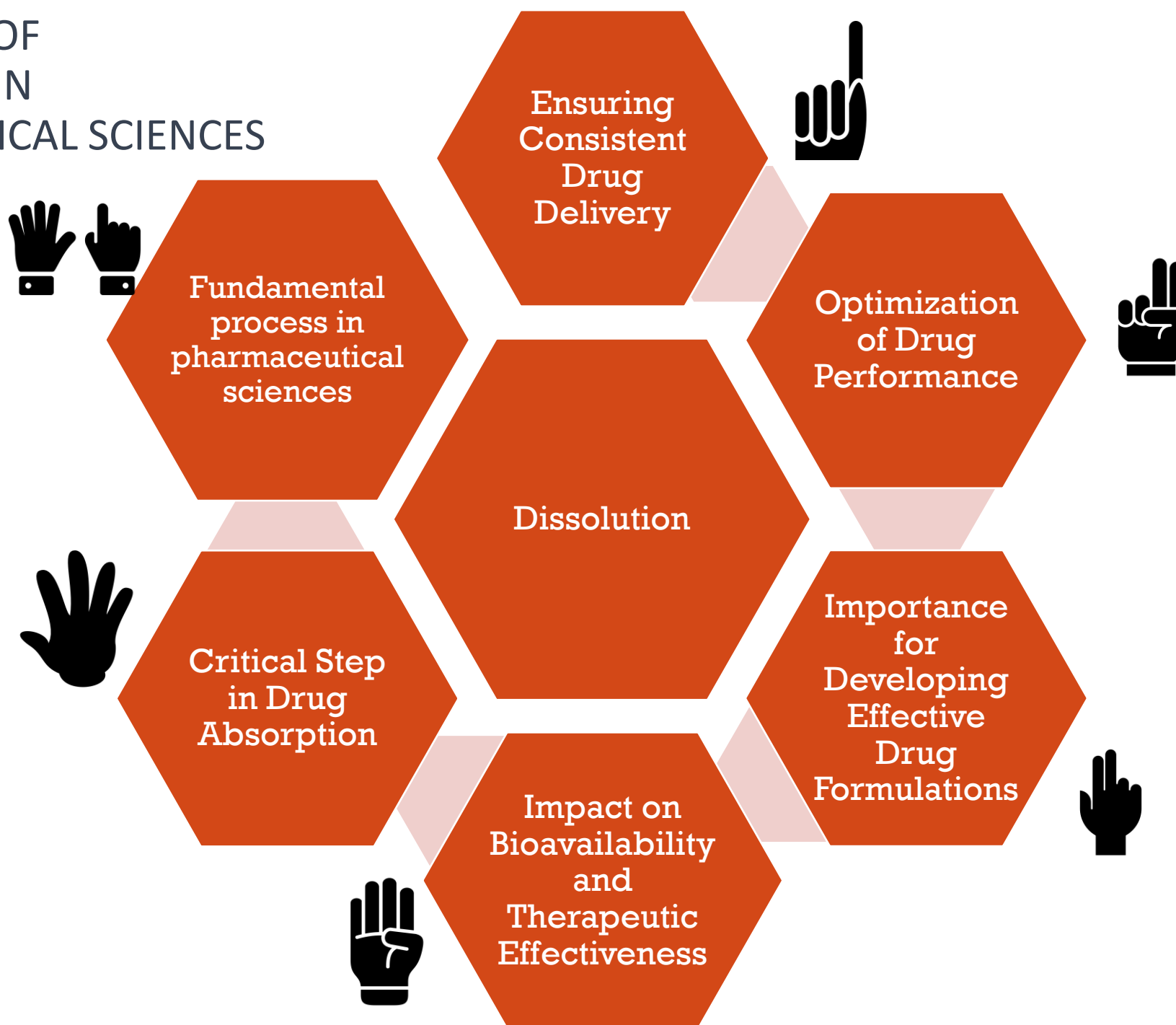




Scheme Demonstrating the dynamic relationship between the drug, the drug product, and the pharmacological effect



IMPORTANCE OF DISSOLUTION IN PHARMACEUTICAL SCIENCES



Dissolution

The **rate** at which a solid drug substance dissolves in a solvent

Drug Absorption and Bioavailability

- Dissolution: crucial role in drug absorption
- Efficient dissolution
 - Enables optimal absorption
 - Desired therapeutic effects

Therapeutic Efficacy

- Dissolution determines
 - Onset
 - Duration of Drug action



Physicochemical properties



- Solubility
- Particle Size
- Crystal Properties

Physiological
conditions of the
intestinal
tract

Formulation characteristics



Physicochemical
properties of the

- Excipients
- Dosage Form
- Manufacturing methods


Formulation
characteristics

Physiological conditions (GI Tract)



- pH
- Transit time
- Fluid Composition

SIGNIFICANCE OF DISSOLUTION TESTING



Purpose of dissolution testing in pharmaceutical development

- **Assessing drug release from formulations**

Standardized method for assessing drug dissolution:

- **In vitro dissolution testing**

Importance of dissolution testing in quality control and regulatory compliance:

- **Ensuring batch-to-batch consistency and regulatory requirements**

DISSOLUTION KINETICS



Understanding the kinetics of drug dissolution:

- Dissolution rate, release rate, absorption rate

Release of drug substance from the dosage form:

- Disintegration, dissolution, diffusion

Absorption of the drug in the body:

- Bioavailability, therapeutic effect

CONSEQUENCES OF INADEQUATE DISSOLUTION



Impact of inadequate dissolution on drug absorption:

- Reduced bioavailability, erratic pharmacokinetics

Inconsistent therapeutic effects:

- Variability in drug response, lack of efficacy

Potential safety concerns:

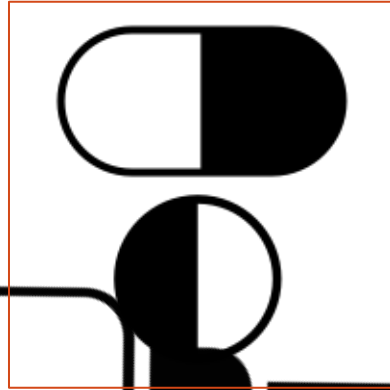
- Suboptimal drug exposure, adverse reactions

Disaster – No Dissolution



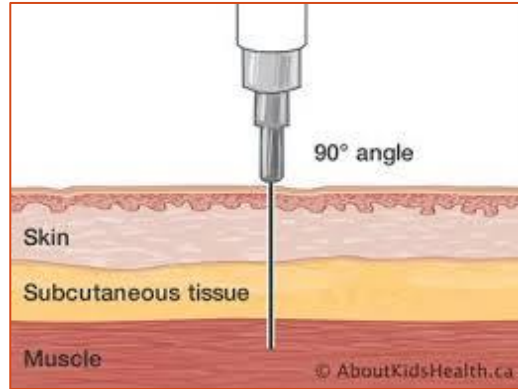
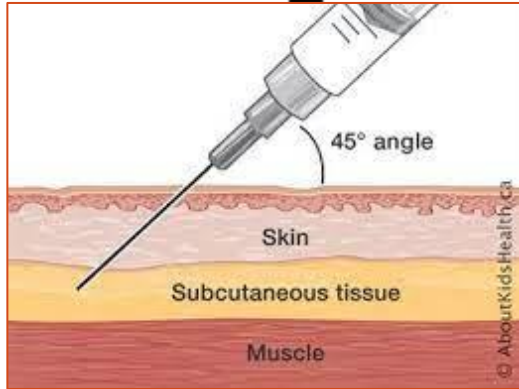
Success





B
a
r
r
i
e
r

Systemic Circulation



Meet My Friend



M FLADMER



M

• Molecule (Drug)

F

• Formulation → Pharmaceuticals

L

• Liberation → Biopharmaceutics

A

• Absorption

D

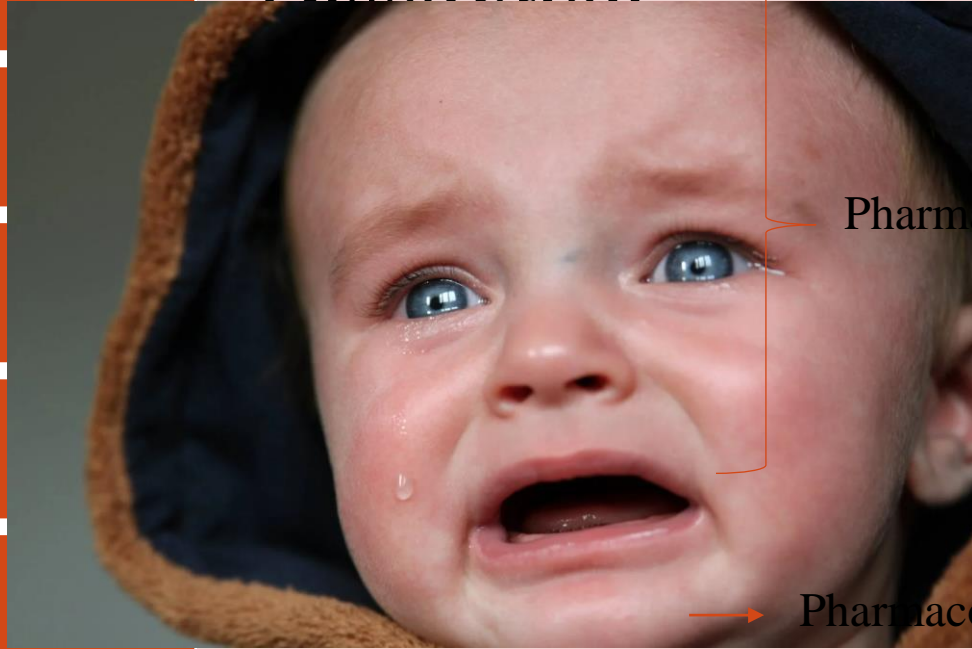
Pharmacokinetics

M

E

R

Pharmacodynamics



STRATEGIES FOR ENHANCING DISSOLUTION



Particle size reduction

- Increased surface area for faster dissolution
- Eg: Nanosizing poorly soluble drugs.

Use of solubilizers:

- Enhancing drug solubility in aqueous media
- Eg: SEDDS

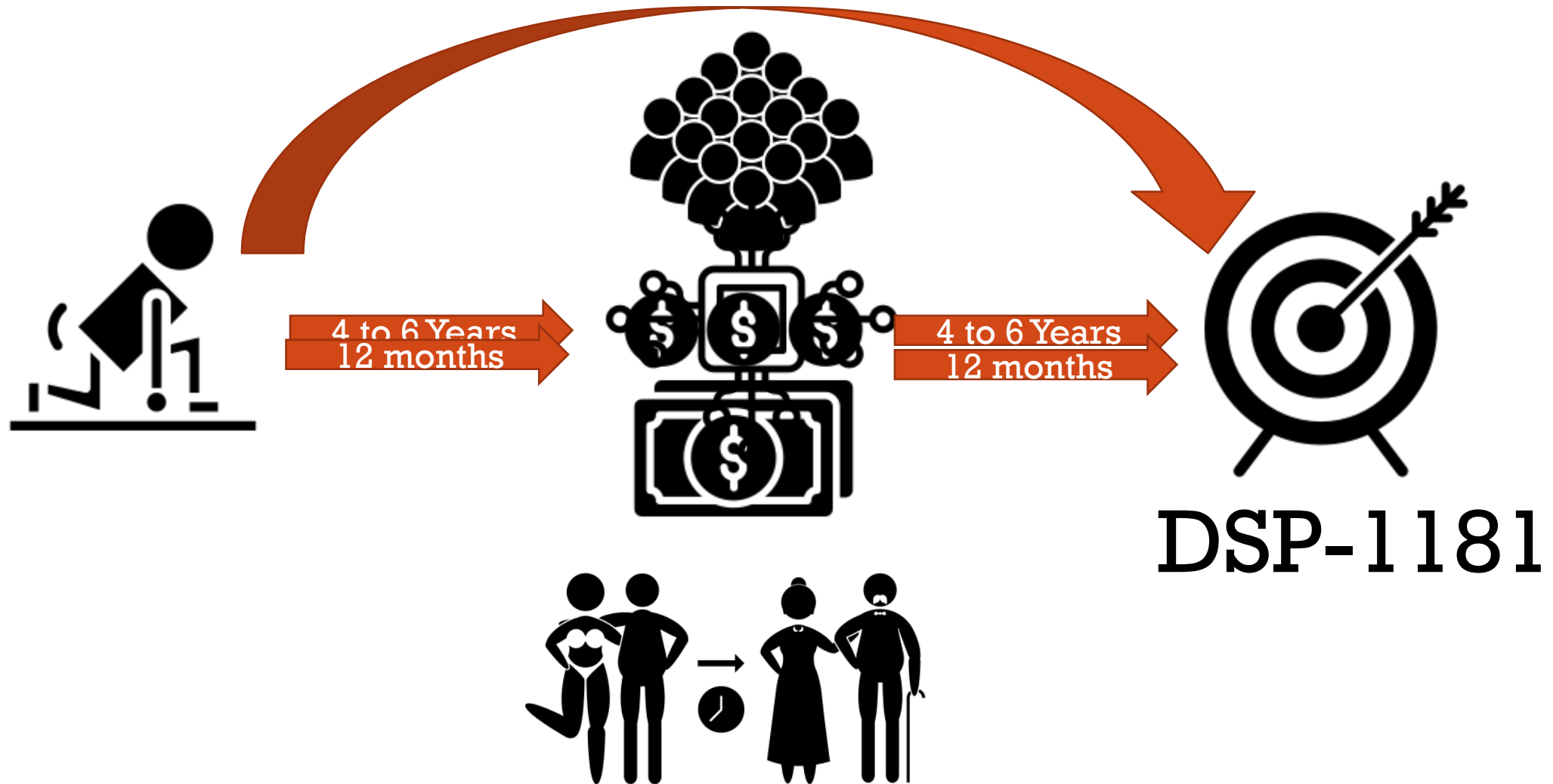
Formulation design optimization:

- Selection of suitable excipients, dosage form modification
- Eg: Solid Dispersion

Inclusion complexes:

- Formation of complex with cyclodextrins to improve solubility

BREAKING BARRIERS: AI-DESIGNED MOLECULE ENTERS PHASE 1 CLINICAL TRIAL - EXSCIENTIA'S GROUNDBREAKING ACHIEVEMENT





**“HISTORY ILLUMINATES THE PRESENT, GUIDING US
TOWARDS A FUTURE WE DARE TO SHAPE”**

HARDEEP SALUJA

ADVANCEMENTS IN DRUG DISSOLUTION OVER THE YEARS

Manual
Disintegration
Testing

Paddle and
Basket Method

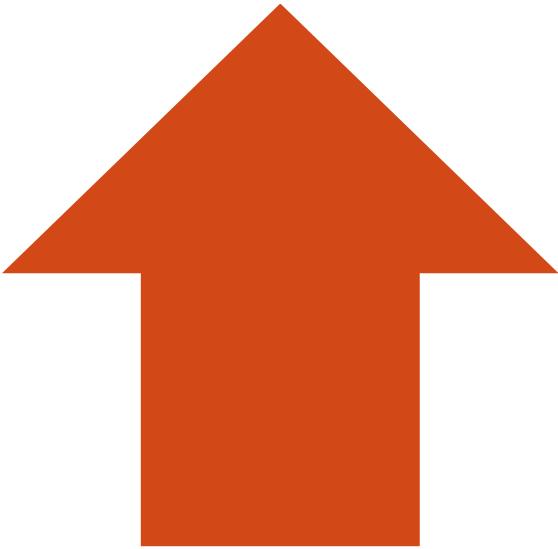
Flow Cell
Apparatus
(Transdermal)

Automated
Dissolution
Apparatus

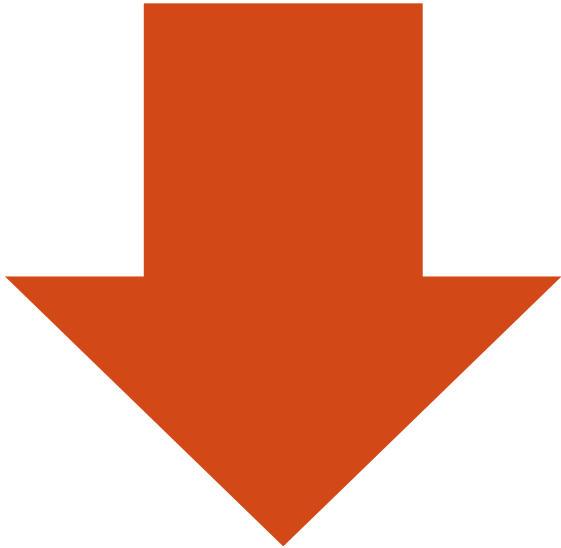
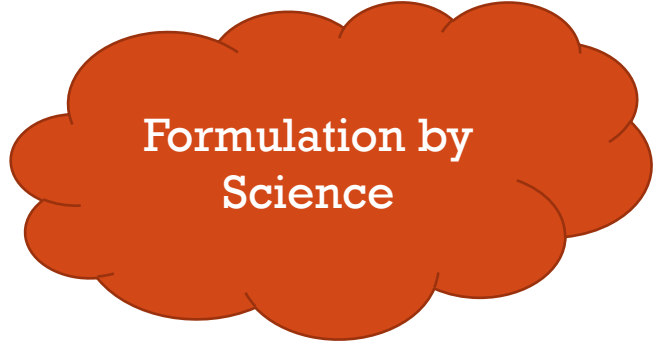
Biorelevant
Dissolution
Testing

Quality by
Design
Approach





FBS



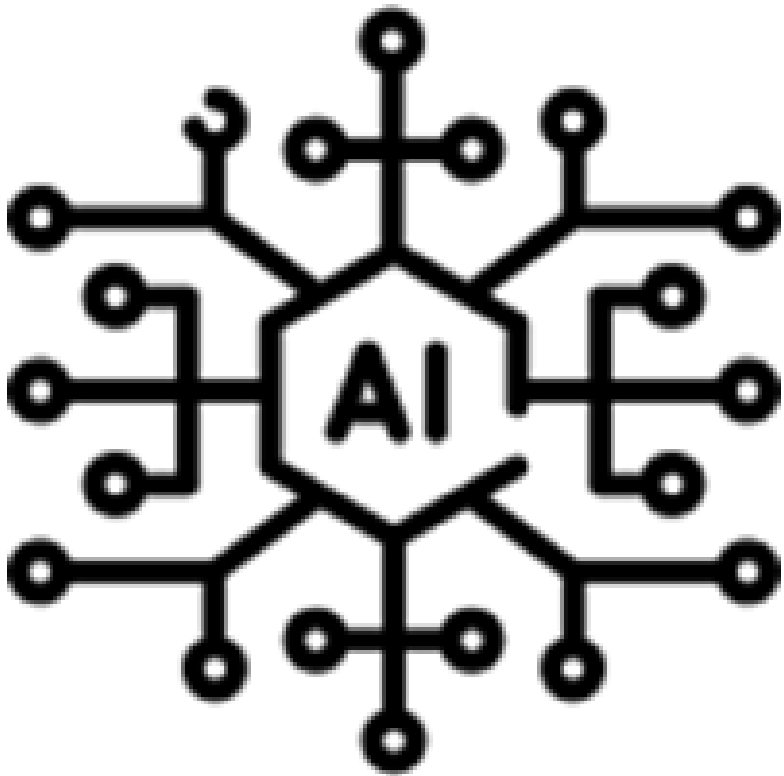
FBC





THE NEXT BIG CHANGE

THE TRANSFORMATIVE POWER OF AI IN DRUG FORMULATION



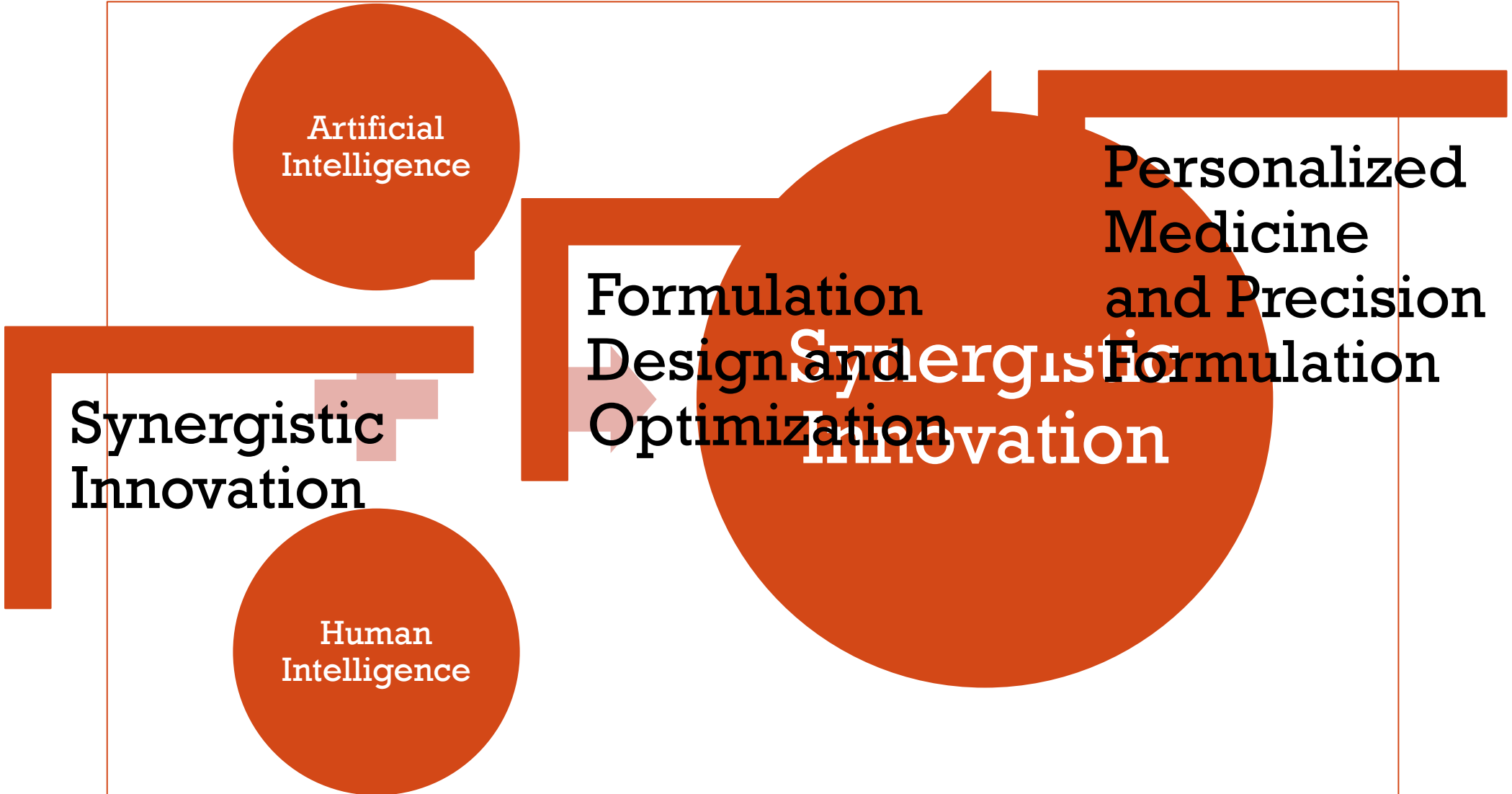
Accelerated development:
Reducing trial and error experimentation.

Enhanced drug performance:
Improving stability, solubility, and bioavailability.

Customized formulations:
Tailoring formulations for individual patient needs.



RETHINKING DRUG FORMULATION





"ARTIFICIAL INTELLIGENCE, DEEP LEARNING, MACHINE LEARNING — WHATEVER YOU'RE DOING IF YOU DON'T UNDERSTAND IT — LEARN IT. BECAUSE OTHERWISE, YOU'RE GOING TO BE A DINOSAUR WITHIN 3 YEARS." - MARK CUBAN, ENTREPRENEUR AND INVESTOR.



T H A N K

Y O U

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