BCS CLASSIFICATION

By

(Dr.) Swarnakshi Upadhyay

BIOPHARMACEUTICS CLASSIFICATION SYSTEM

INTRODUCTION:

- The biopharmaceutics classification system is guidance for Predicting the intestinal drug absorption provided by the U.S. Food and Drug Administration. The fundamental basis for the BCS was established by Dr. Gordon Amidon.

DEFINITION:

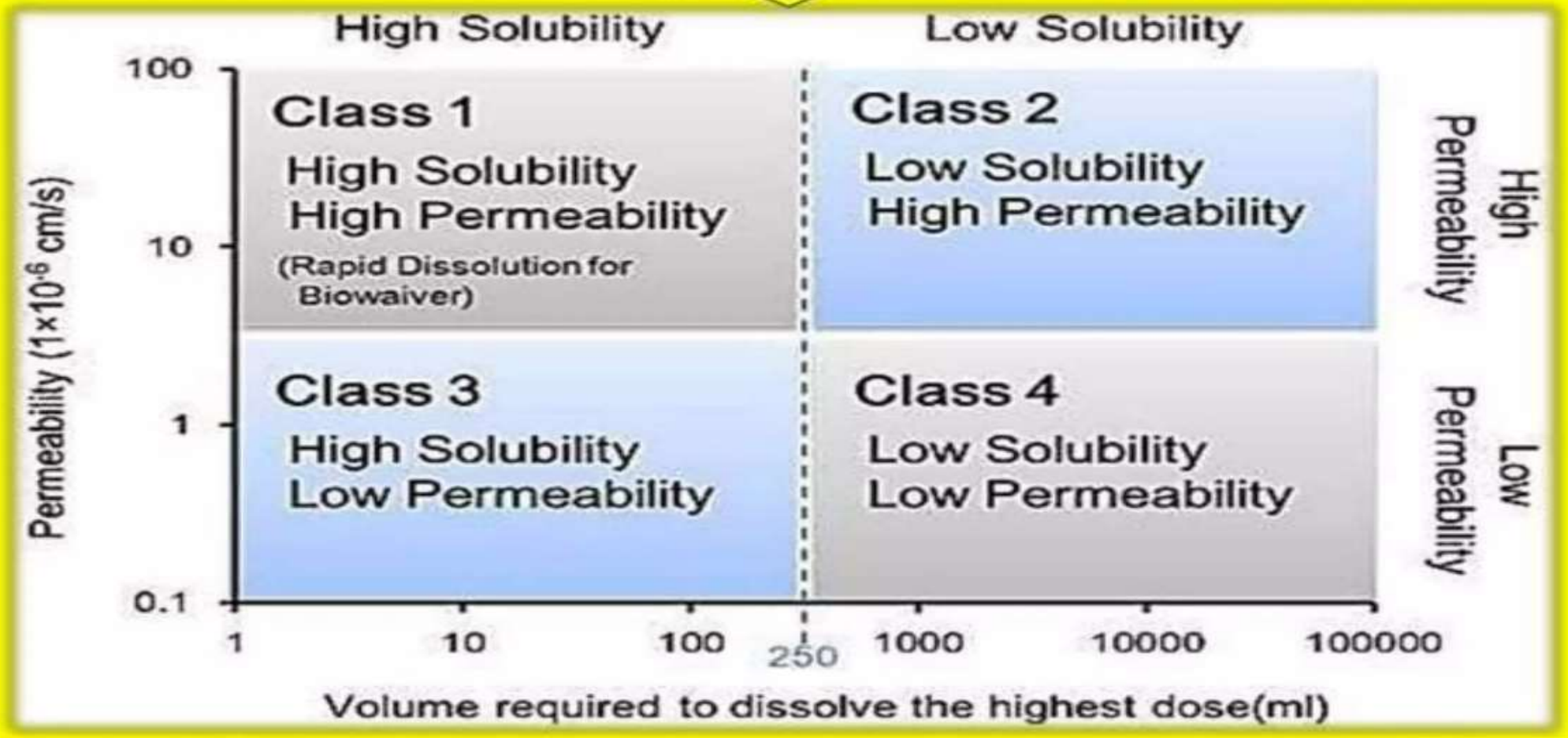
- The Biopharmaceutical Classification System is a scientific framework for classifying a drug substance based on its aqueous solubility & intestinal permeability & dissolution rate

OBJECTIVE OF THE BCS

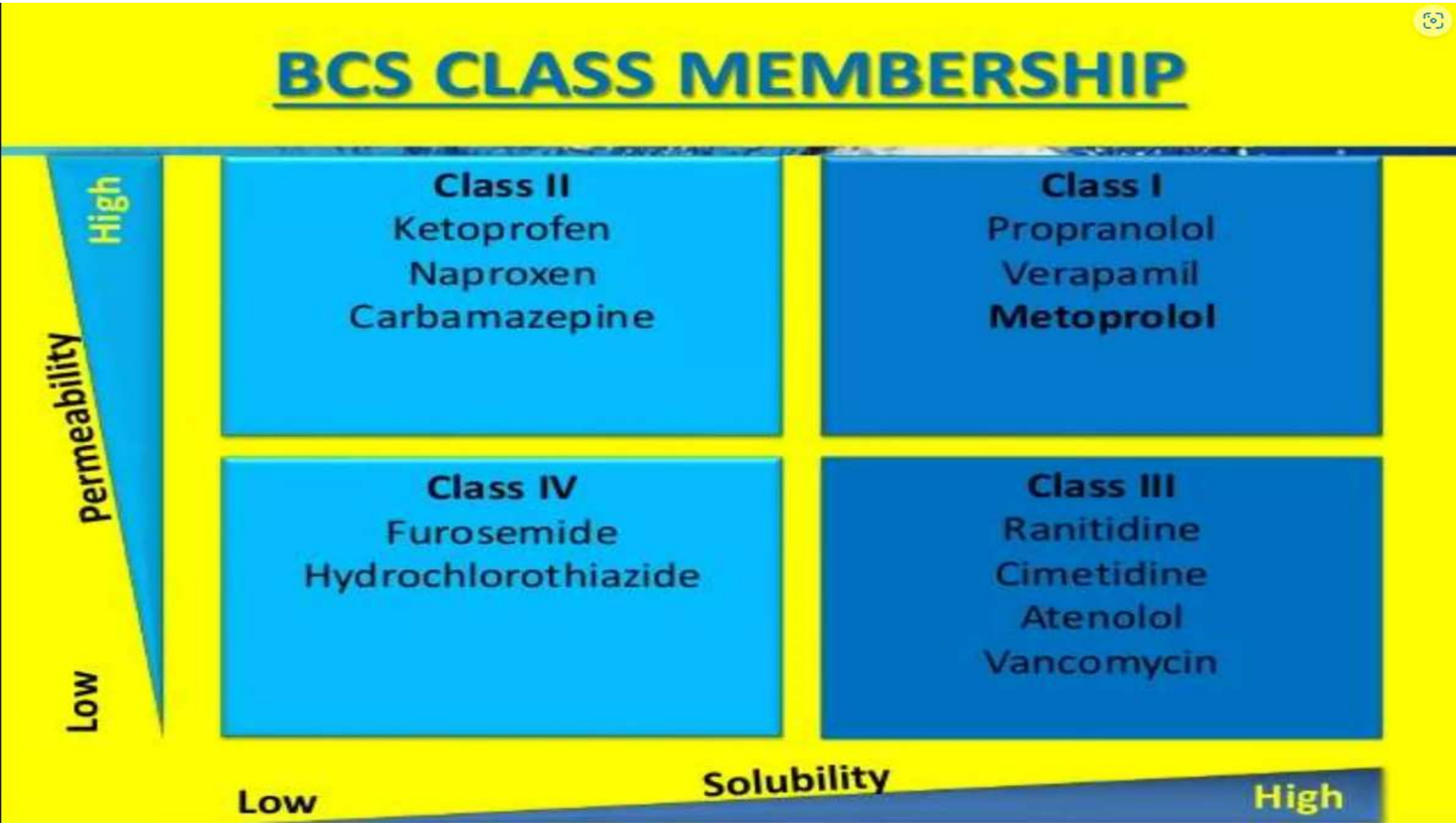
- To improve the efficiency of the drug development and review process by recommending a strategy for identifying expendable clinical bioequivalence test.
- To recommend a class of immediate-release (IR) solid oral dosage forms for which bioequivalence may be assessed based on in vitro dissolution tests.
- To recommend methods for classification according to dosage form dissolution along with the solubility–permeability characteristics of the drug product.

BIOPHARMACEUTICS CLASSIFICATION SYSTEM

(as defined by the FDA after Amidon *et al.*)



BCS CLASS MEMBERSHIP



CLASSIFICATIAON

- According to the BCS, drug substances are classified as follows:

A. CLASS I

- High Permeability and high Solubility.
- These are well absorbed and their absorption rate is usually higher than excretion.
- Drugs dissolved rapidly
- Drugs absorbed rapidly
- Rapid therapeutic action
- Excellent property
- Ideal for oral route
- Ex. Metoprolol, Diltiazem, Verapamil, Propranolol,

Continue....

B. CLASS II

- High Permeability and Low Solubility.
- Bioavailability is limited by their solvation rate.
- Drugs dissolve slowly
- Drugs absorbed rapidly
- Controlled released drugs
- Oral / IV route for administration
- Ex. Glibenclamide, Ezetimibe, Phenytoin, Nifedipine.

Continue....

C. CLASS III

- Low Permeability and High Solubility.
- Dissolved rapidly
- The absorption is limited by the permeation rate but drug is solvated very fast.
- Absorbance is limited
- Incomplete bioavailability
- Oral / IV route for administration
- Ex. Cimetidine, Acyclovir, Captopril

Continue.....

D. CLASS IV

- Low Permeability And Low Solubility.
- Poor bioavailability and Not well absorbed over the intestinal mucosa.
- Low dissolution rate
- Low permeability property
- Slow or low therapeutic action
- IV or other routes are required
- Example- Hydrochlorothiazide

FACTOR AFFECTING ON BCS

- The Biopharmaceutical Classification System has been developed to provide a scientific approach to allow for to prediction in vivo pharmacokinetics of oral immediate release (IR) drug product by classifying drug compound based on their,
  - SOLUBILITY
  - PERMEABILITY
  - DISSOLUTION

Continue....

1. SOLUBILITY

- The Maximum Amount of solute dissolved in a given solvent under standard conditions of temperature, pressure and pH.
- Solubility is the ability of the drug to be solution after dissolution.
- The higher single unit dose is completely soluble in 250 ml at pH 1- 6.8 (37°C).

Continue....

2. PERMEABILITY

- Permeability of the drug to pass the biological membrane which is the lipophilic.
- Permeability is indirectly based on the extent of absorption of a drug substance.
- Drug substance is considered to be highly permeable, when the extent of absorption in human determined to be 90% or more of administered drug or compare to in vivo reference dose.

Continue....

3. DISSOLUTION

- A drug product is considered to be RAPIDLY DISSOLVING when > 85% of the labeled amount of drug substance dissolves within 30 minutes using USP dissolution apparatus I or II in a volume of 900 ml or less in the following media:
  - 0.1 N HCl or simulated gastric fluid (pH 1.2) without enzyme.
  - pH 4.5 buffer & pH 6.8 buffer.
  - Simulated intestinal fluid without enzyme

IVIVC EXPECTATIONS FOR IRP BASED ON BCS

Class	Solubility	Permeability	Absorption rate control	IVIVC expectations for Immediate release product
I	High	High	Gastric emptying	IVIVC expected, *if dissolution rate is slower than gastric emptying rate*, otherwise limited or no correlations
II	Low	High	**Dissolution**	IVIVC expected, if *in vitro* dissolution rate is similar to *in vivo* dissolution rate, unless dose is very high.
III	High	Low	Permeability	Absorption (permeability) is rate determining and limited or no IVIVC with dissolution.
IV	Low	Low	Case by case	Limited or no IVIVC is expected.

- **IVIVC**- in vitro in vivo correlation
- **IRP**- immediate release product

SIGNIFICANCE OF BCS

- It can save both time and money—if the immediate -release, orally administered drug meets specific criteria, the FDA will grant a waiver for expensive and time-consuming bio-equivalence studies.
- Valuable tool for formulation scientist for selection of design of formulated drug substance.
- When integrated with other information provide a tremendous tool for efficient drug development.
- Reduces cost and time of approving Scale- up and post approval challenges.
- Applicable in both pre-clinical and clinical drug development process.
- Works as a guiding tool in development of various oral drug delivery systems.