

# **Practical pharmacology**

## **Part 1**

21

**pharma**

**ology**

**It is science of the drugs**

Drug

Science

## **2What is Drug**

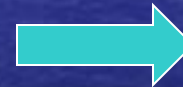
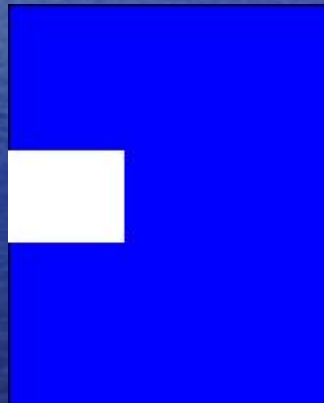
**It is the chemical that affect  
physiological body function  
through interaction with  
receptors**

# **?What is Drug**

**It is the chemical that affect  
physiological body function  
through interaction with  
receptors**



**A**



**Respon  
se**

# Forces involved in D-R interaction

**Covalent bonds**

**Ionic bonds**

**Hydrogen bonds**

**Vander waals bonds**

# Forces involved in D-R interaction

**Covalent bonds**

**Ionic bonds**

**Hydrogen bonds**

**Vander waals bonds**



# Forces involved in D-R interaction

**Covalent bonds**

**Strong**

**irreversible**

**Alkylating agents**



# Forces involved in D-R interaction

**Covalent bonds**

**Ionic bonds**

**Hydrogen bonds**

**Vander waals bonds**

# Forces involved in D-R interaction

**Ionic bonds**

**common**

**Affected by pH**

# Forces involved in D-R interaction

**Covalent bonds**

**Ionic bonds**

**Hydrogen bonds**

**Vander waals bonds**



# Forces involved in D-R interaction

**Hydrogen bonds**

**?**



# Forces involved in D-R interaction

**Covalent bonds**

**Ionic bonds**

**Hydrogen bonds**

**Vander waals bonds**

# Forces involved in D-R interaction

**Vander waals bonds**

**?**

# Receptors types



```
graph TD; A[Receptors types] --> B[On cell membrane]; A --> C[Intracellular]; B --> D[GPCR]; B --> E[Receptor with intrinsic ion channel]; B --> F[Enzyme linked receptors];
```

The diagram is a flowchart titled "Receptors types" in yellow text at the top. A white line descends from the title and splits into two branches. The left branch leads to a teal box labeled "On cell membrane" in white text. The right branch leads to a teal box labeled "Intracellular" in white text. From the "On cell membrane" box, a red line descends and splits into three arrows pointing to three separate teal boxes: "GPCR", "Receptor with intrinsic ion channel", and "Enzyme linked receptors", all in white text. The background of the slide is a blue sky with clouds and a blue ocean.

**On cell membrane**

**Intracellular**

**GPCR**

**Receptor with intrinsic ion  
channel**

**Enzyme linked receptors**



# Receptors types

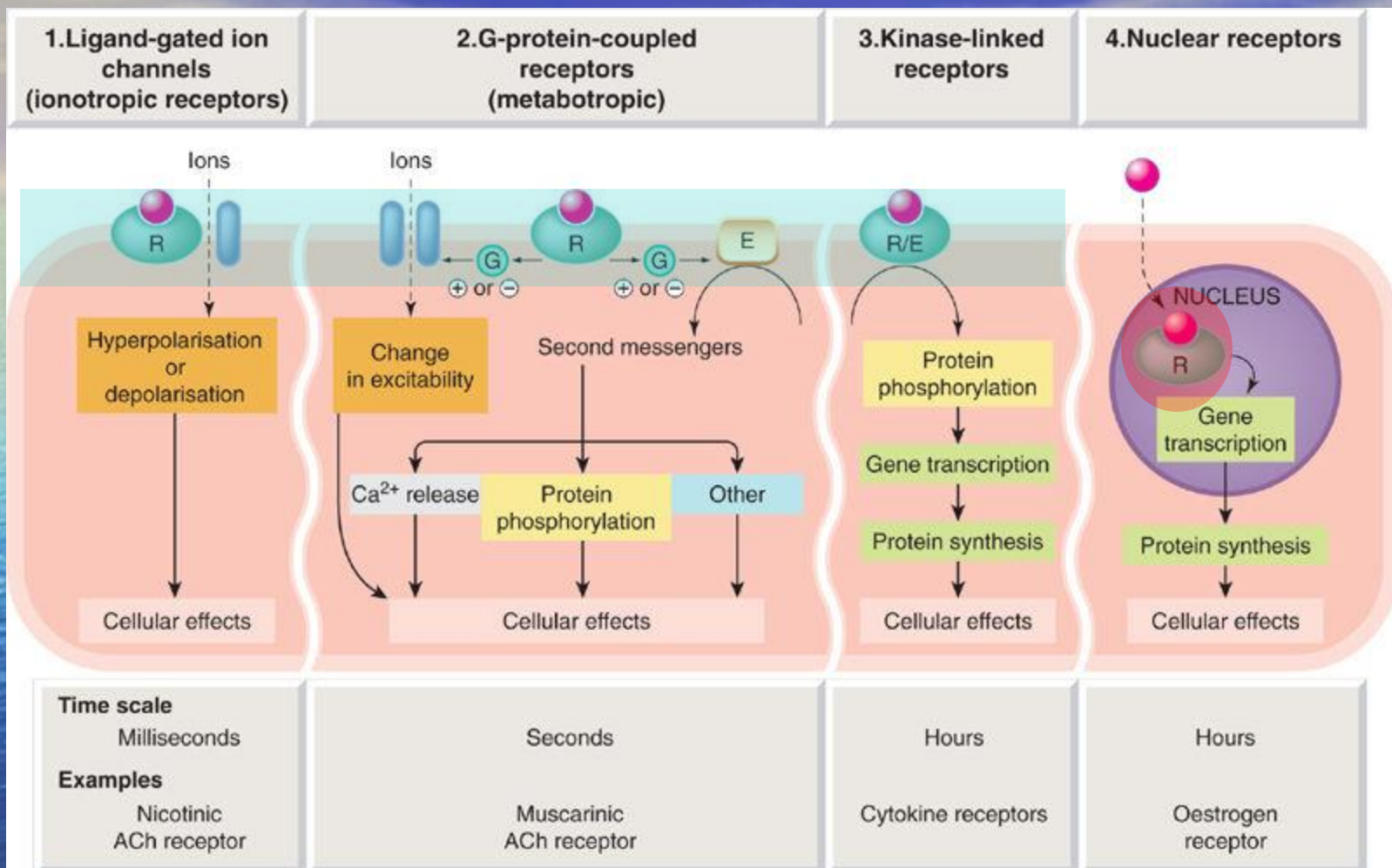
```
graph TD; A[Receptors types] --> B[On cell membrane]; A --> C[Intracellular]; C --> D[Transcription factors]
```

**On cell membrane**

**Intracellular**

**Transcription factors**





Rang et al: Rang & Dale's Pharmacology, 7e

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# Drug-Receptor Interaction

**k**

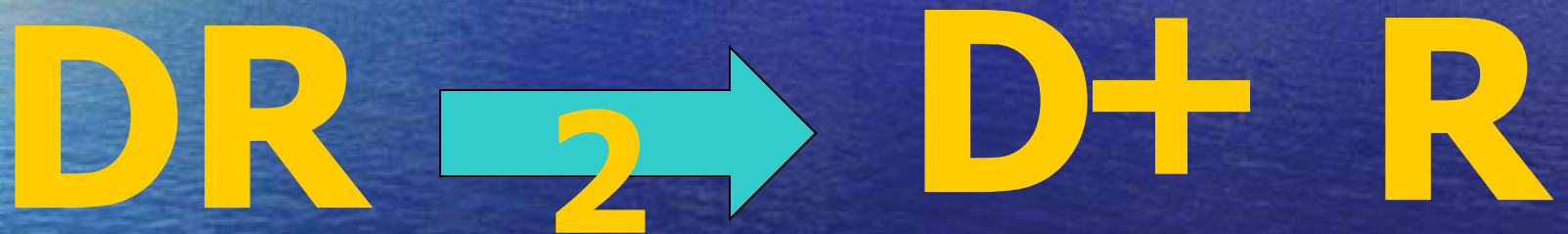


**$k_1$  is association rate constant**



# Drug-Receptor Interaction

**k**



**$K_2$  is dissociation rate  
constant**

# Drug-Receptor Interaction

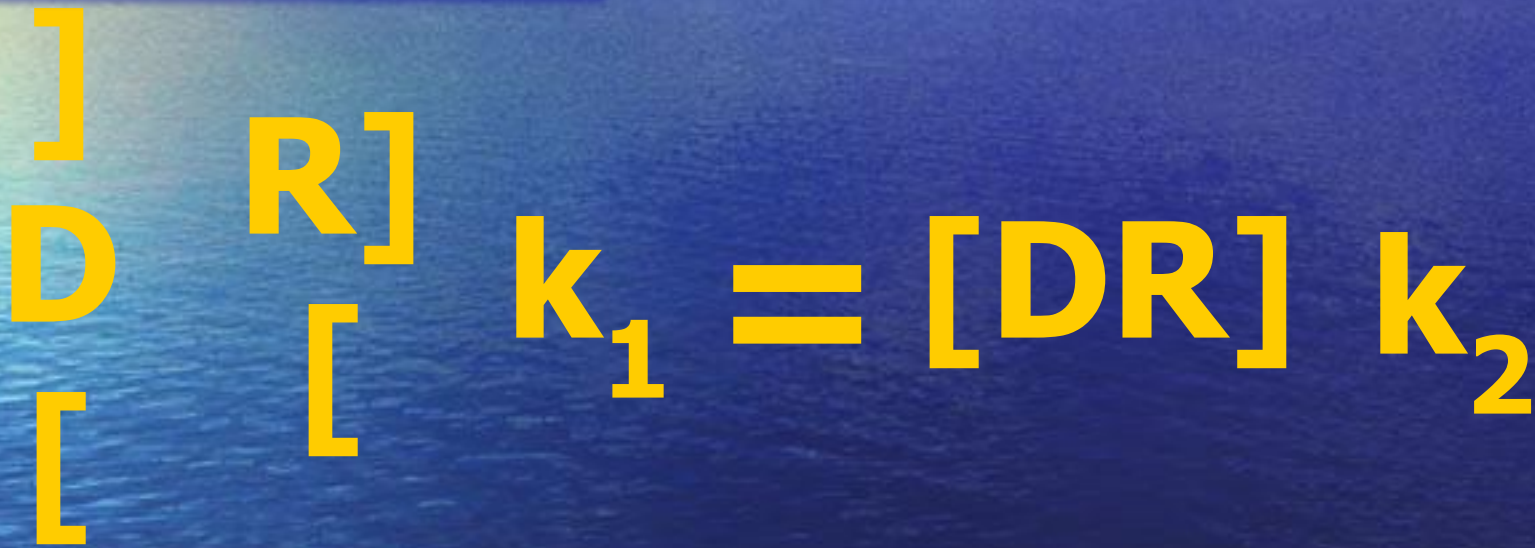
At equilibrium





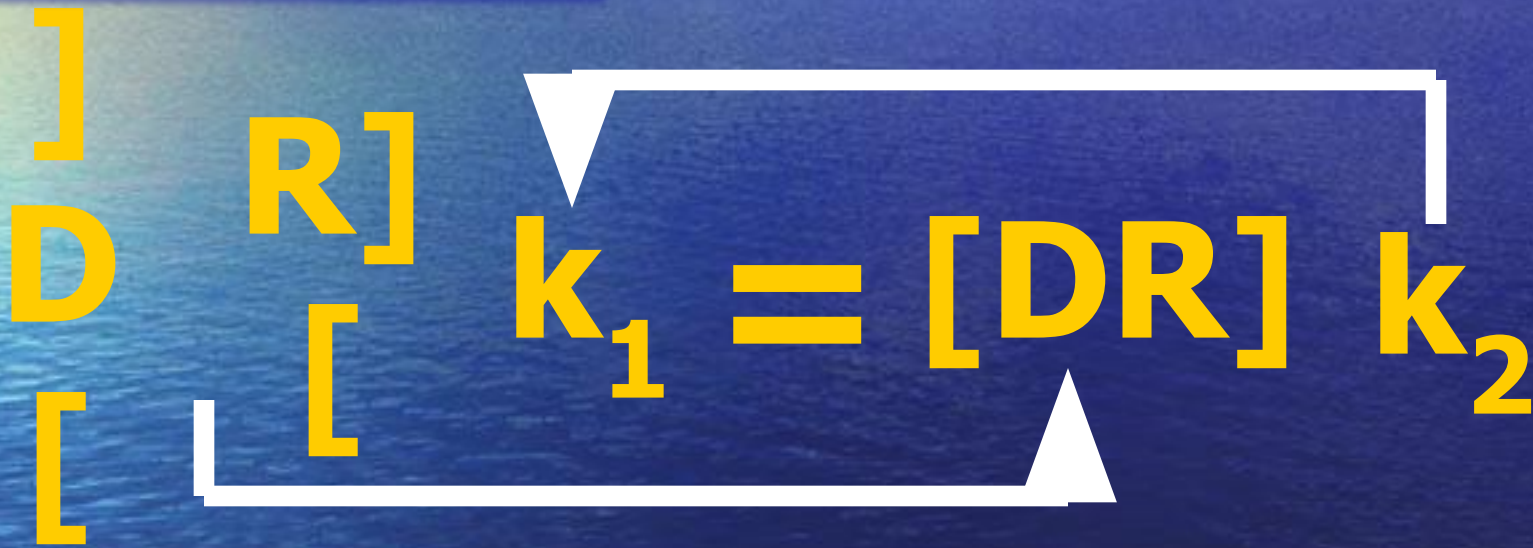
# Drug-Receptor Interaction

At equilibrium



# Drug-Receptor Interaction

At equilibrium



# Drug-Receptor Interaction

$$K_d = \frac{k_2}{k_1} = \frac{[R][D]}{[DR]}$$

**K<sub>d</sub> (dissociation equilibrium constant)  
is conc. of the drug that  
bind 50 % of the receptors**



$K_d$

- It is a measure of drug affinity

- Its units is conc. units

Drug A

Has higher  $K_d$  than

Drug B

? Which one has a higher affinity

# Important concepts

- Affinity
- Efficacy
- potency

# Affinity

- The ability of the drug to bind to the receptor
- Measured by  $K_d$
- Both agonist and antagonist have affinity to their receptors



# Efficacy

- It is the ability of the drugs to elicit pharmacological effect
- Measured by  $E_{\max}$
- Agonist has efficacy and antagonist has no efficacy

# potency

- The ability of the drug to produce response at lower conc.
- Measured by ED50



# The drug may be

- Agonist
- Antagonist
- Partial agonist



# Agonist

- Has affinity and efficacy
- $IA=1$

# Antagonist

- Has affinity but no efficacy

- $IA=0$



# Partial agonist

- Has affinity and efficacy

- $IA=0-1$



# antagonism

- Physical
- Chemical
- Physiological
- Pharmacokinetic
- pharmacodynamic

# Chemical antagonism

- One drug reacts chemically with an active drug to form an inactive compound,
- It involves precipitation, complexation, neutralization redox reaction.
- Intended □ treatment of heavy metal toxicity by complexation with chelators.
- Incidental □ complexation of tetracycline calcium in dairy products.



# Physiological antagonism

- 2 drugs act on different sites in the same or different system.
- a- Intended ☐ Norepinephrine in case of anaphylaxis.
- b-Incidental ☐ patient taking barbiturates for anxiety, co-administration of anti-tussive (ephedrine).



# Pharmacokinetic antagonism (ADME)

- a- Intended ☐ forced alkaline diuresis in management of barb Poisoning.
- b- Incidental ☐ Barb. + other drugs



**Induction of the metabolism of concomitant drugs, their decrease plasma level.**

# Pharmacodynamic antagonist

```
graph TD; A[Pharmacodynamic antagonist] --> B[Competitive]; A --> C[Non-competitive]; B --> D[Reversible]; B --> E[Surmountable antagonism]; B --> F[Ach. + atropine];
```

**Competitive**

**Non-competitive**

**Reversible**

**Surmountable antagonism**

**Ach. + atropine**

# Pharmacodynamic antagonist

```
graph TD; A[Pharmacodynamic antagonist] --> B[Competitive]; A --> C[Non-competitive]; B --> D[Reversible]; B --> E[Irreversible]; E --> F[Non-surmountable antagonism]; F --> G[Ach. + succinylcholine];
```

**Competitive**

**Non-competitive**

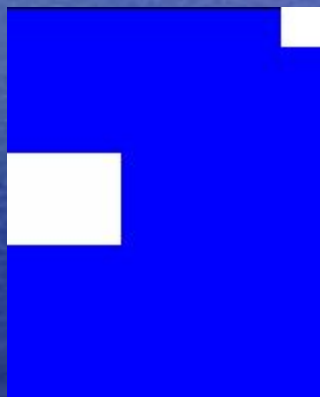
**Reversible**

**Irreversible**

**Non-surmountable antagonism**

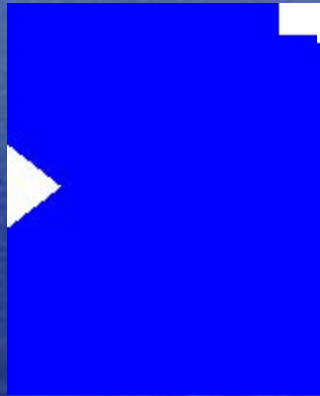
**Ach. + succinylcholine**





**A**

**X**



**An**

# Dose-Response Curve

- What ?

- Types ?



**Response**



**Hyperbolic curve**

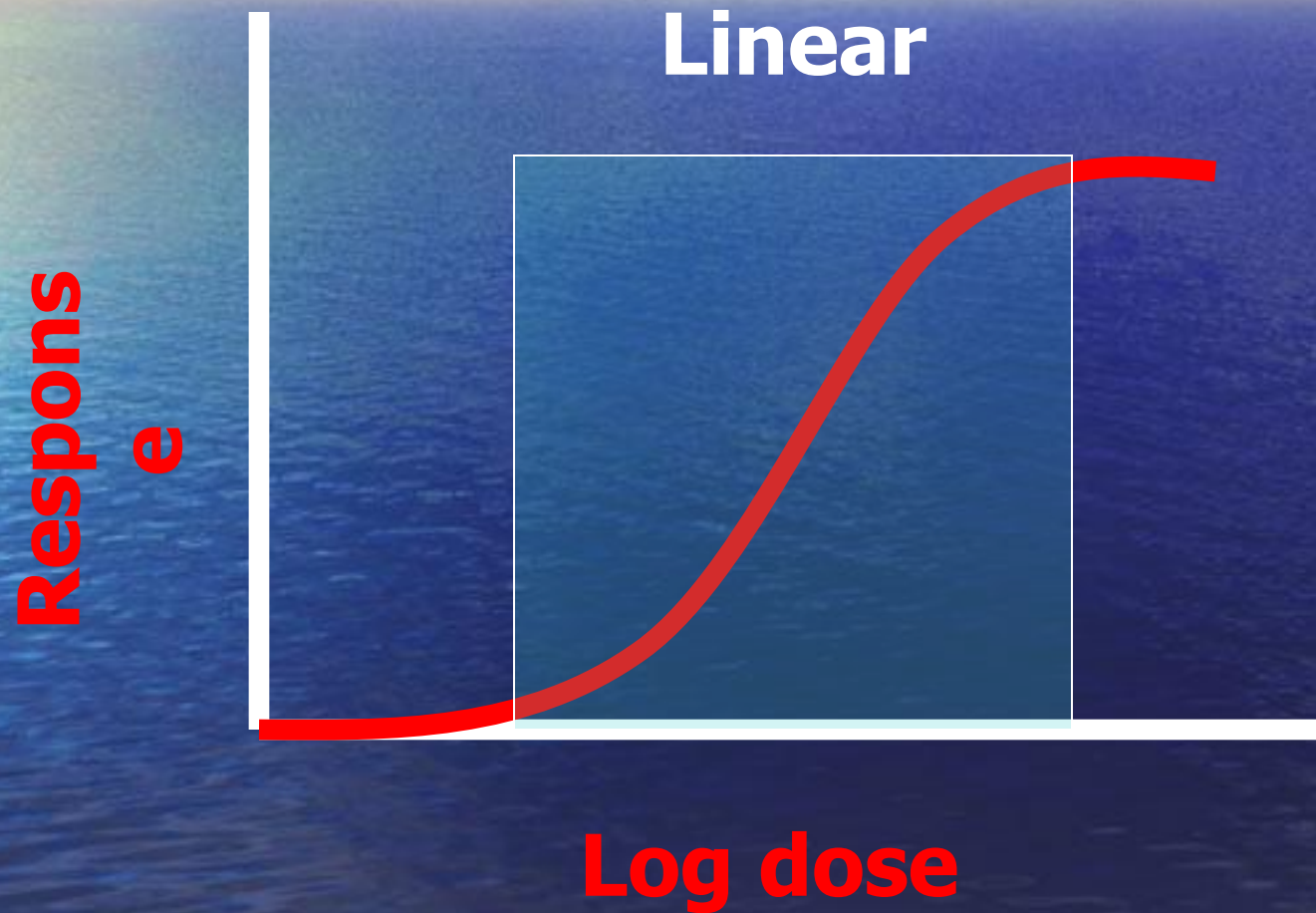
**Dose**

**Response**



**Sigmoidal shaped curve**

**Log dose**

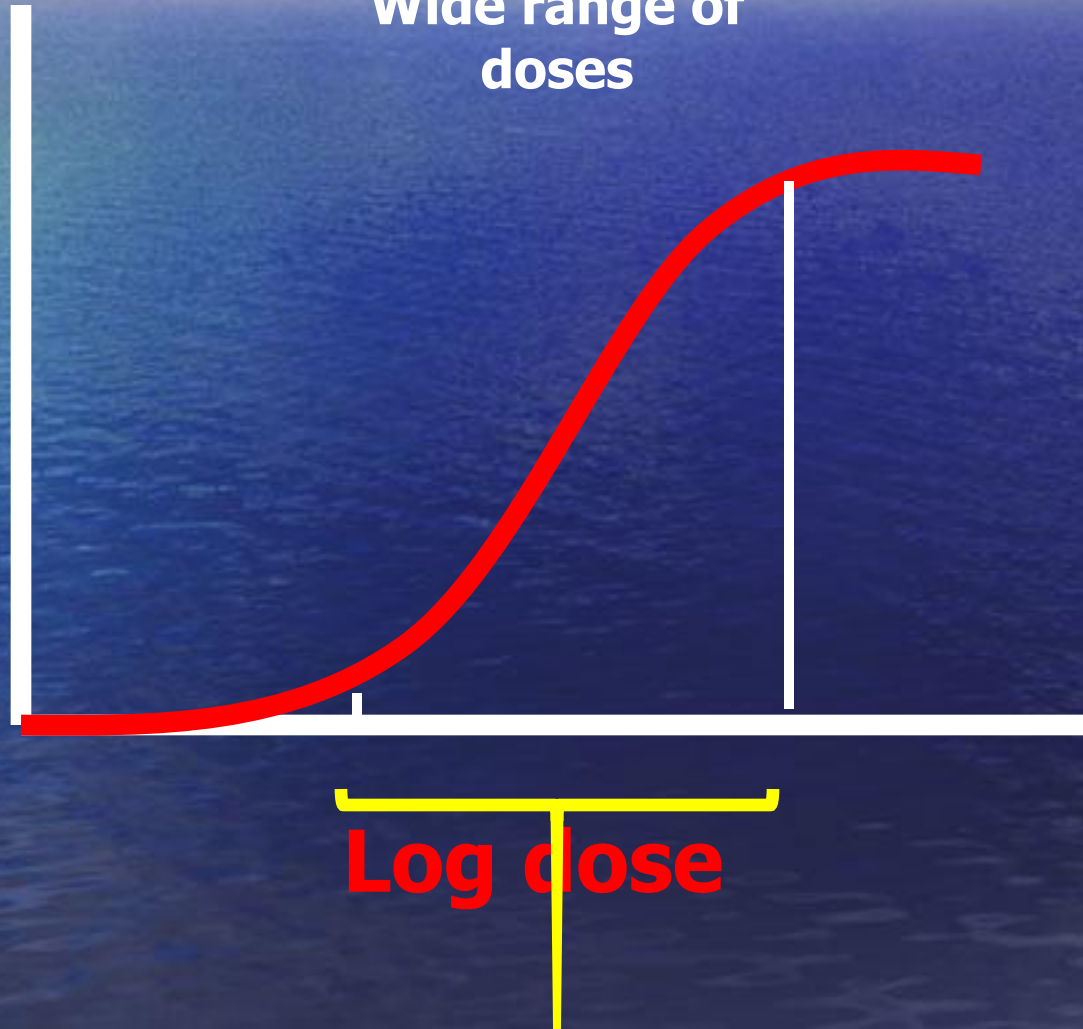


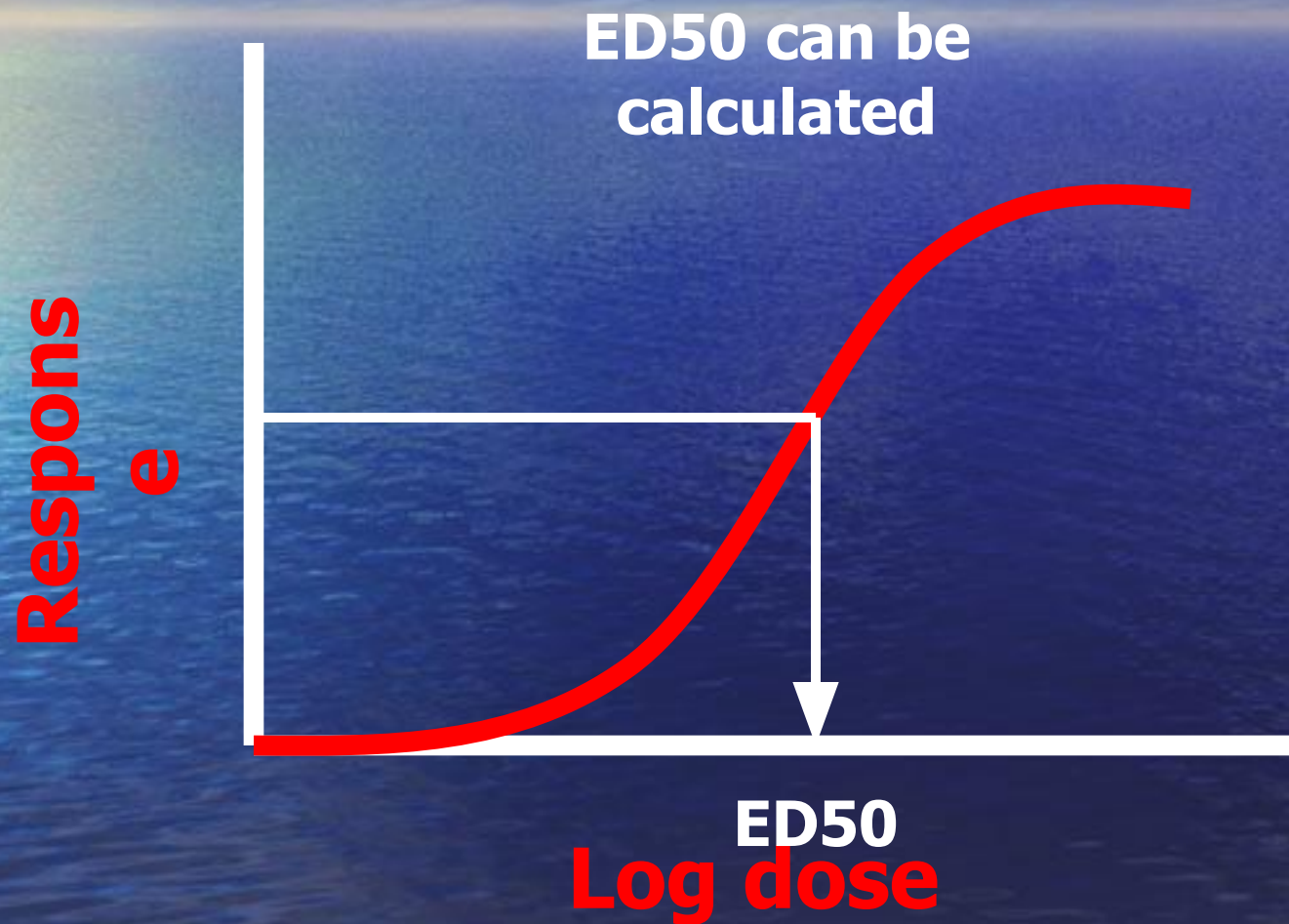


**Response**

**Wide range of  
doses**

**Log dose**



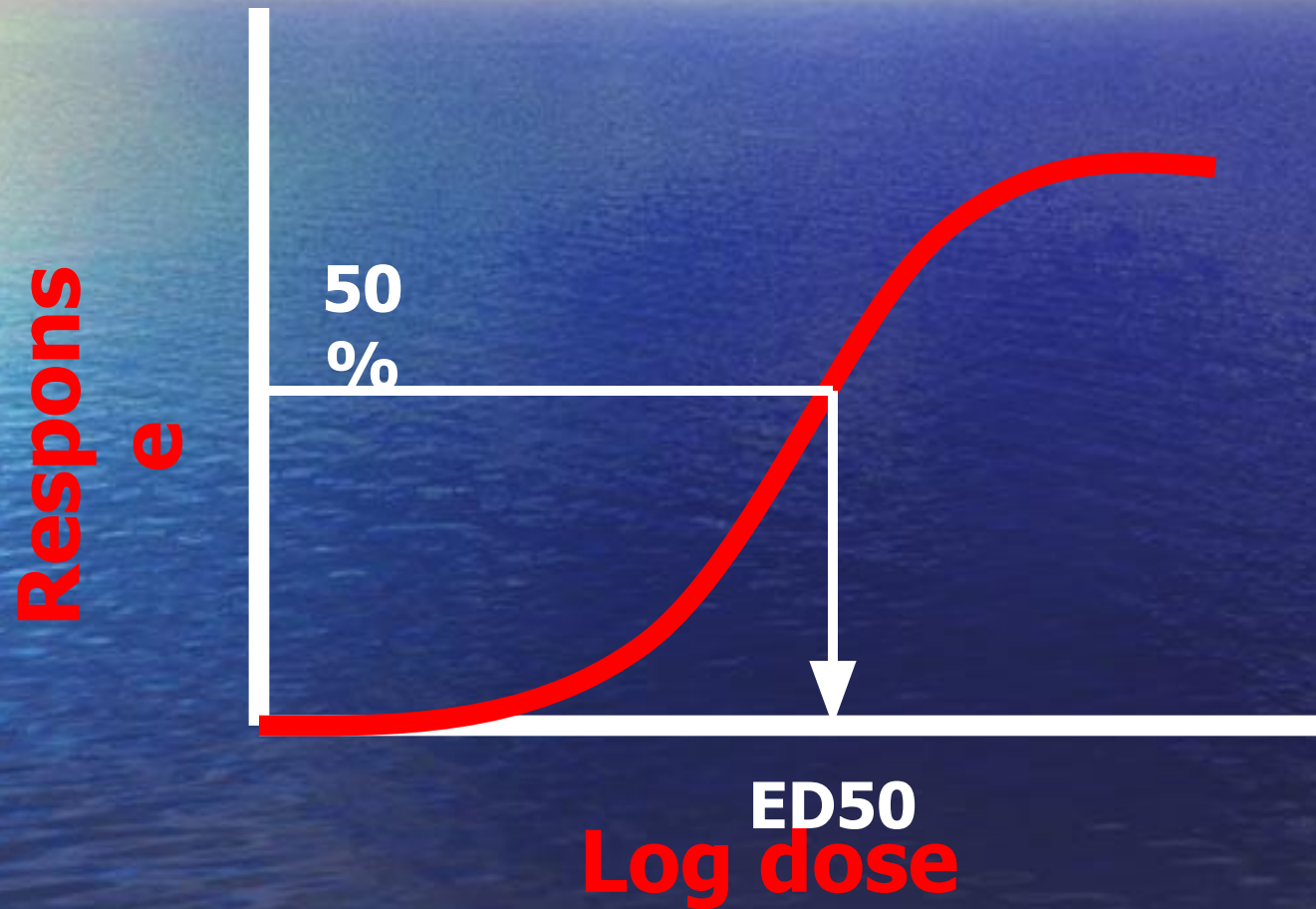


# Graded DRC

- Depends on graded response
- ED50 ?

**The dose that give 50% of maximal response**

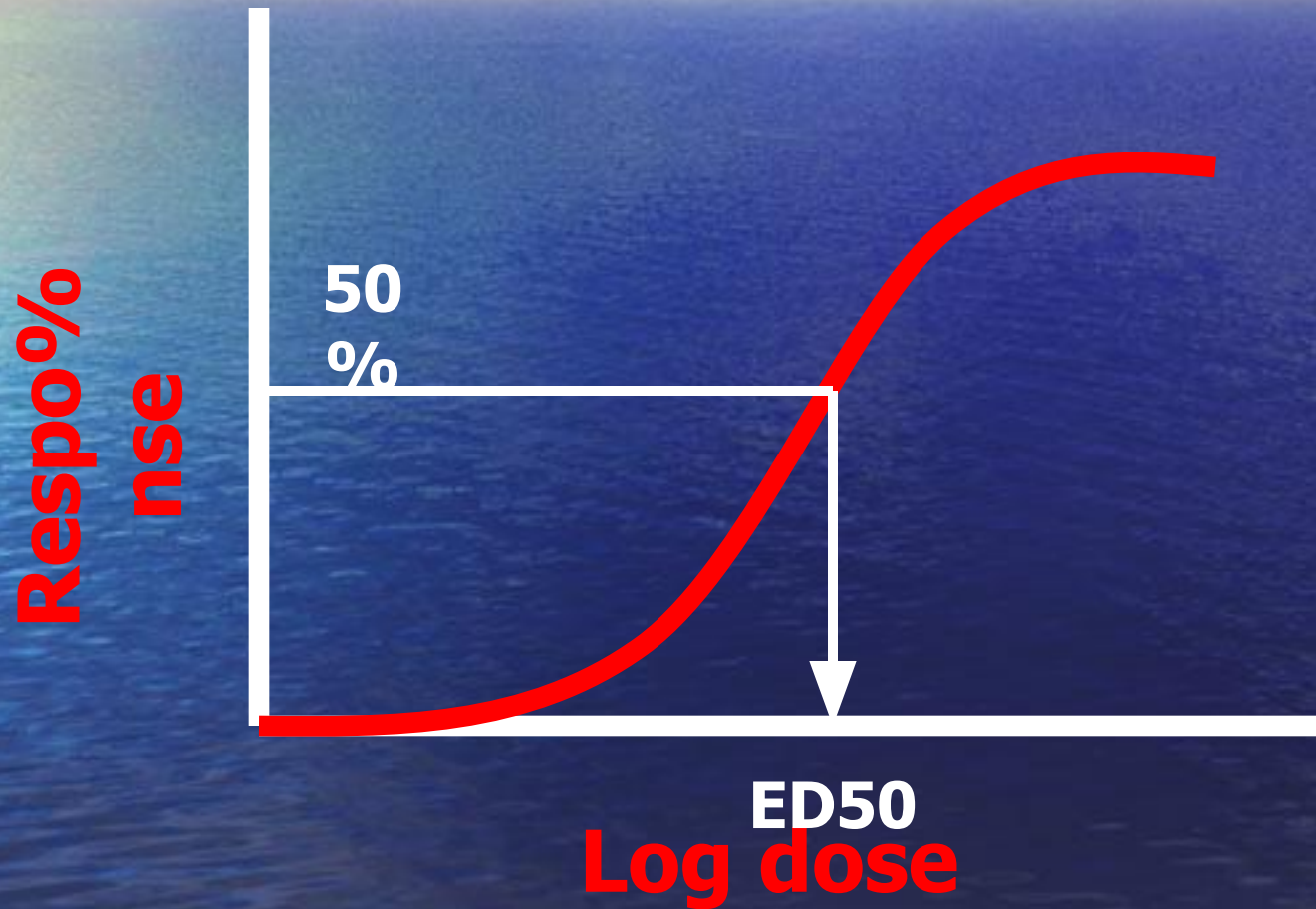




# Quantal DRC

- Depends on quantal response
- ED50 ?

The dose that give response in 50% of population





# ED50

- Compare between potencies of two drugs

Drug A

Has higher ED50  
than

Drug B

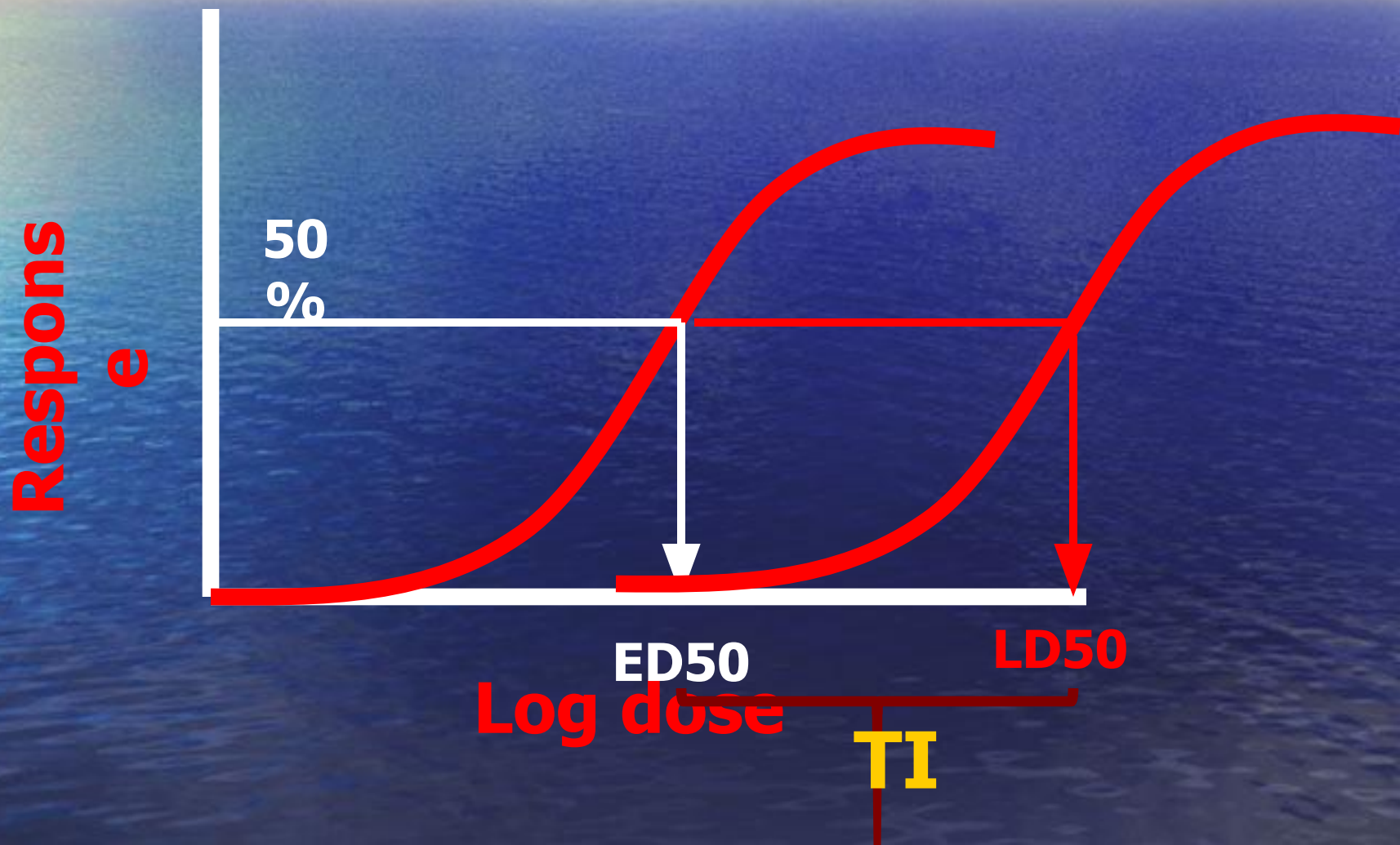
? Which one is more potent

# ED50

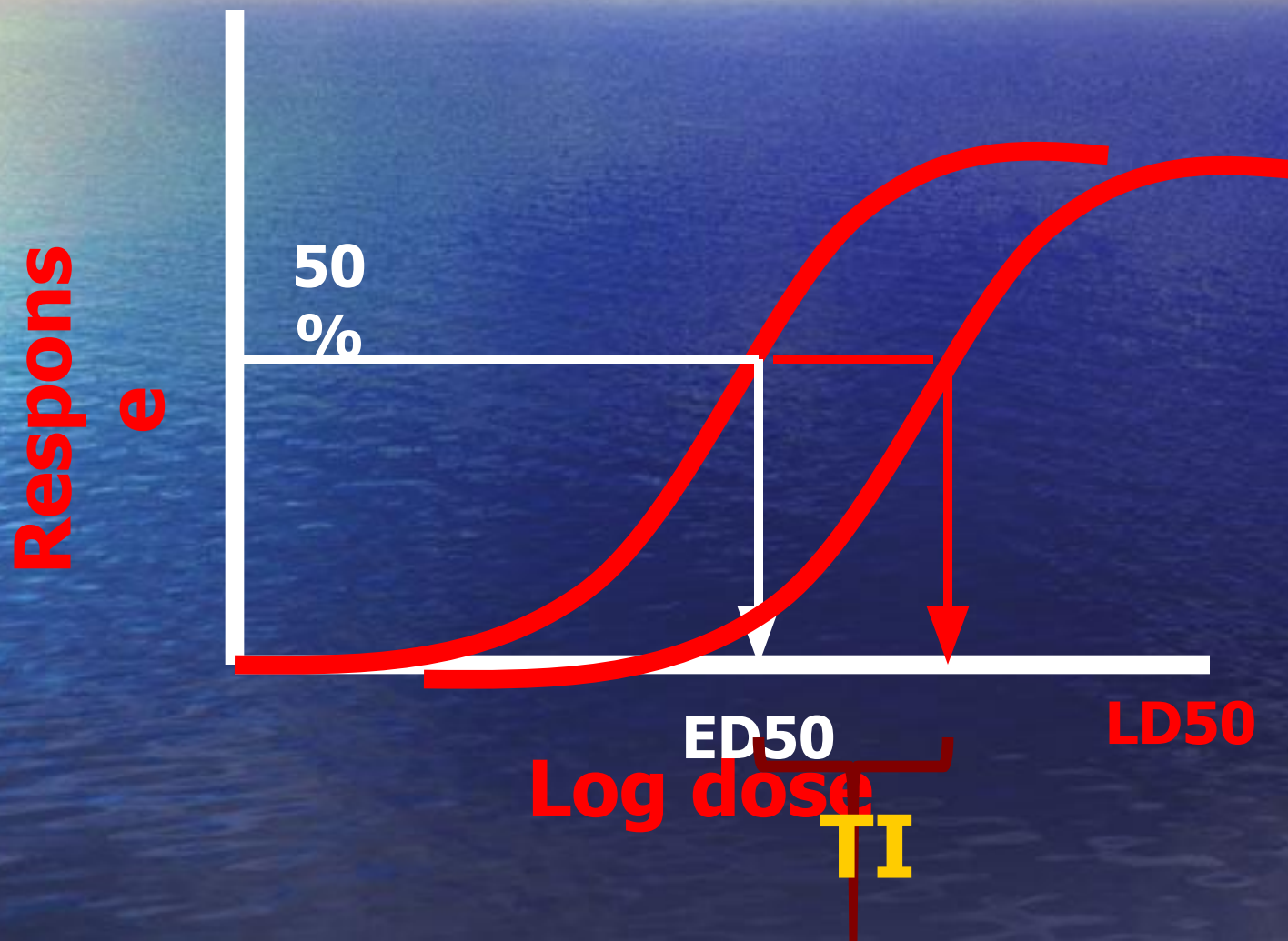
- Calculation of the therapeutic index

$$TI = \frac{LD50}{ED50}$$

Is a measure of drug safety







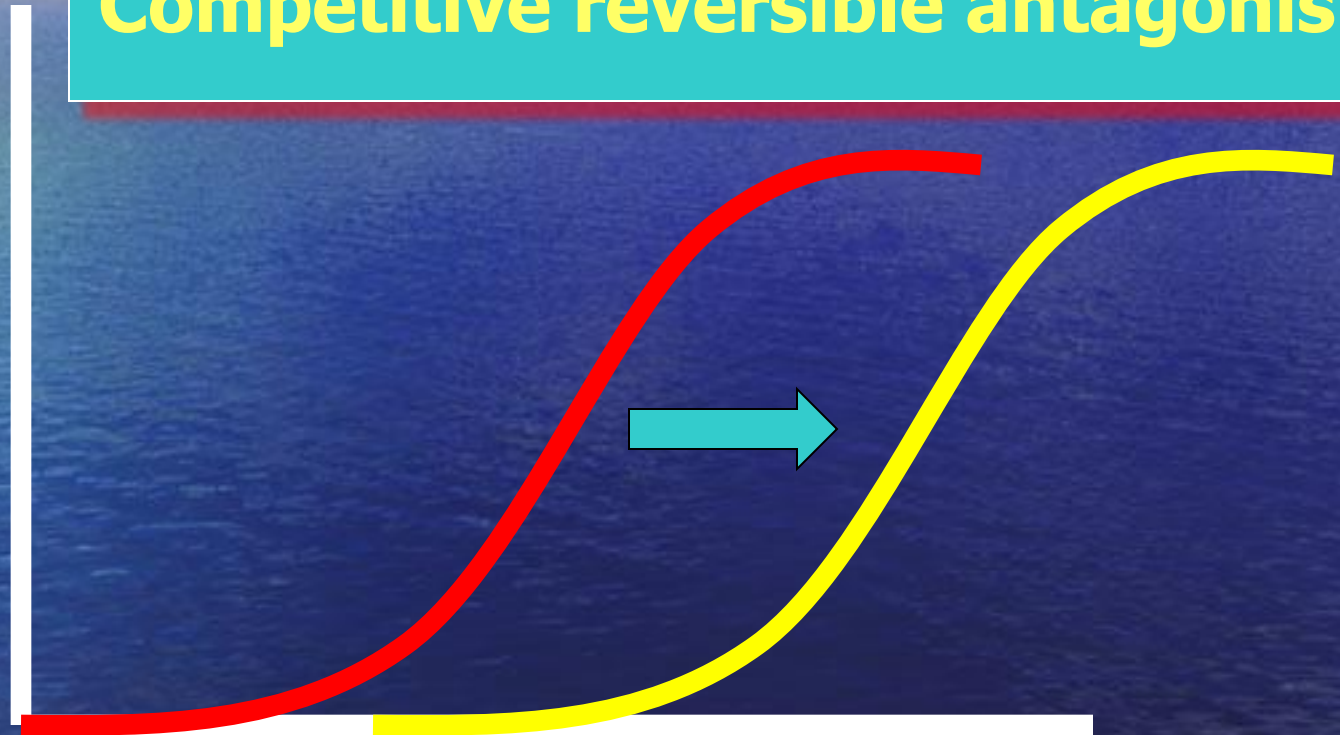
**Drug A**      **Has higher TI than**      **Drug B**

**? Which one is more safer**

# DRC & antagonists

Competitive reversible antagonist

Response

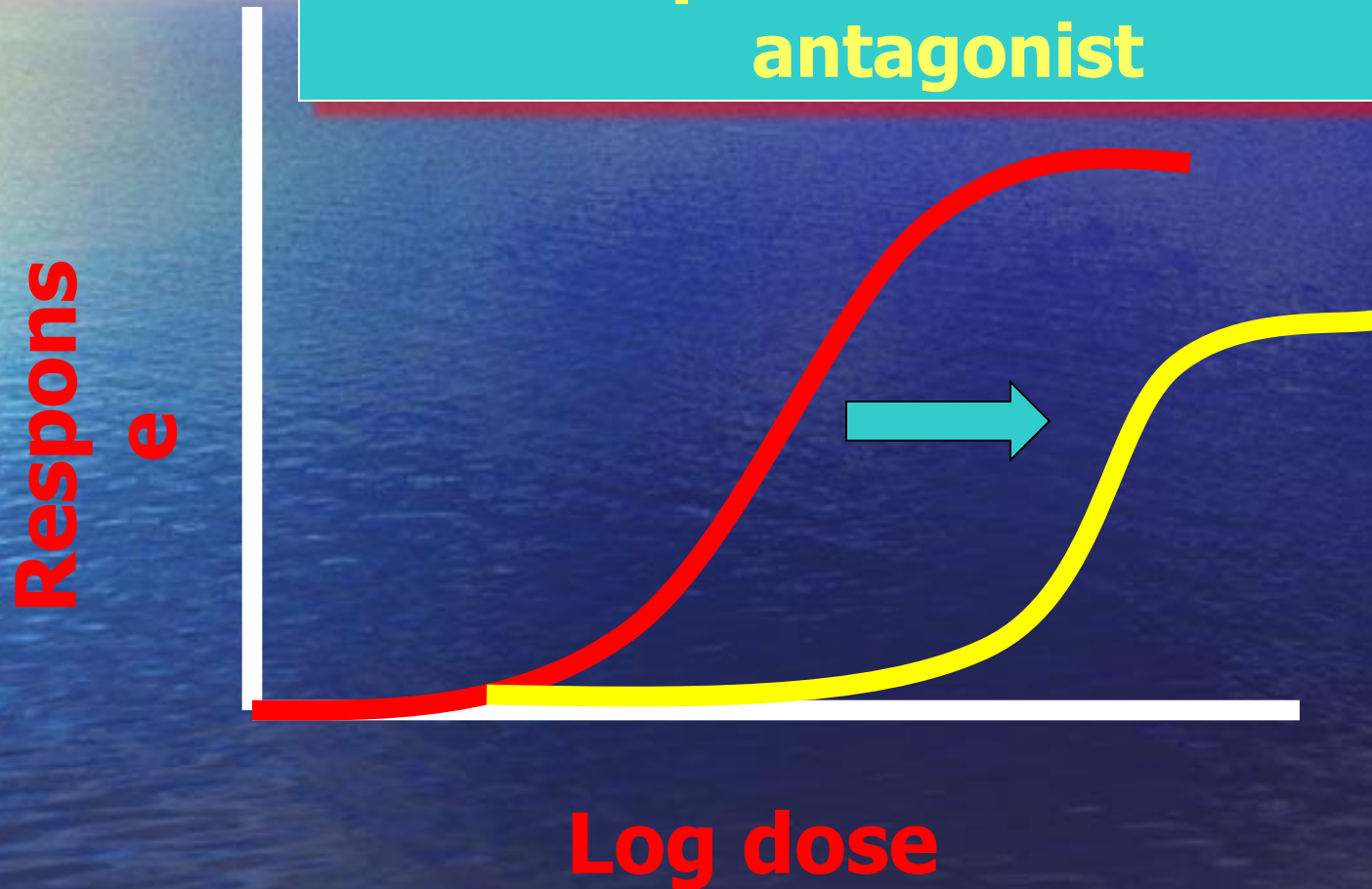


Log dose



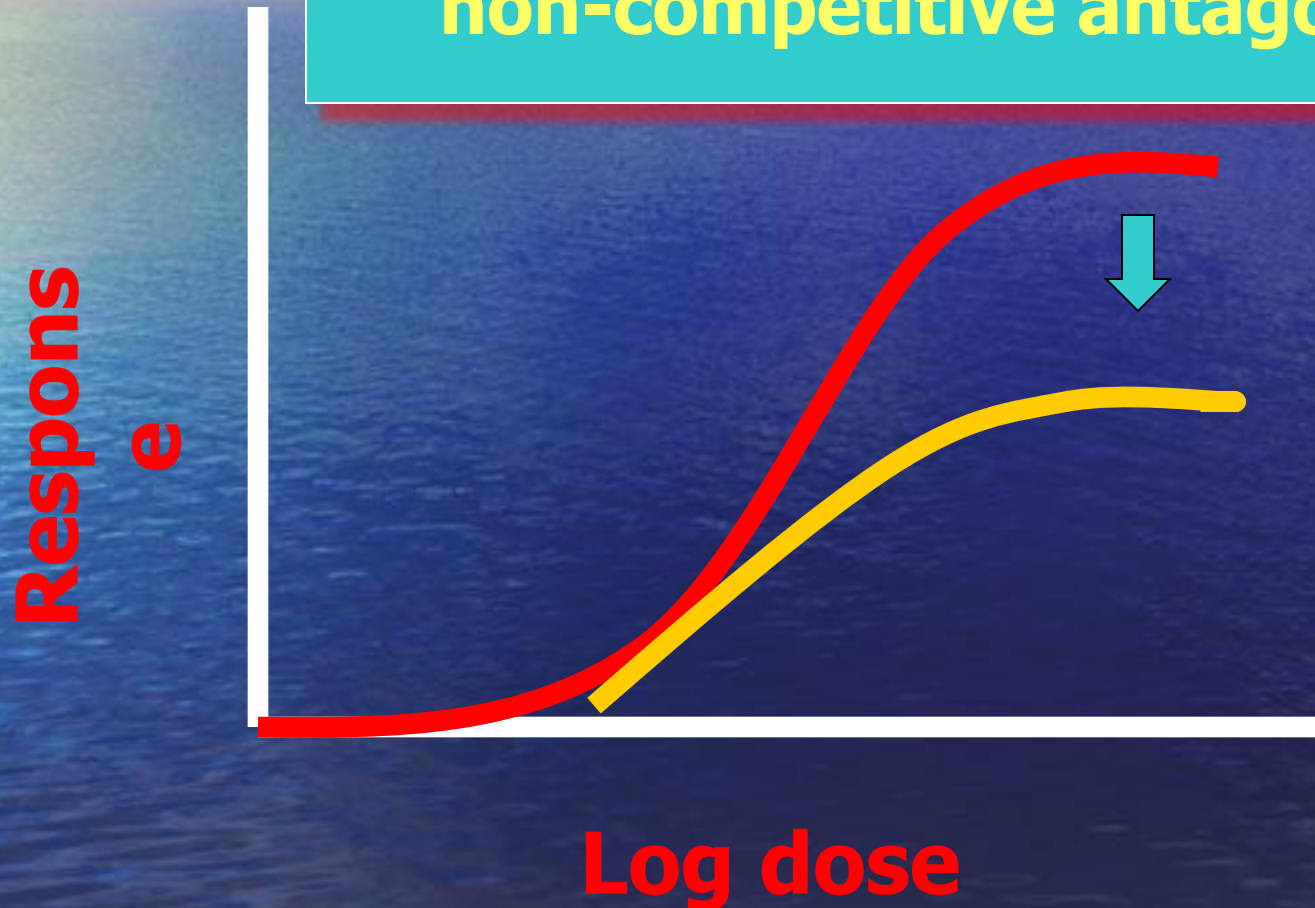
# DRC & antagonists

Competitive irreversible antagonist



# DRC & antagonists

non-competitive antagonist



# Important notes

**Parrallism**

**Indicate competition**



# Important notes

**Emax**

**Indicate reversibility**



**Thank you**