UNIVERSITY MEDICINE • EXERCISE SHEET

11.2 Pharmacodynamics

Name: _____ Class: _____ Date: _____ **Total: 24 marks**

KEY WORDS potency • partial agonist • therapeutic index

Objective

Read curves for potency, efficacy and margin.

1 Key knowledge and worked examples

■ **Two features per curve**

Potency = EC_{50} position; efficacy = E_{max} ceiling ✓. Partial agonists cap lower and displace full agonists; competitive antagonists shift right in parallel; non-competitive cut the ceiling.

■ **Worked example: the margin**

$TI = TD_{50}/ED_{50}$, illustrative 100/10 = 10 ✓. Narrow-TI drugs are the monitored ones.

2 Practice

2.1 Two drugs, same E_{max}, EC_{50} differs 10× – name the difference. [3]

2.2 What does a partial agonist do to the ceiling of a mixture? [3]

2.3 State the therapeutic index formula. [3]

3 Exam-style questions

3.1 Three illustrative curves: A (EC_{50} 2 mg, E_{max} 100 %), B (EC_{50} 20 mg, E_{max} 100 %), C (EC_{50} 2 mg, E_{max} 60 %).

Classify each on both axes (A potent and full; B 10× less potent, equally efficacious; C potent partial agonist) ✓. Predict C's effect co-given with a full agonist at saturating concentration (ceiling pulled toward C's 60 %) ✓. State which of A or B is preferred if both reach the target and A costs the same (potency then matters for dose size only) ✓. [8]

3.2 An illustrative antagonist pair on the same agonist curve.

Compare competitive (parallel right shift; effect restored by raising agonist concentration) with non-competitive (ceiling falls; no concentration wins) ✓. Explain which pattern an overdose of agonist can overcome and why ✓. [7]

Solutions

2.1

- Potency – B is 10× less potent, equally efficacious ✓.

2.2

- Lowers it – the partial agonist competes and caps the mixture near its own ceiling ✓.

2.3

- $TI = TD_{50}/ED_{50}$ (illustrative 100/10 = 10) ✓.

3.1

- A: potent, full efficacy ✓.
- B: 10× less potent (EC_{50} 20 mg), same ceiling ✓.
- C: potent but partial – E_{max} 60 % ✓.
- C + full agonist at saturation: ceiling pulled toward 60 % (displacement) ✓.
- Potency only sets dose size; if both reach target, either serves ✓.

3.2

- Competitive: right shift, parallel, surmountable ✓.
- Non-competitive: ceiling lowered, unsurmountable ✓.
- Overcome: the competitive case – more agonist outcompetes at the binding site ✓.
- The non-competitive case removes the rope: no tug-of-war is possible ✓.

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