

ReceptorCards: a novel educational resource for teaching pharmacology

Dr Leanne Stokes & Dr Rosemary Norton
School of Pharmacy, University of East Anglia, Norwich UK.
Email: l.stokes@uea.ac.uk or r.norton@uea.ac.uk

Introduction:

During the first year of the BSc Pharmacology & Drug Discovery undergraduate degree program at UEA we focus on teaching cell biology, receptors and cell signalling pathways plus drug-receptor theory. Students typically find learning and comparing different receptor types difficult. Theoretical principles of drug action is classed as core knowledge. This includes knowledge and understanding of drugs that can be used in health and disease, how drugs interact with their target (receptors), and how physiological and pathophysiological processes are affected by drug action. We have developed a set of small pocket-sized cards covering the main receptor types. These cards introduce the basic receptor families (enzymes, GPCRs, ion channels, transporters) with a number of important examples. Our new resource will help support future students in their learning and revision.

Method:

A trial set of Receptor and signalling cards were developed in conjunction with two undergraduate pharmacy students. These cards were provided to our first and second year students on the BSc Pharmacology and Drug Discovery course in the 2017-18 academic year. A mixed methods approach was used to evaluate the usefulness of this resource. Ethical approval was granted by the University of East Anglia School of Education and Lifelong learning research ethics committee for a short questionnaire to be provided to students. The questionnaire was composed of both Likert scale questions and open boxes. A total of 33 students were surveyed at the end of the 2017-18 academic year to evaluate their perceptions on the usefulness of these cards and any suggested amendments.

ReceptorCards

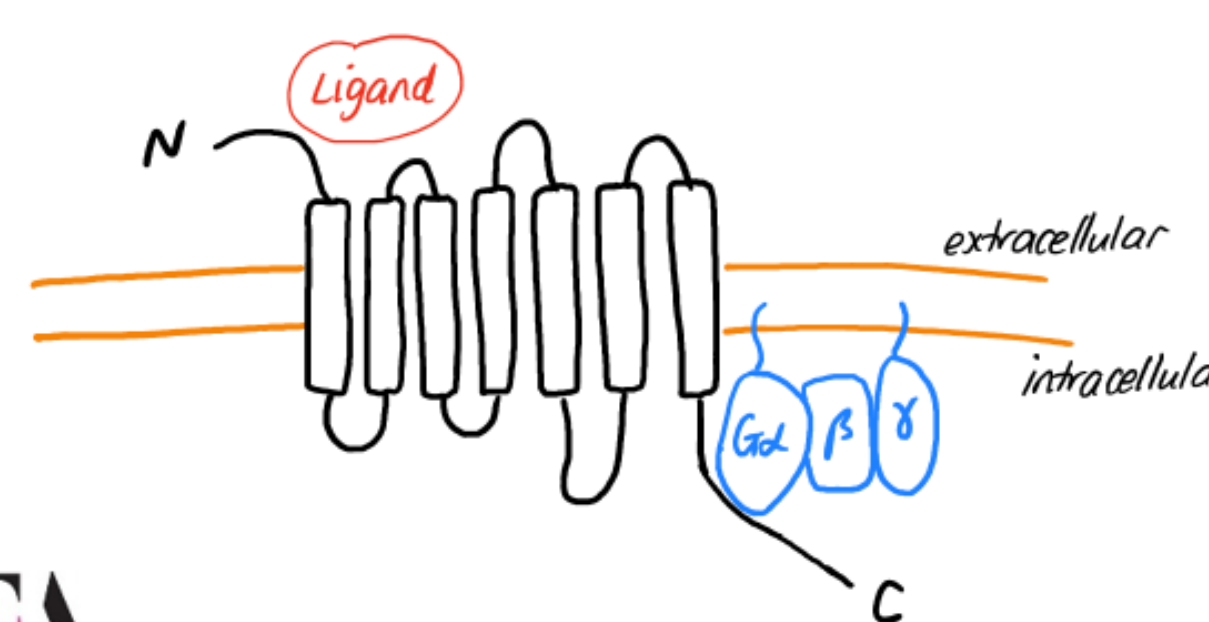
Created by Dr Leanne Stokes, Dr Rosemary Norton, Dr Derek Warren, Emily Jordison and Samantha Fisher

This work was supported by the British Pharmacological Society

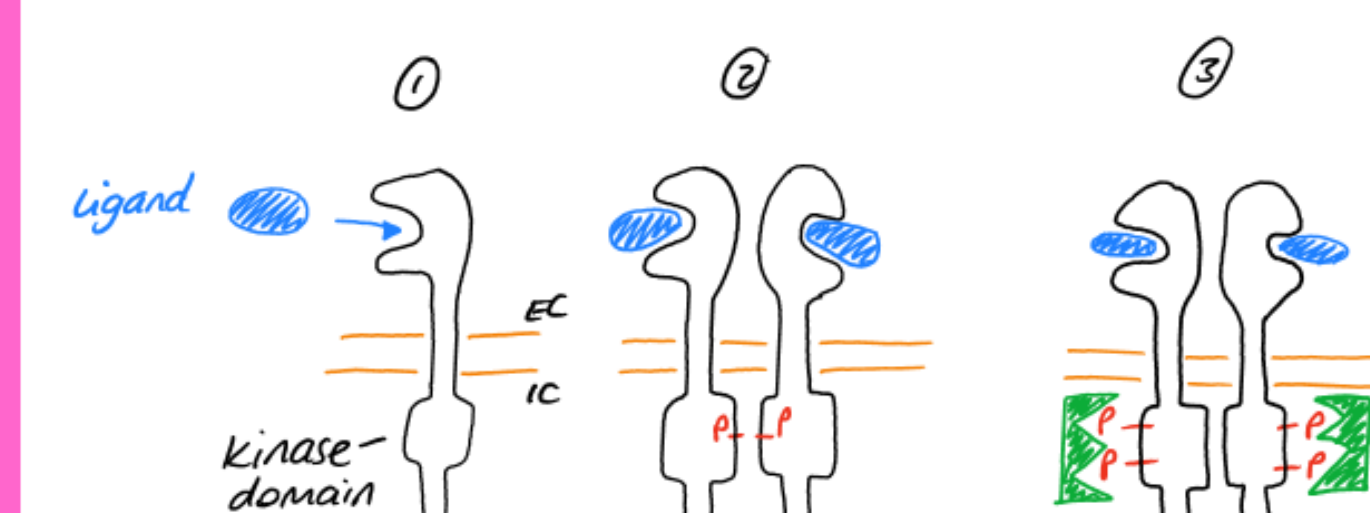


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G protein Coupled Receptors



Enzyme-linked receptors



Example cards:

Muscarinic receptors

Signalling Pathway
G_{aq/11} (M₁, M₂, M₃):

- G_{aq} stimulates PLC β
- PIP₂ hydrolysed into DAG + IP₃
- DAG activates PKC
- IP₃ triggers Ca²⁺ release

G_{ai/o} (M₂, M₄):

- G_{ai} inhibits adenylate cyclase
- Reduction of cAMP
- Enhance K⁺ permeability

Classification:
GPCR - class A, rhodopsin-like

M₁: Neuronal, CNS, glandular
M₂: Cardiac
M₃: Glandular, SM (lungs)
M₄: CNS
M₅: CNS

Agonist: ACh**, carbachol, cevimeline (M₃)
Antagonist: atropine (non-selective), pirenzepine (M₁)

cAMP

I am a second messenger
I am produced from ATP by adenylate cyclase
I am metabolised by a phosphodiesterase enzyme
I am converted into 5'-AMP
I activate protein kinase A (PKA)
I can induce hormone synthesis and secretion
I can regulate ion channels
I can regulate gene expression through CREB and CRE

Student feedback from pilot study at UEA

I am using the cards when I travel because of the pocket size that is ideal

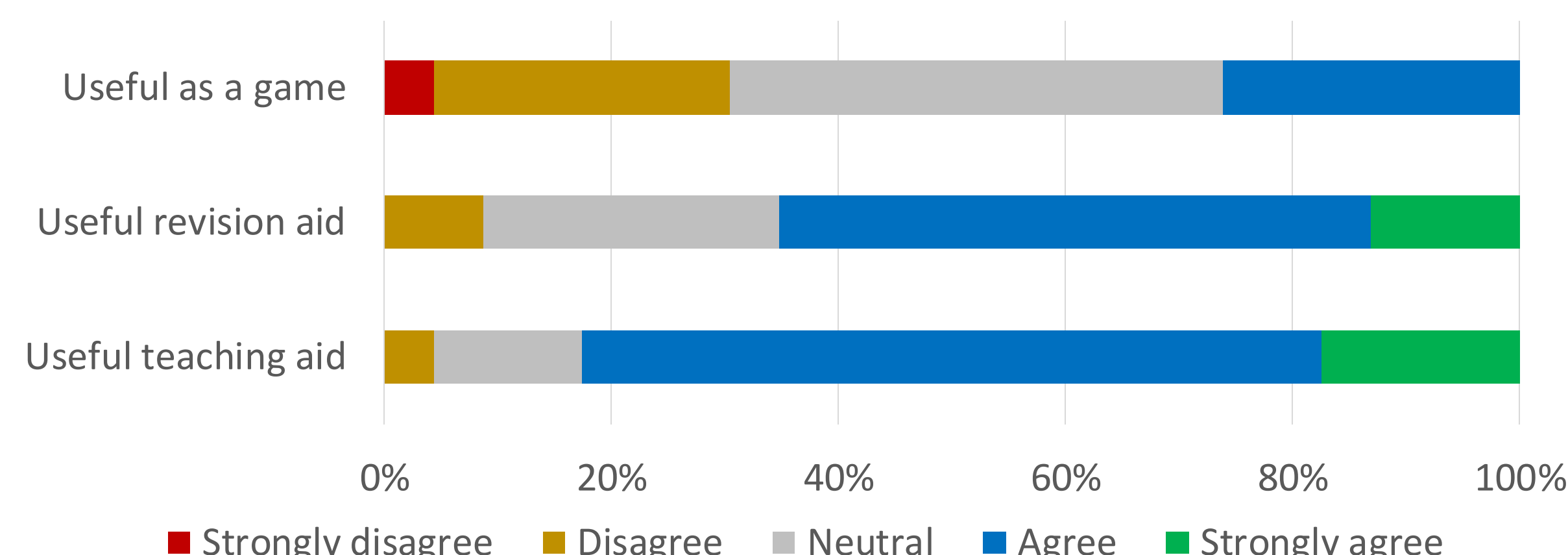
Use them more in lectures/workshops

I used it particularly when I did revision for the exam and it helped.

If possible, expand to other areas of the course

They were helpful to visualise structures and as cues to remember key information

Student evaluation



A small pilot study evaluated 33 students studying BSc Pharmacology & Drug Discovery and their opinions of the ReceptorCards in 2017-2018. The questionnaire had a response rate of 70%. Comments in the open boxes on their use included that they were useful for travel, for testing knowledge, revision, as a reference source, brainstorming, and for use in taught sessions. Improvements suggested expansion to other areas of the course, make more use of them in taught lectures and workshops, and to add more information to the cards.

Acknowledgements

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