PROVOCATION-BASED LEARNING

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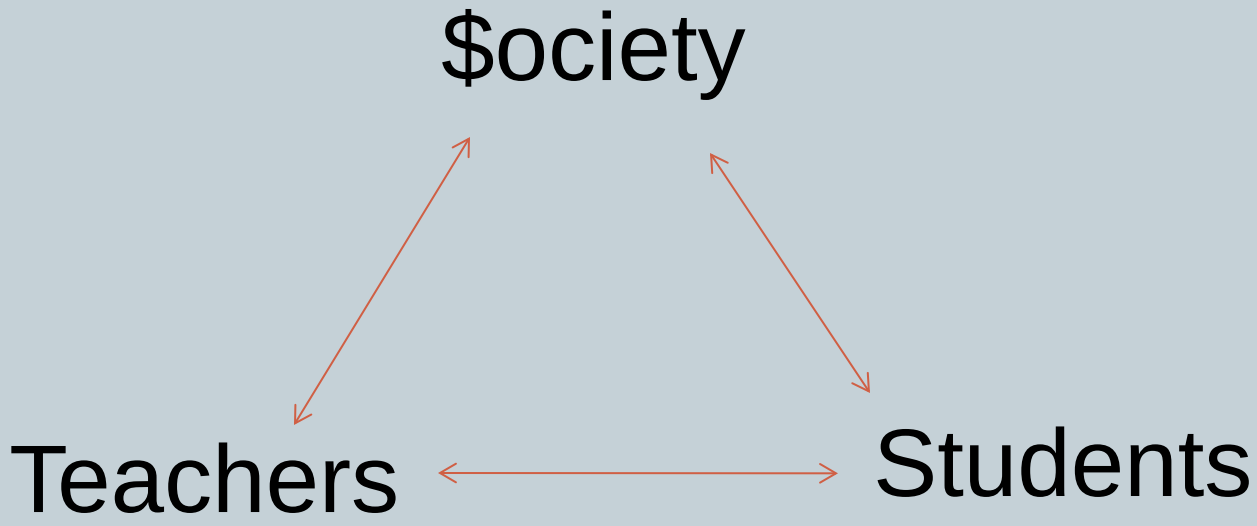
The Educational Enterprise



The Teacher's Four Questions

What should I teach? - Objectives
How should I teach? - Delivery
Have my students learned anything? –Evaluation of Students
How do I know that I have taught them? –Evaluation of Course

THE DELIVERY ISSUE

Shifting the Locus of Control

Teacher  Student

EDUCATION a POLITICAL ACT that
SEEKS to PRODUCE CHANGES

Get students engaged

DOES ACTIVE LEARNING WORK?

Wealth of Data in support of Active Learning

Sources:

(a) Evidence from Learning Sciences, Cognitive Science, Educational Psychology

(b) Attempts to repair misconceptions (physics, chemistry, engineering)

Michael (Adv. Physiol Educ 30 ,159, 2006)

Prince (J. Eng. Educ. 93, 223, 2004)

THE PROBLEM OF SCALE: EDUCATIONAL ALLOMETRY?

Situation

- Mandate—to teach biology to first year undergrads
- Health Sciences Program
- Large class

- Approach: “Active Learning”

Fostering Student Engagement: Operational Considerations

- What are the overall objectives?
- Who are my students?
- What approaches can be used with available resources?
- What assessments will I need to use?
- Are these consonant with my course objectives?

Evaluation: General Principles

1.Students must learn from the procedures

2. Students must be tested on their strengths as well as their weaknesses

3. Must be consonant with the goals of the program

Elliot Eisner-

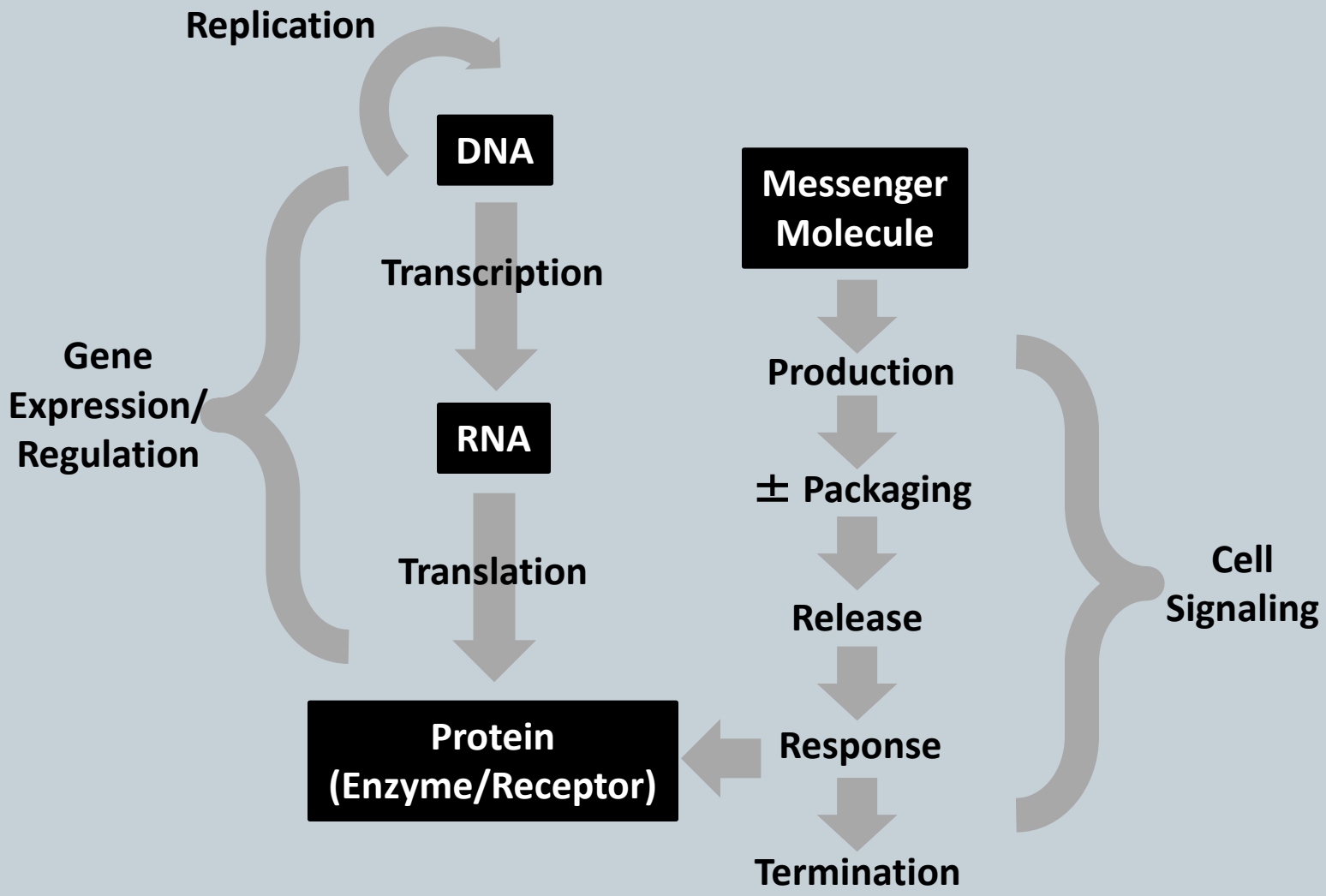
Educational Outcomes

Instructional

Expressive

Objectives

- “Facts”
- The way to those facts
- Cellular communication
- Limited number of molecules discussed
  - Histamine
  - Acetylcholine
  - Noradrenaline
  - Prostaglandins
  - Nitric Oxide


Replication
DNA
Transcription
RNA
Translation
Protein
(Enzyme/Receptor)
Gene
Expression/
Regulation
Messenger
Molecule
Production
± Packaging
Release
Response
Termination
Cell
Signaling

Interactive Sessions

- Didactic- 2 instructors
- Two 3-hour sessions per week
- All students attended both
- Large class room-fixed seats
- Interrupted– 45 min sessions
- Small Group summaries
- Q and A

TERM ONE
Summaries (end-of-each session)

Legacy Summaries
“ Luck-Free” Exam

THE LEGACY GROUP SUMMARIES

PART ONE:
Each Group will attempt a synthesis of their learning. This will take the form of a “Welcome” letter to incoming students describing what the course is about. This would flesh out the Course Outline that they will receive officially.

PART TWO:
Here you will pick up on a concept/issue that was difficult to understand. This in a sense created a bottleneck. You will explain why you chose this particular item and then write a piece that would help the incoming students understand it.

Cell and Molecular Bio

FOR

HEALTH SCI

Did you think cells were simple?

By: "Proteens and Designer Genes"
Georgiades-2

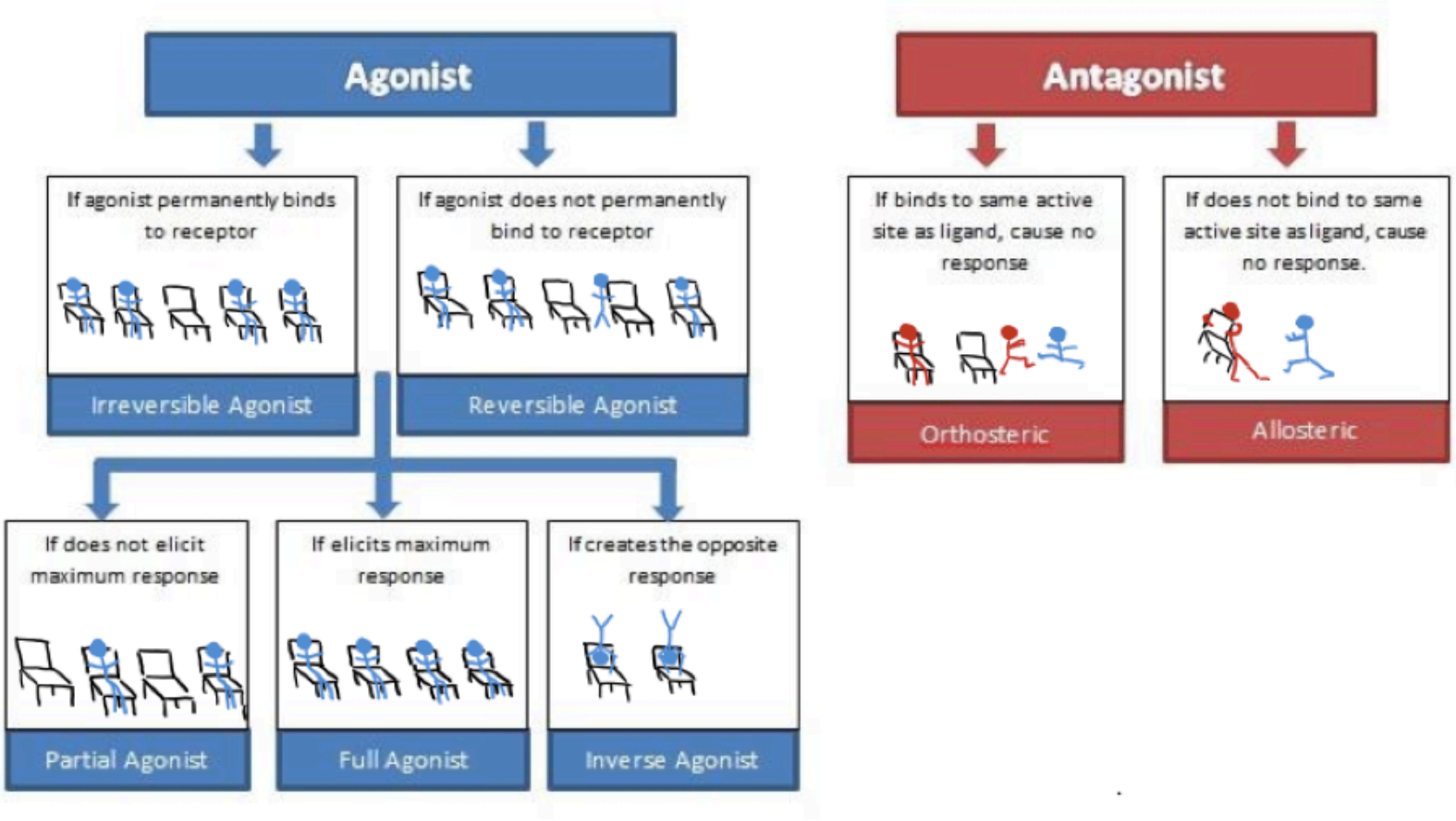
Keep Calm and Cell Bio On!

Ronald Leung, Lisa Feng, Sharon W[illegible] Kennedy Hao, Whitney Reinhart, Nicola Sahar[illegible]

First Year Health Sci Students 2012

The Analogy: Imagine the receptors as chairs and the ligands as people. Assume there is ten of each. A full agonist, in this case, would be represented through the occupation of all ten chairs to elicit the maximum response. Partial Agonists, on the other hand, can be demonstrated via the occupation of a fraction of the ten chairs, which would not reach elicit the full response. People who do not stand up to leave the chairs demonstrate irreversible ligands. An inverse agonist would be demonstrated through people doing a handstand on the chairs, instead of sitting in the traditional way. These ligands would produce an opposite response to the original. People who take the chairs but do not sit on them prevent another person (the orthosteric ligand) from sitting—thus, they represent allosteric ligands that reduce response. Competitive antagonism, on the other hand, is when a good person (agonist) and a bad person (antagonist) "fight" for the same chair. Thus, it can be inferred that if there were more bad people relative to the good people, there would be a higher probability for the bad people to win the chair.

Figure 5 (The Visual Aid): Mapping out the various ligand-receptor interactions.



“Luck-Free” Exam

- Instructional Outcomes
- Eight to Ten Questions given
- Students encouraged to prepare for these
- Mid-Year exam- any 4 given

Sample Question

- You have received a summer studentship to work for Huronsville Nutraceuticals. They are interested in exploring the beneficial effects of fruit juices on cardiovascular function. Your specific task is to compare the effects of pomegranate juice, grape extracts and red wine. You have 3 test systems available to you: (i) Isolated pig coronary arteries which can be used to test responses to contractile and relaxant agents. (ii) Human platelets and a means of studying platelet aggregation. (iii) Isolated cells that can be used to monitor changes in intracellular calcium using fluorescent probes.

Sample Question

You have been asked to come up with 3 novel molecular approaches to treating asthma. You recall learning about parasympathetic activation causing constriction of smooth muscle in the lungs and that this was mediated by a postganglionic muscarinic acetylcholine receptor. You hit on the perfect hypothesis -- that a splice variant of the muscarinic receptor leads to the asthma symptoms. All you have to do is find 3 different ways of controlling how the gene for the altered muscarinic receptor is expressed and your problem is solved!

TERM TWO

NO formal classes
Exercises and Projects
TRIPSES (Group/Individual)
Legacy TRIPSES
UNSIN PROJECT

THE TRIPSE (Tri-Partite Problem Solving Exercise)

Given limited data

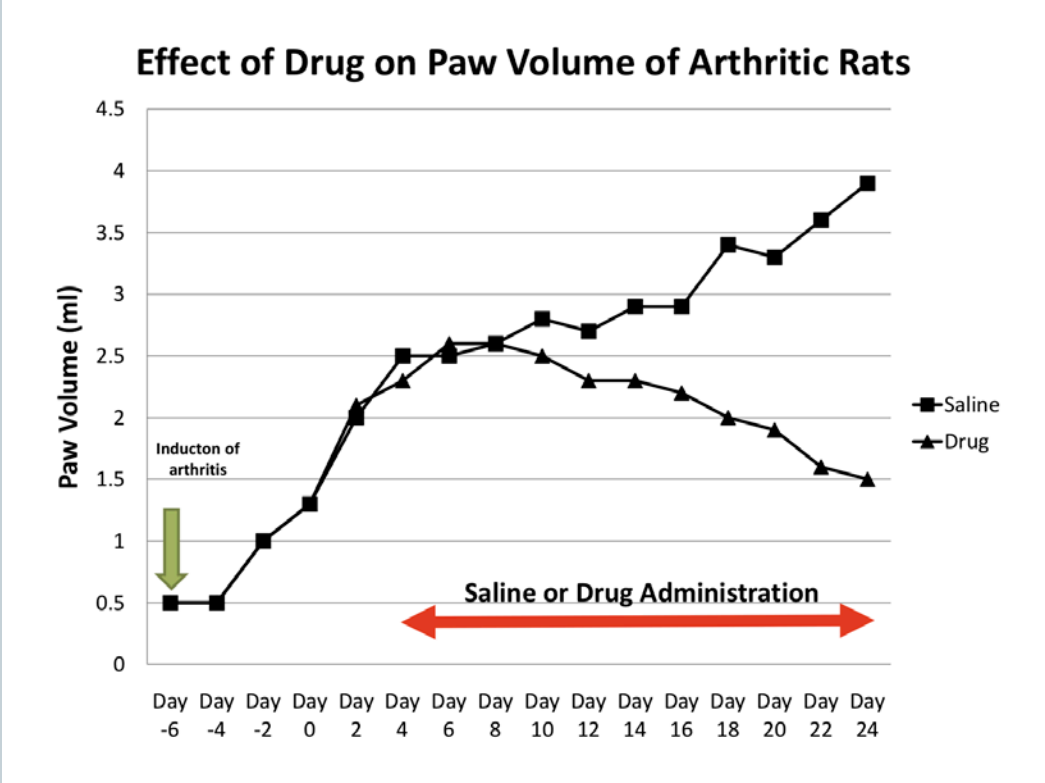
Part 1: Students frame possible explanations

Part 2: Suggest possible avenues for exploration

Part 3: Given new information –Re-assess

THESE FEET NOT MADE FOR WALKING

Swollen joints are characteristic of many forms of arthritis. Experimental models are widely used to explore the pathogenesis of this clinical condition and to test potential anti-arthritic drugs. Rats were injected with a specific chemical in their paws to induce swelling and inflammation. Once a significant increase in paw volume had been noted, one group of rats (triangles) were administered a particular drug for a given period of time. Rats administered equivalent amounts of saline (squares) served as controls.



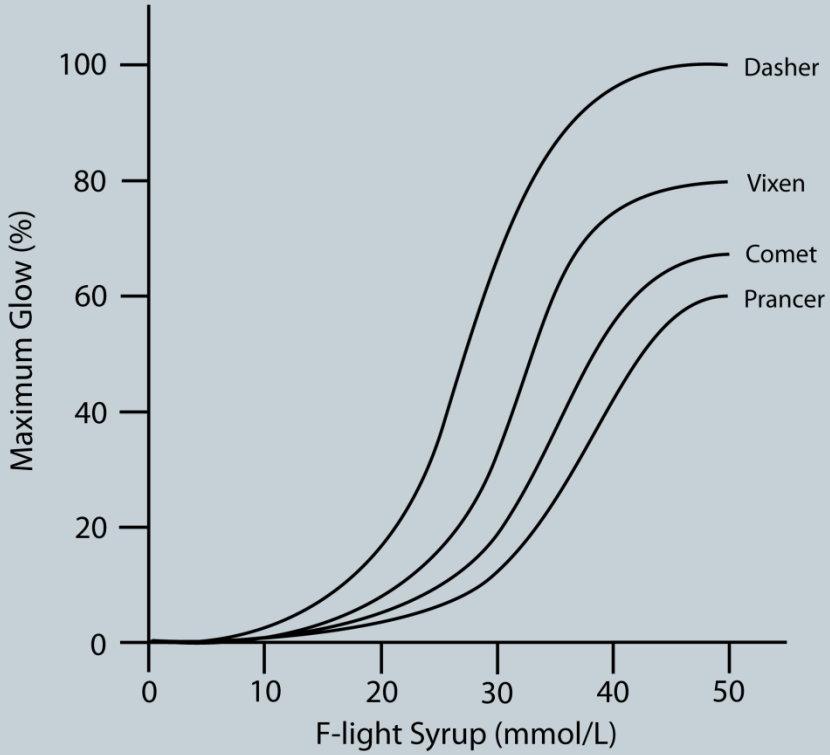
Biochem Mol Biol Educ. 2013 May;41(3):145-55.

The Legacy TRIPSE Exercise

- **The Problem**
- Write a challenging problem based on published material, namely research article(s). These problems must be written in a fashion that permits future students to raise plausible hypotheses/explanations, as you have been doing in Part 1 of the TRIPSE.
-

Rudolph the Dead-Nose Reindeer

T’was the night before Christmas and Santa’s reindeer were eating dinner. Annoyed by Santa’s favouritism, the underpaid and disgruntled elves mixed their own surprise ingredient, mistletoe, into each reindeer’s normal meal. Dasher wasn’t very hungry this evening, so he didn’t eat any dinner at all. Vixen ate just a little portion of his meal, Comet ate almost all of his, and Prancer finished the whole thing. Before the reindeer take flight, Santa normally gives them increasing concentrations of F-light syrup until their noses glow as red and bright as possible. To Santa’s chagrin, upon giving them increasing doses of F-light syrup, only Dasher’s nose was able to reach the full, expected glow. Seeing Santa struggle, his elves stepped out and sneered, “Happy Christmas to all, and to all a good flight!”



100% glow is in reference to maximum glow observed in previous years.

Note: Mrs. Clause, a budding pharmacologist, has a standard reindeer nose cell line available to be used in tests.

THE UNSIN PROJECT

- Groups formed (10 -12)
- Allotted at random to 4 GROUPS- Anti-Gluttony/Anti-Wrath/Anti-Sloth/Anti-Lust
- Frame a molecular intervention to counter sin
- Proposal for continued funding
- Work together in Groups
- Met each group –pre-arranged schedule
- ONE student selected at random to present
- Festi-Cuffs-no holds-barred discussions
- Final Report Marked

What Transpired

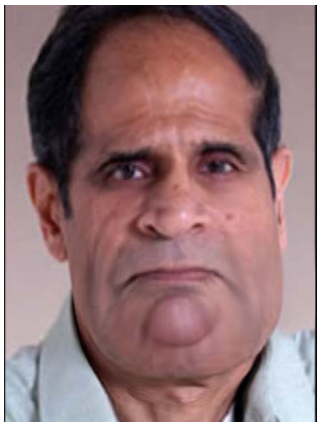
- Evidence of Group learning
- Documentation of search strategies
- Multiple molecules targeted
- Reports highly detailed
- Exhilarating
- High ratings

'Ndulge

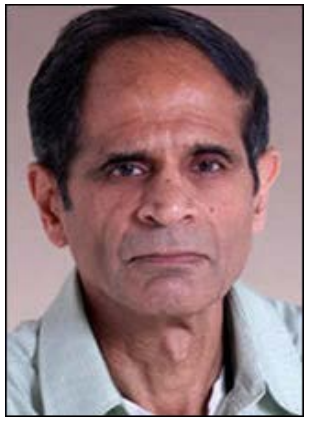
Anti-Gluttony

" Folks, I used to look full of myself
...now I'm a hottie with a body
- B.K. Rangachari

Before



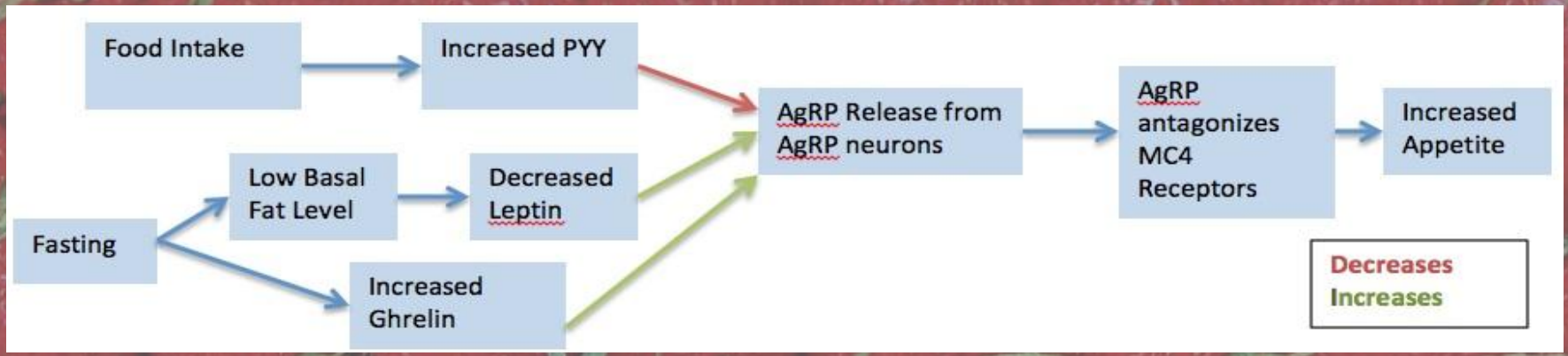
After



Mei Lin Chen, Jacqueline Cheung, Priya Gupta, Linda Hu, Sharon Liu, Lyndsey Merry,
Anjali Periyalwar, Priscilla Wong, Eric Zheng

Definition of Gluttony: The consumption of food beyond the amount necessary to maintain a homeostatic balance of energy.

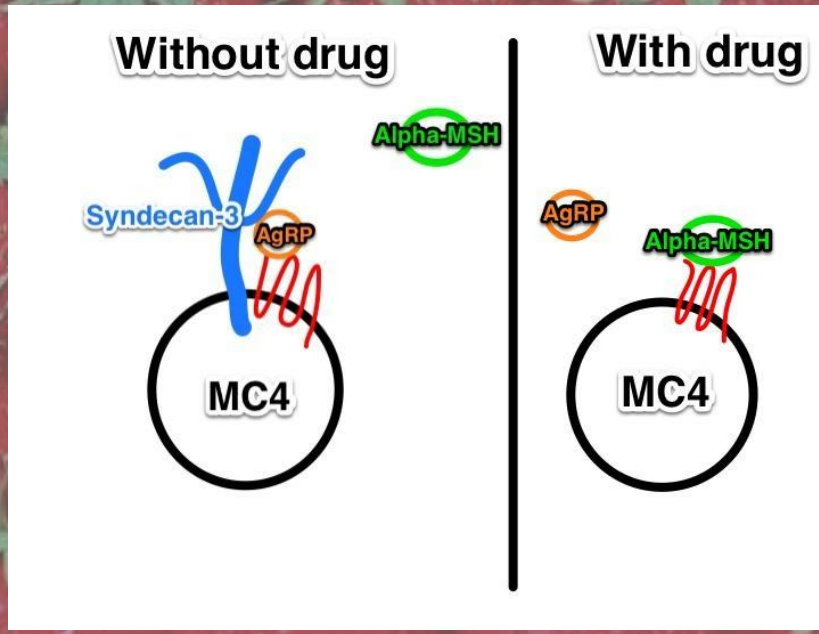
Target locus: Syndecan-3



Drug: Indulge-sense Nasal Spray

Locus: Syndecan-3 is a co-receptor to MC4 that enables AgRP to bind. By decreasing Syn-3, less AgRP is able to bind to MC4 receptors, decreasing appetite.

Nature of intervention: Antisense RNA to reduce the expression of Syndecan-3.



EADERALL

overcomes the problem of **leptin resistance** via an alternate pathway

Leptin

Leptin-R

failed transport through BBB

SOCS-3 antagonism

STAT-3

AMPK

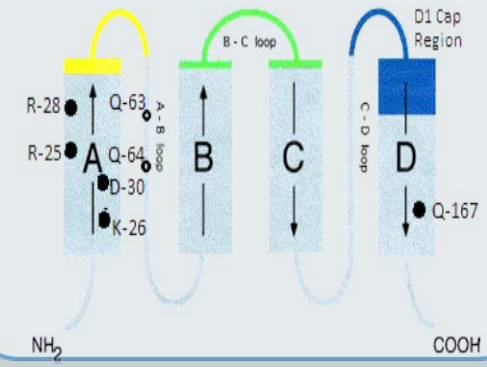
decreased appetite, fat metabolism

CNTF

CNTF-R

GP-130 CNTFR-α complex

THE MOLECULE



laboratory

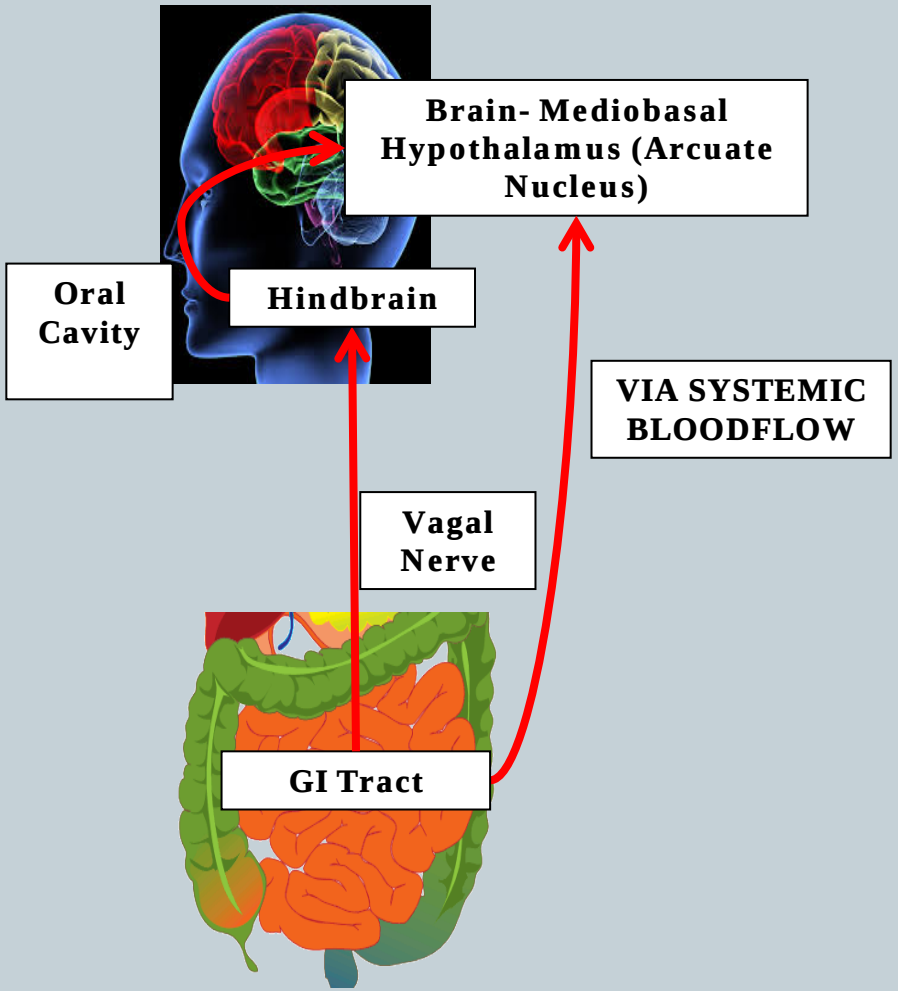
Gluttnix

Nixing Gluttony at the Source

Gluttony is the uncontrollable indulgence of food beyond the body's requirement to reach energy homeostasis. The satiation pathway in the body helps individuals feel satisfied after eating a meal.

- **Gluttnix is a new drug that is founded on the mechanism of PYY_{3-36}. It can cross the blood-brain barrier and bind to Y_2 receptors in the body to induce satiety and treat gluttony. It has been designed to have:**

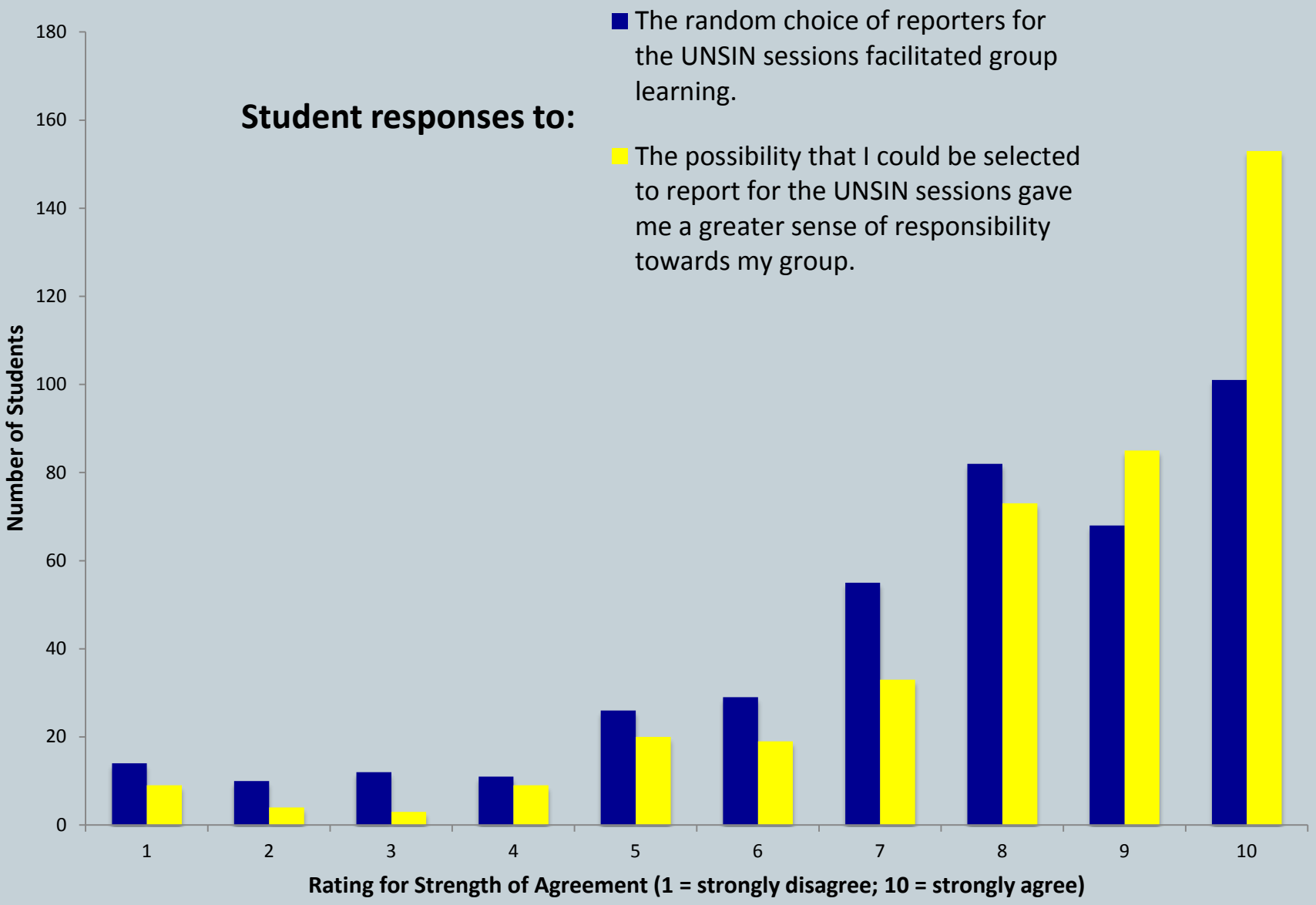
1. **More selectivity towards Y_2 receptors rather than other Y-type receptors**
2. **Greater metabolic stability in comparison to PYY_{3-36}**
3. **Greater affinity towards Y_2 receptors in comparison to PYY_{3-36} itself**

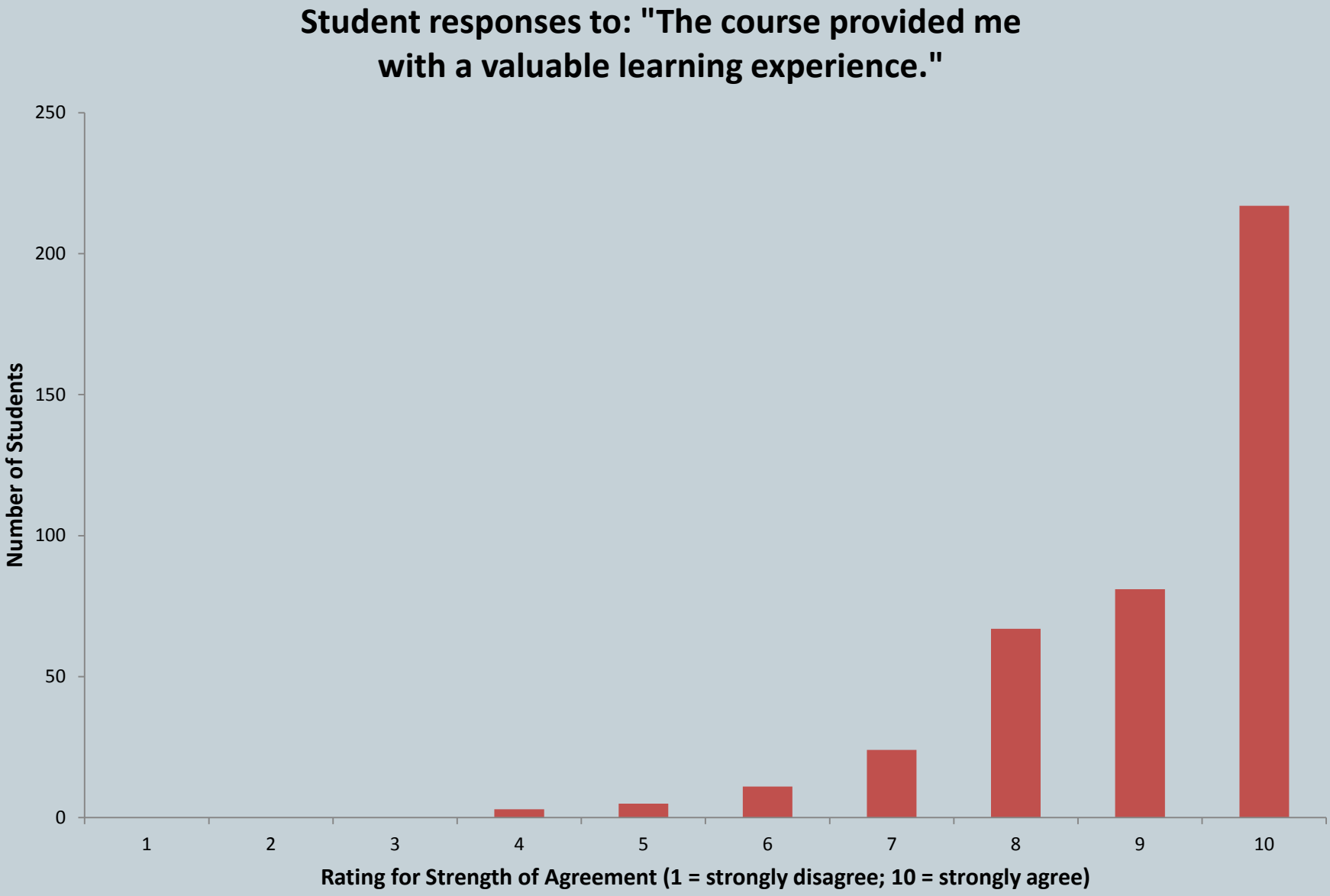


- **Gluttnix will be sold as an over-the-counter medical chewing gum to help treat people with episodic and chronic binge eating. It is currently in Phase II testing.**

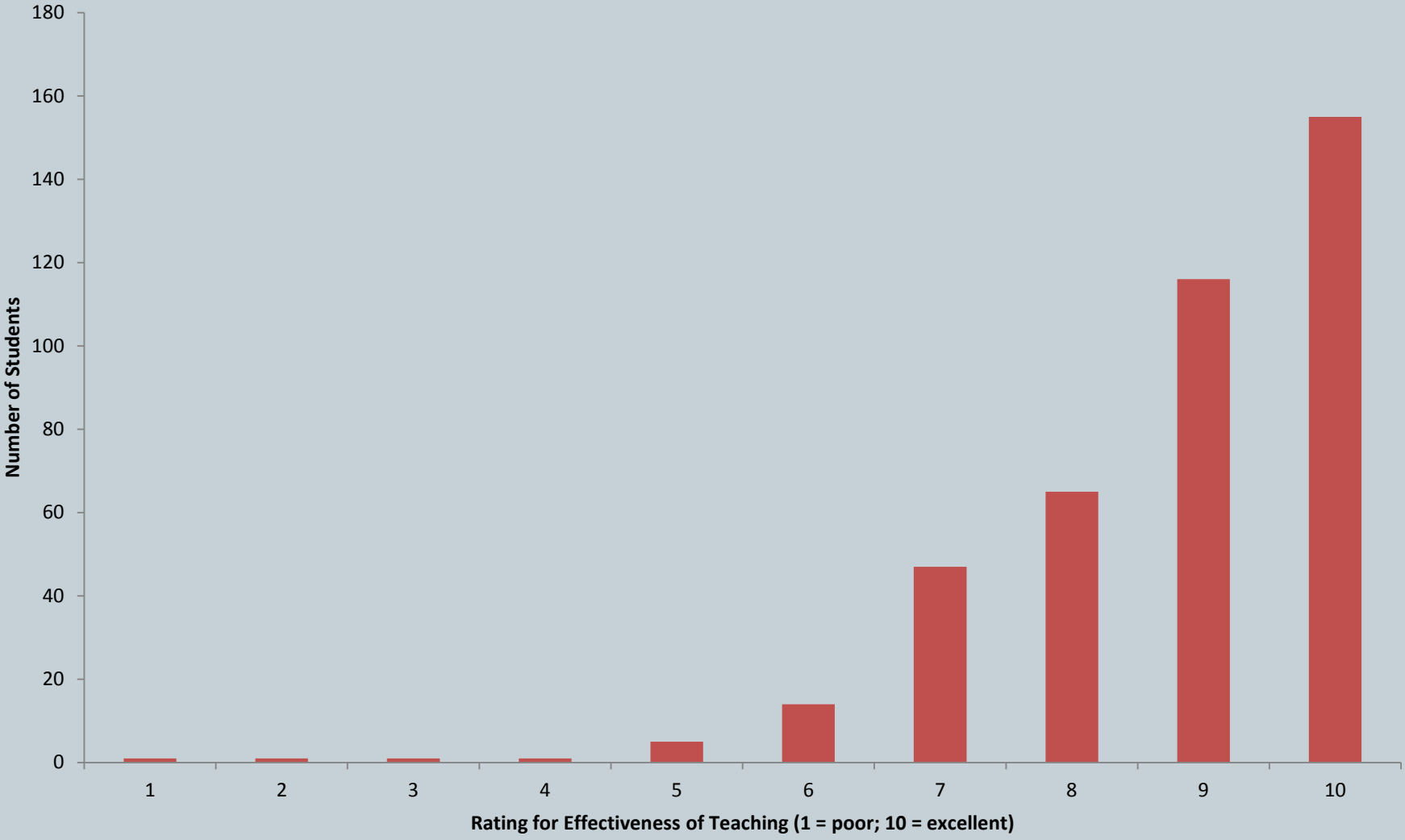
[redacted]

SIN	COHORT 1	COHORT 2	COHORT 3	COHORT 4
GLUTTONY	CCK GHRELIN GABA LEPTIN PYY	MC4R OPIODS NPY PYY2	DOPAMINE OPIOIDS CCK NPY T2R (GUT)	NPY PYY AgRP CNTF
SLOTH	DOPAMINE GABA GLUTAMATE OREXIN	DOPAMINE (3 GRPS) OREXIN	DOPAMINE (2 GRPS) NORADRENALINE OREXIN HISTAMINE	DOPAMINE (3 GRPS) NEUROPEPTIDE S
WRATH	CRF2 SEROTONIN GLUTAMATE GABA	GLUTAMATE (2 GRPS) DOPAMINE GABA	SEROTONIN (4 GRPS) MULTIPLE RECEPTOR SUBTYPES	SEROTONIN (5 GRPS) Multiple Subtypes
LUST	PROLACTIN TESTOSTERONE OXYTOCIN ESTROGEN	PHEROMONES ESTROGEN PROLACTIN ANDROGEN DOPAMINE	PROLACTIN (2) SEROTONIN DOPAMINE (2) GnRH	GnRH (2 grps) PROLACTIN TESTOSTERONE DOPAMINE


Student responses to:
The random choice of reporters for the UNSIN sessions facilitated group learning.
The possibility that I could be selected to report for the UNSIN sessions gave me a greater sense of responsibility towards my group.
Number of Students
180
160
140
120
100
80
60
40
20
0
1
2
3
4
5
6
7
8
9
10
Rating for Strength of Agreement (1 = strongly disagree; 10 = strongly agree)


Student responses to: "The course provided me with a valuable learning experience."
Number of Students
250
200
150
100
50
0
1
2
3
4
5
6
7
8
9
10
Rating for Strength of Agreement (1 = strongly disagree; 10 = strongly agree)

Student responses to: "Overall what is your opinion of the effectiveness of Dr. P.K. Rangachari as an instructor?"



Engaging Students

During Course

After the Course was over

Continuity

Other Courses

- Drugs, Devices, Desires– History of Medical Technology
- Molecules in the Marketplace- Pharmacology
- Matters of Taste: Taste receptors/Cultural Issues
- Toxic Tales: Toxicology and Creative Writing
- Teaching, Learning and Examinations (Pharmacy students, Keele UK, on-line course)

- **COMMON ELEMENTS:** ***Blending basic sciences and humanities/ Multiple Assessments/Menu of Options***

Frame the challenge as a problem

Consider context

Assess resources

Check out available methods

Select appropriate methods

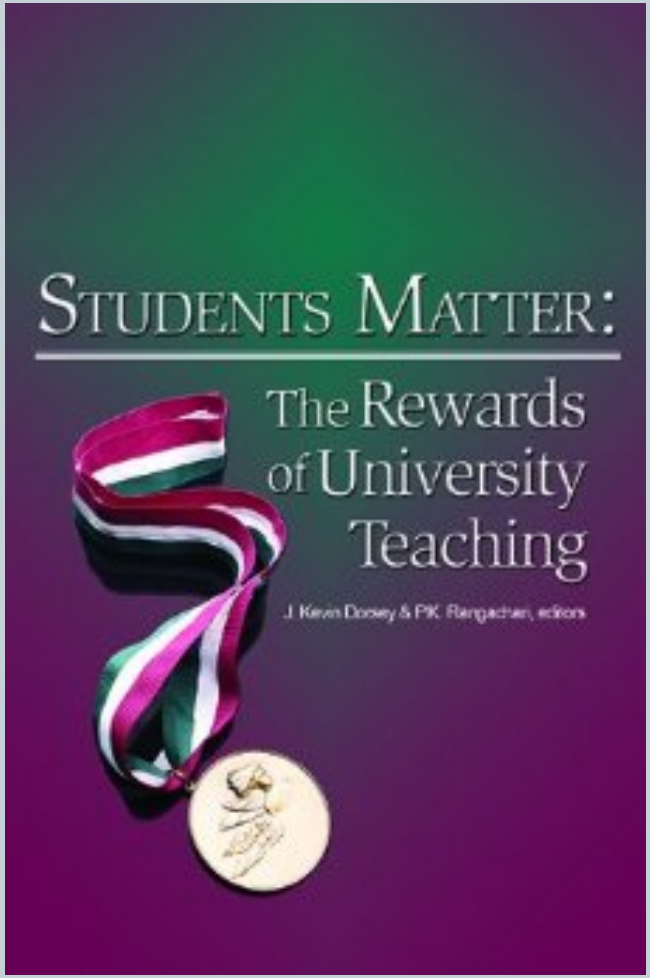
Consider assessment of outcomes appropriate to selected method

Make incremental changes

Monitor changes

Reflect/Re-assess

Repeat



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BRISBANE 1960

La longue durée

CARDIFF 2013