



Molecular Antibody Protein Structure Model

Team Members

Jon Mantes – Leader

Andy LaCroix – BSAC

Kimberli Carlson – Communicator

Kara Murphy - BWIG

Advisor – Prof. Wan-Ju Li

Client – Marge Sutinen

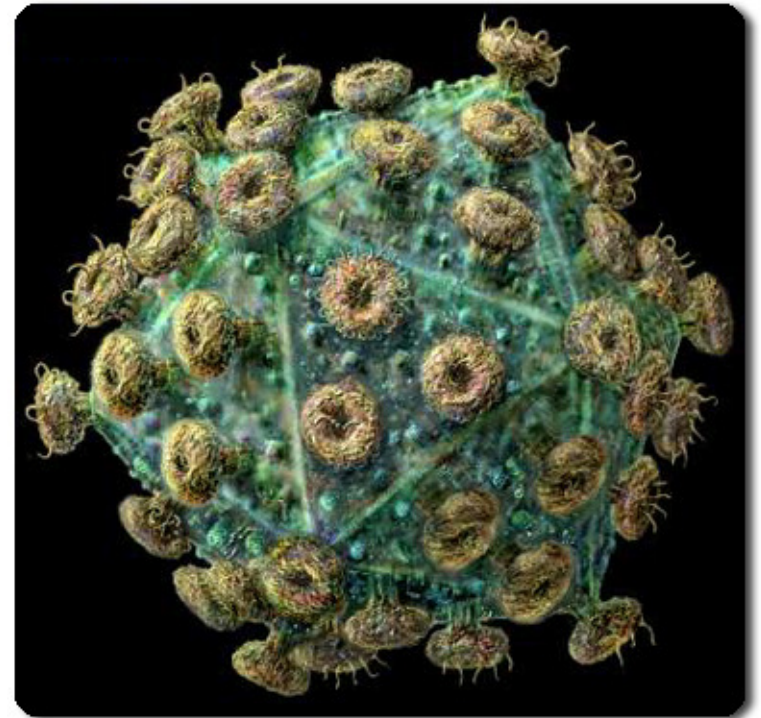
Overview



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- Injection/ Replication Design Matrix
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Motivation and Background

- Human Immunodeficiency Virus
 - Causes AIDS
 - No cure for disease
 - Spread through body fluids
- Conveys Severity of HIV
 - Permanent infection
 - Preventative measures



http://deems.files.wordpress.com/2008/11/hiv_virus.jpg

Existing Devices

- Posters
 - 2D picture
 - National Institute of Allergy and Infectious Diseases
- Computer Simulations
 - Getty Images video
- 3D Model
 - Merck and Company Inc.



Client Requirements



- 3D and color coded
- Demonstrate irreversibility of HIV infection
- Easily visible to class of ~30 students
- Three basic steps:
 - Binding
 - Replication
 - Budding
- Compact and easily to transport
- PDF explanation of each step
- Budget of \$100

Binding Options

1) Locking Mechanism

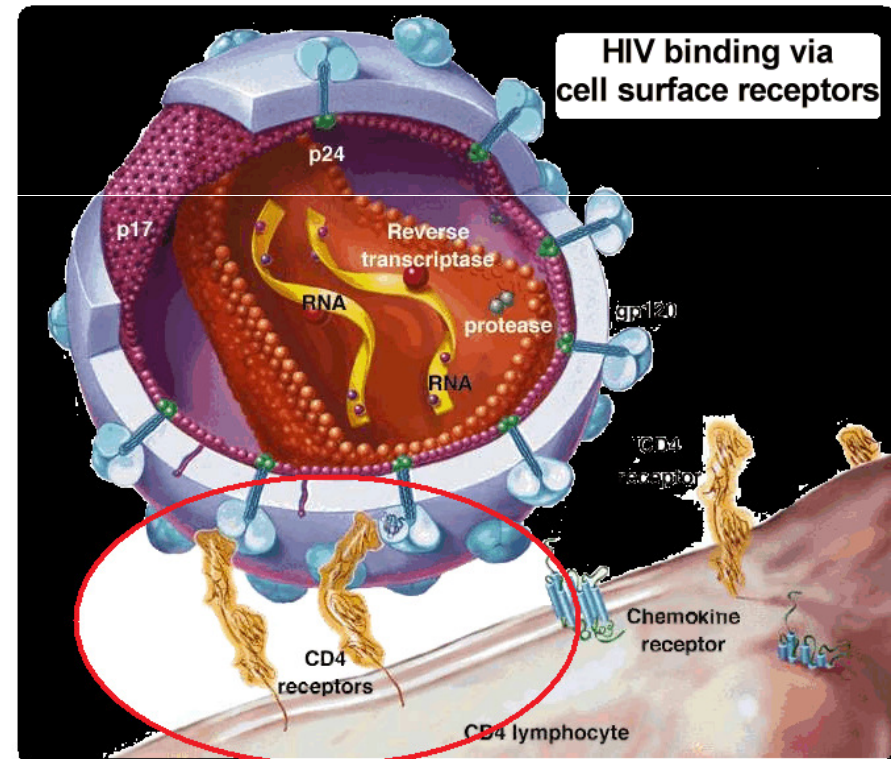
- ◆ Use a bottle cap to screw on
- ◆ Shows irreversibility of attachment

2) Magnets

- ◆ Ease of attachment
- ◆ Shows exclusive binding to CD4 receptors

3) Velcro

- ◆ Easy to manufacture
- ◆ Low cost



http://webs.wichita.edu/mschneegurt/biol103/lecture15/hiv_cellbinding.gif

Binding Design Matrix



Design	Ease of Use (30)	Cost (10)	Manufacturability (20)	Teaching Effectiveness (30)	Consistency (10)	Total (100)
Locking Device	25	10	15	29	9	88
Magnets	27	6	17	20	8	78
Velcro	22	8	18	13	6	57

Injection/Replication Options

1) Syringe pushing liquid through intertwined DNA tube

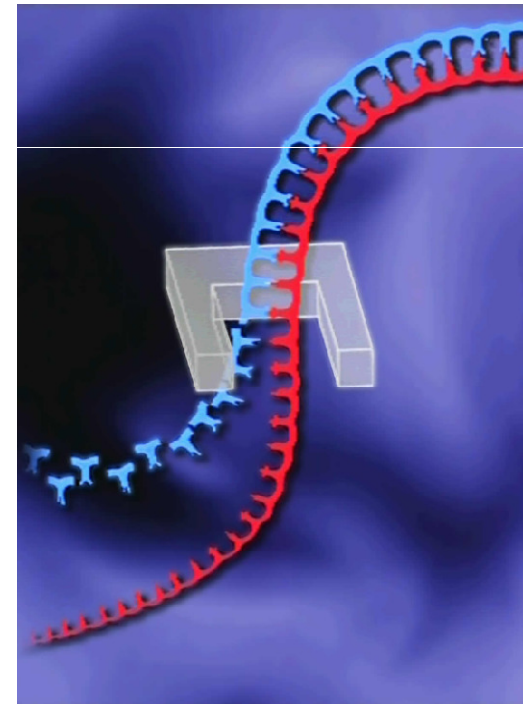
- ◆ Low cost and easy to manufacture
- ◆ Visual teaching tool as HIV intertwines with host cell DNA

2) Liquid filled squeeze bottle

- ◆ Easy to use
- ◆ Have to refill after each use

3) Marble rolling through tube

- ◆ Easy to use
- ◆ No clean up



http://hiv.boehringer-ingenelheim.com/com/HIV/Information_material/Images2.jsp

Injection/ Replication Design Matrix



Design	Ease of Use (30)	Cost (10)	Manufacturability (20)	Teaching Effectiveness (30)	Consistency (10)	Total (100)
Syringe/ Tube	27	10	16	25	10	88
Squeeze Bottle	19	8	18	20	8	73
Marble/ Tube	16	8	12	13	5	54

Budding Options

1) Hatch to release infected cells

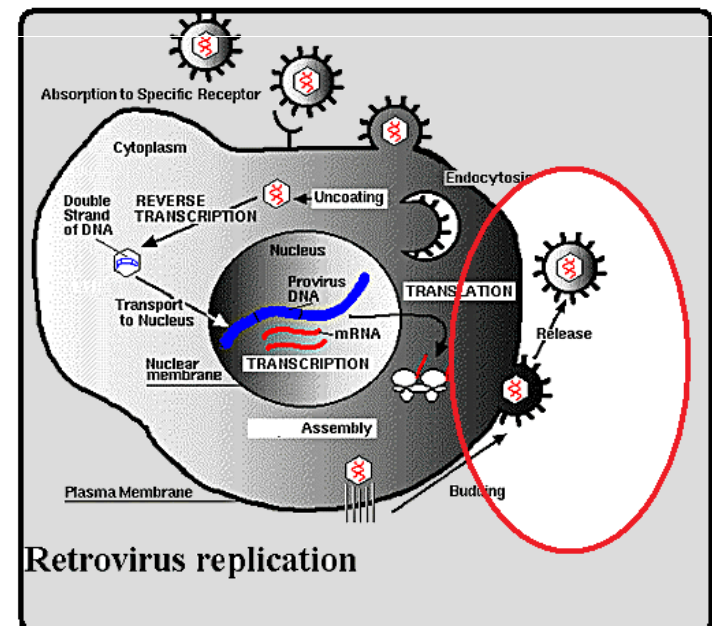
- ◆ Good visual teaching tool
- ◆ Easy operation

2) Tubes extended from nucleus to new cells

- ◆ Hard clean up process after operation

3) Bubbles

- ◆ Could be problematic with refilling & has risk of being inconsistent in operation



http://www.mun.ca/biochem/courses/3107/Topics/retrovirus_replication.html

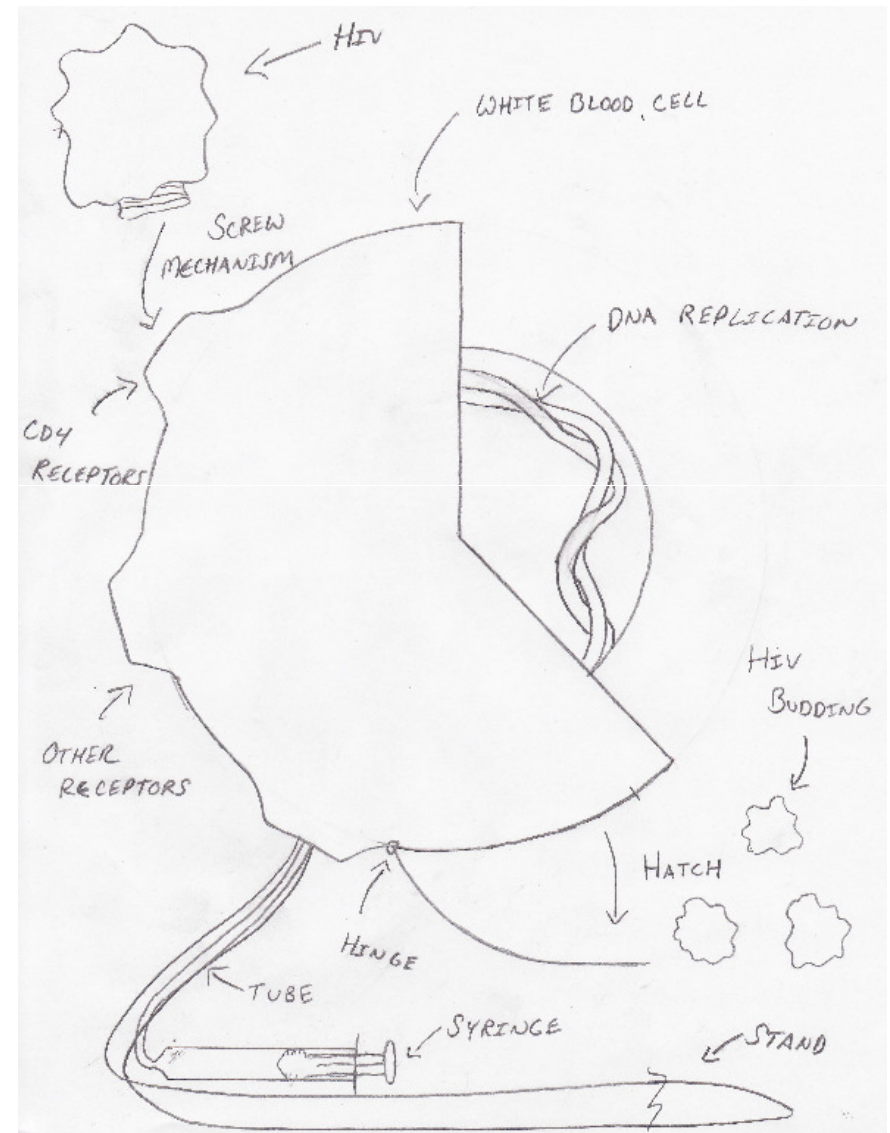
Budding Design Matrix



Design	Ease of Use (30)	Cost (10)	Manufacturability (20)	Teaching Effectiveness (30)	Consistency (10)	Total (100)
Hatch	24	7	15	27	9	82
Tube/ Nucleus	28	4	19	18	9	78
Bubbles	19	4	10	24	4	61

Final Design

- Acrylic shell host cell
 - Covered in molding clay for texture
- Locking device for binding stage (screw cap)
- Syringe & Tube for injection/replication stage
 - Colored liquid simulate DNA replication
- Hatch releases replicated HIV
 - Original and mutated HIV



- Demonstration of steps of infection:
 - Screw-on attachment of HIV
 - Reasonable force required to squeeze liquid from syringe
 - Reliable hinge mechanism for budding HIV particles
- Light weight for easy transport
- Stable stand
- HIV/AIDS is a controversial topic
- Keep description of HIV infection purely scientific

Future Work

- Reliable support mechanism for nucleus
- Order materials
 - Acrylic shells
 - Molding material
 - Tubes
 - Miscellaneous materials
- Begin fabrication process



<http://www.thedeafblog.co.uk/Thinking.jpg>

References



- “Computer Generated Model of HIV in Bloodstream.” Getty Images. 5 October 2009. <cache.gettyimages.com>
- Noble, Rob. “The Structure of HIV.” Avert. 12 October 2009. <<http://www.avert.org/hiv-virus.htm>>
- “Replication Cycle of HIV.” National Institute of Allergies and Infectious Diseases. 5 October 2009. <www3.niaid.nih.gov/topics/HIVAIDS/Understanding/How+HIV+Causes+AIDS/howhiv.htm>

Questions?