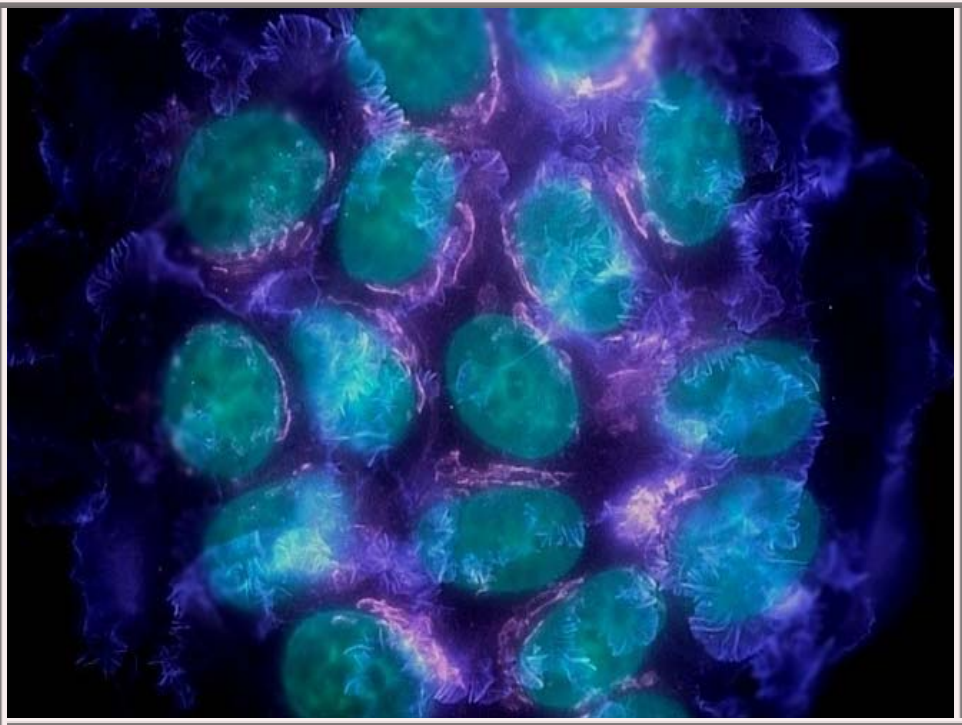

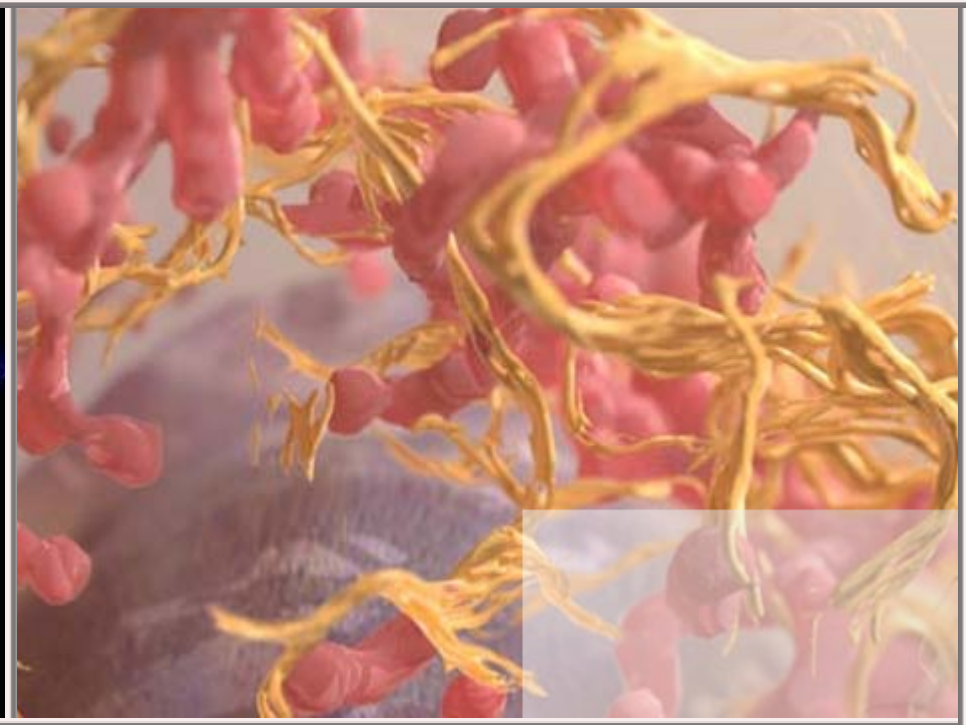

Final Presentation

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Anonymous student MK and NM

Image credits: Left, courtesy of Torsten Witmann, used with permission. Right, Donald Bliss and Sriram Subramaniam, National Library of Medicine, NIH.

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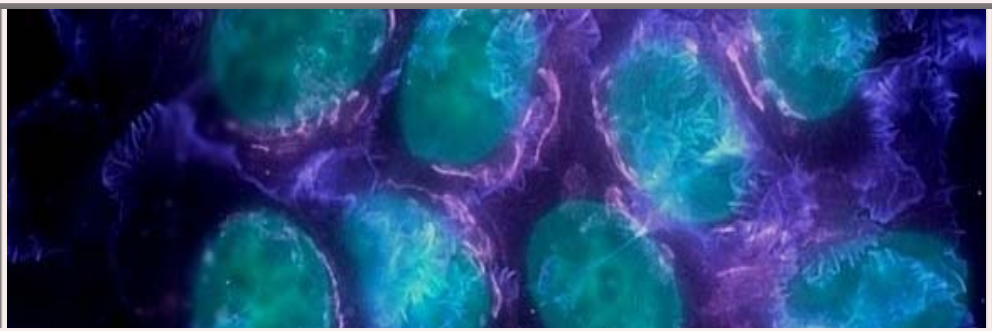
OUR MISSION

COMMON DISEASE, KILLS 500,000 A YEAR
ABNORMAL CELL GROWTH AND DIVISION
CAN ORIGINATE IN DIFFERENT ORGANS

SPREAD FROM ORIGINAL TUMOR
TRAVELS THROUGH BLOOD/LYMPH
MAIN CAUSE OF DEATH



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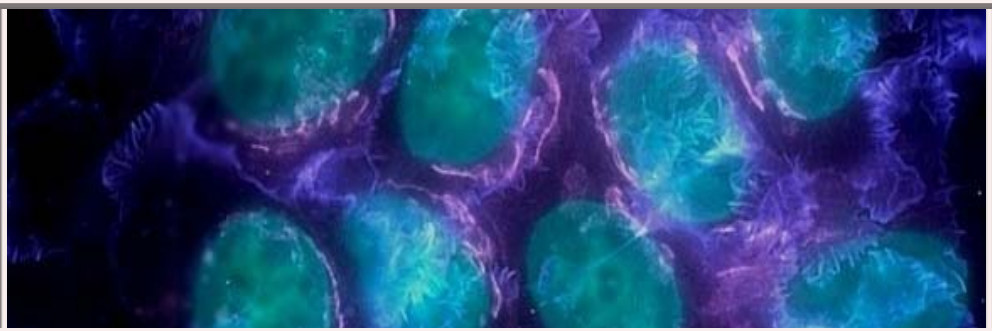
OUR MISSION

DIAGNOSTIC IMAGING TOOLS
BETTER UNDERSTANDING OF METASTASIS
PATTERNS OF MOVEMENT, TIMING

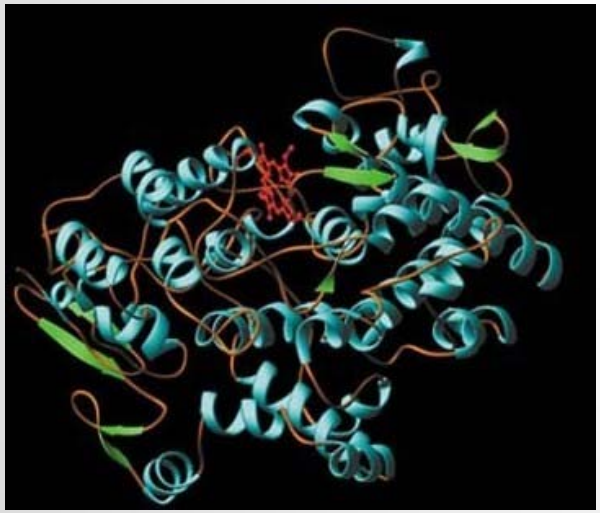
LEAD TO DEVELOPMENTS IN TREATMENTS
COULD BE USED FOR KILLING CANCER CELLS



SCIENCE BEHIND IT

SIGNALS

OVEREXPRESSION OF ENZYMES
COX-2: PREVENTS APOPTOSIS
MMP-1: BREAKS BASEMENT MEMBRANE



Courtesy of Larry Marnett, Ph.D. Used with permission.
http://www.mc.vanderbilt.edu/lens/article/?id=49&pg=999

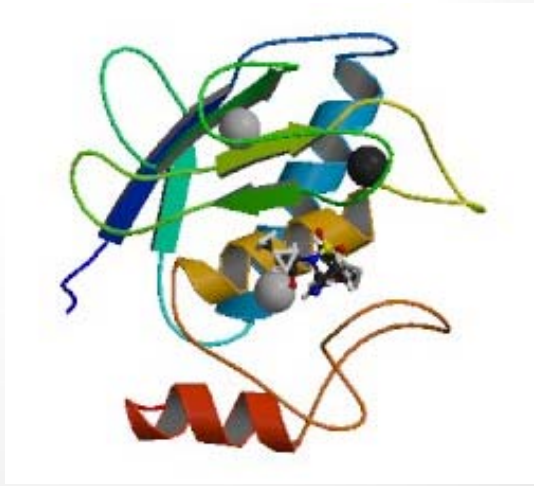
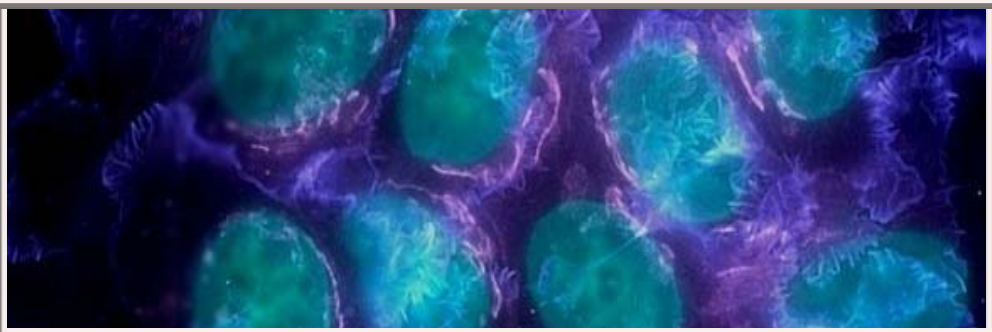


Image: http://www.rcsb.org/

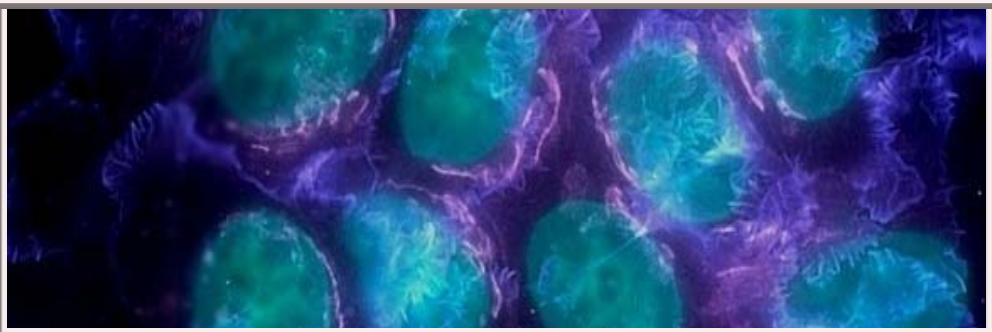


SCIENCE BEHIND IT

DETECTION

RIBOZYMES CLEAVE MRNA
PRODUCTS OF REACTIONS
BINDING ENDS LUCIFERASE INHIBITION
EXPRESSION LEADS TO LIGHT

Image removed due copyright restrictions.
Fluorescent imaged mouse, from http://www.caliperls.com/tech/optical-imaging/image-gallery/oncology-angiogenesis-models.htm

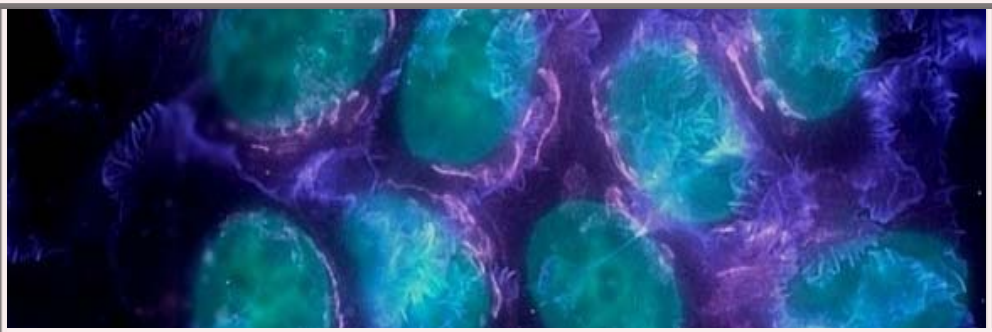


HOW IT WORKS

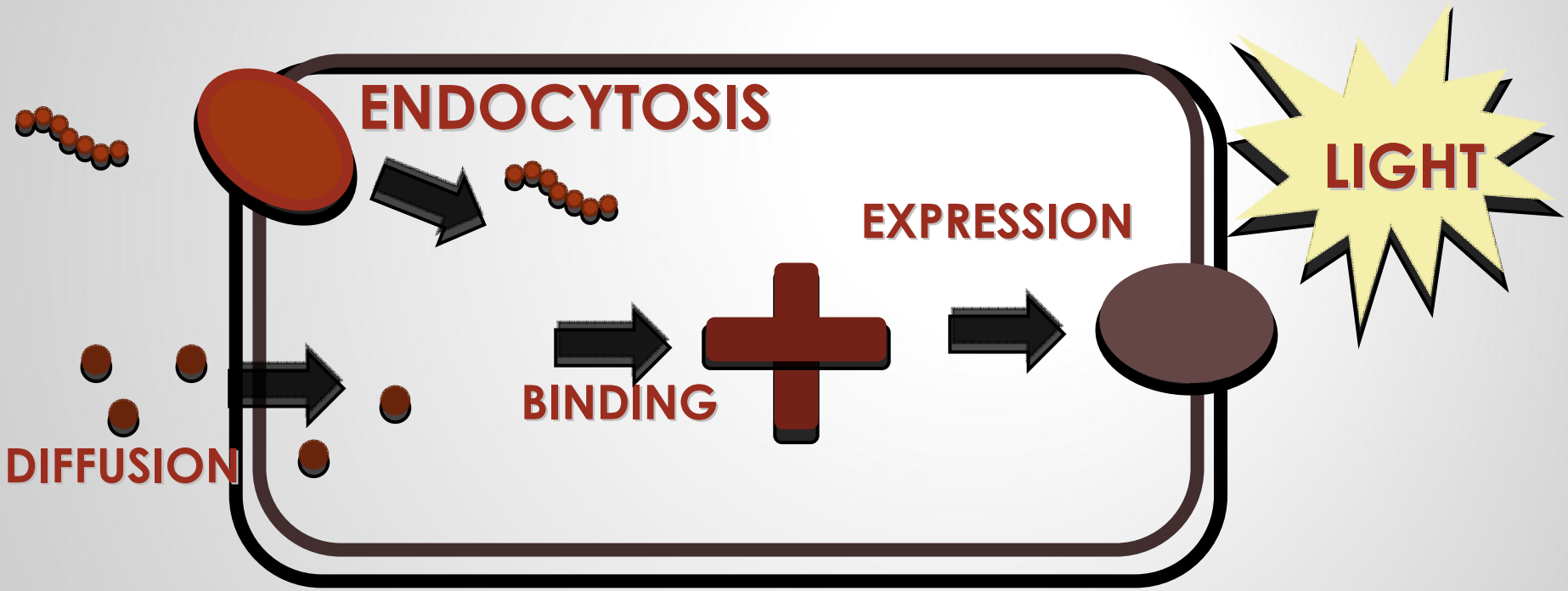
TREATMENT

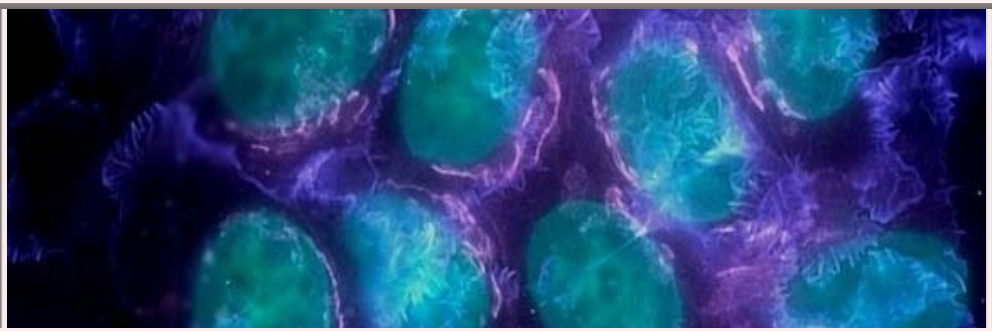
REMOVE PATIENT CELLS
ADD PLASMIDS/CHANGE DNA
DELIVER MODIFIED T-CELLS
ADD DOSE OF LUCIFERIN
TAKE IMAGES WITH CCD CAMERA

Image removed due copyright restrictions.
Photo of CCD imaging system, http://www.caliperls.com/products/contract-research/in-vivo/optical-imaging-studies.htm

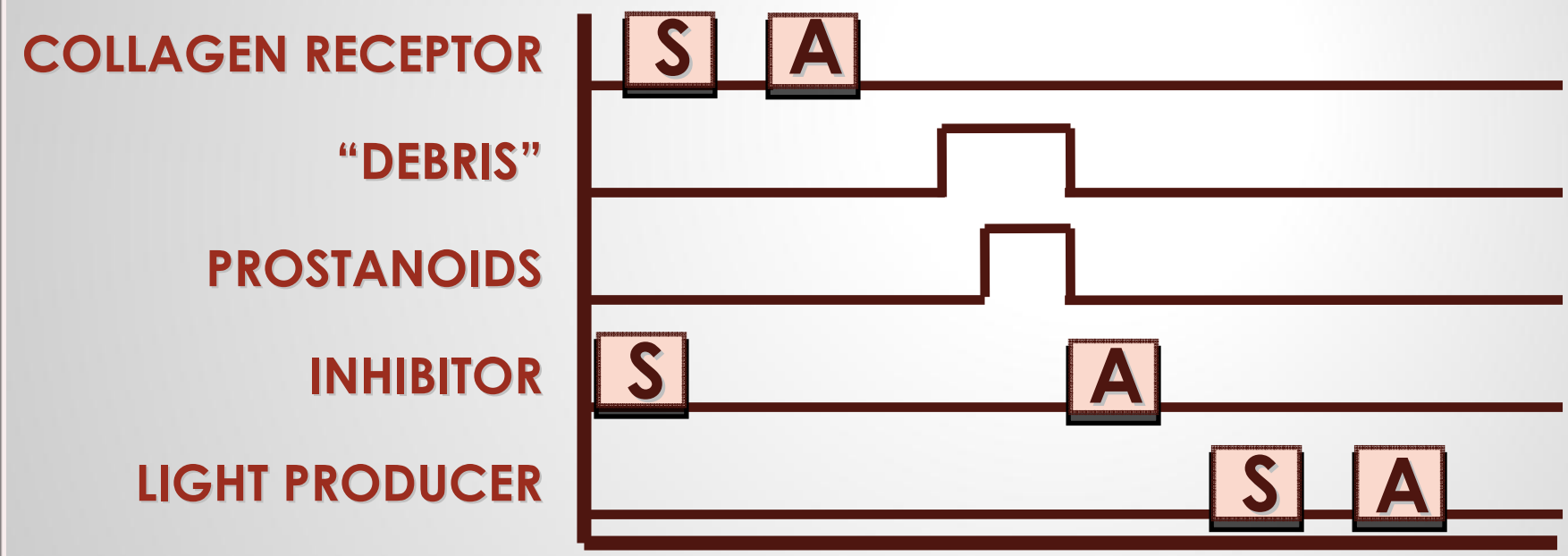


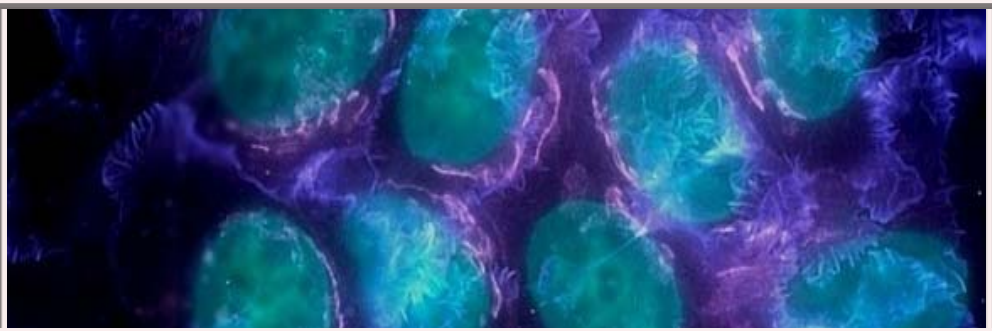
HOW IT WORKS





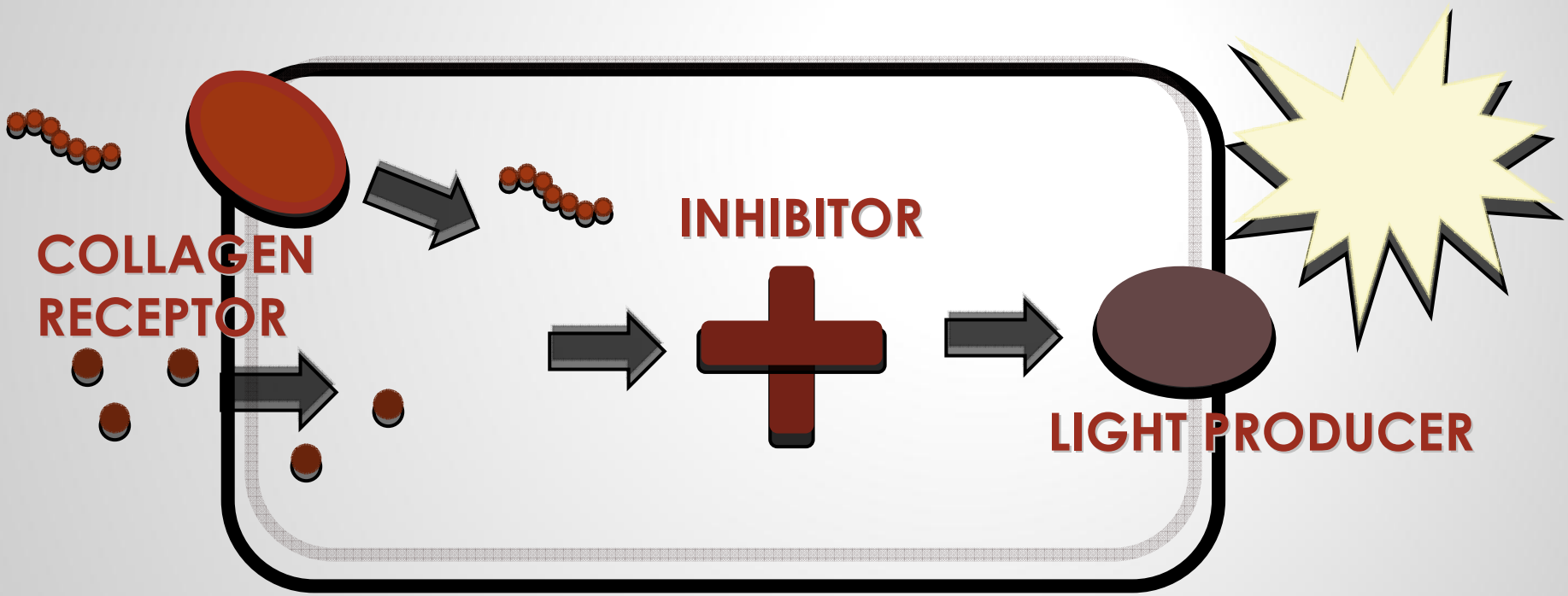
HOW IT WORKS

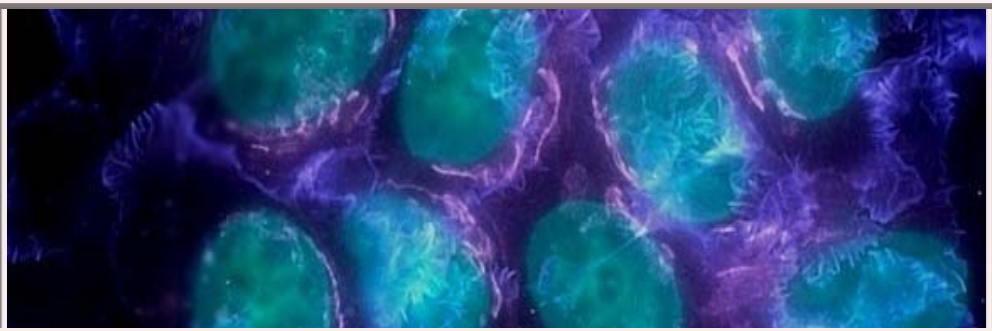

COLLAGEN RECEPTOR
S
A
"DEBRIS"
PROSTANOIDS
INHIBITOR
S
A
LIGHT PRODUCER
S
A



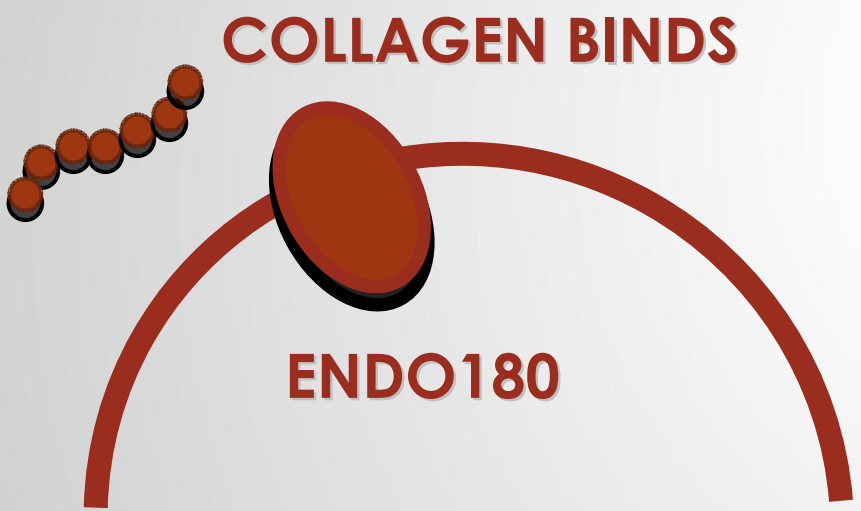
HOW IT WORKS

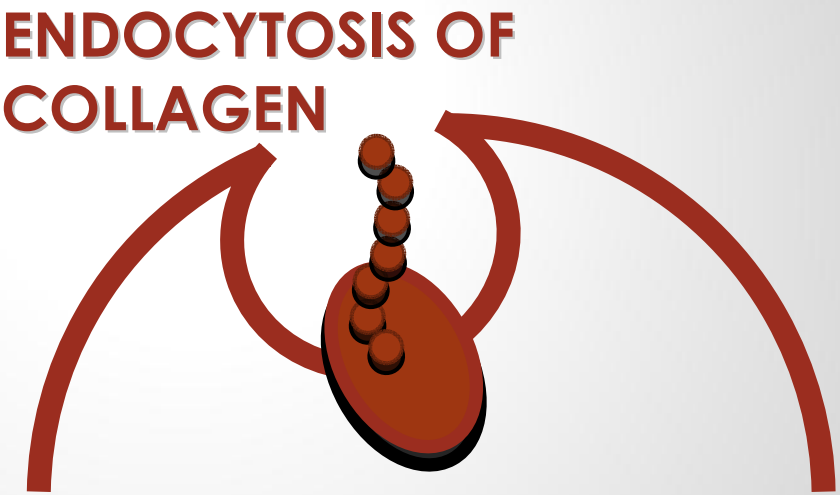
DEVICE OVERVIEW

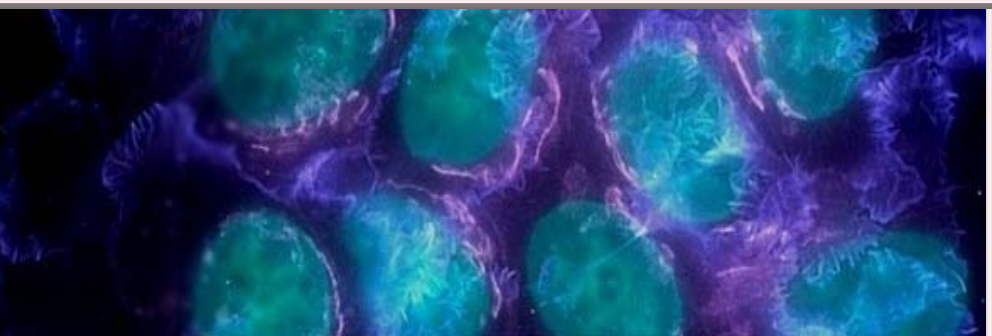




BREAKING IT DOWN



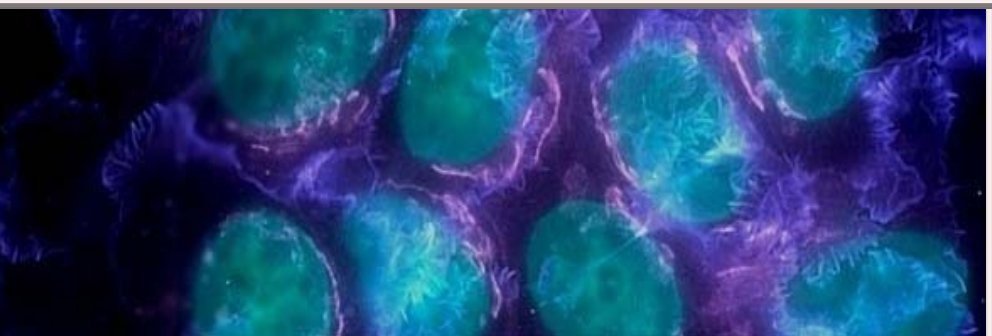




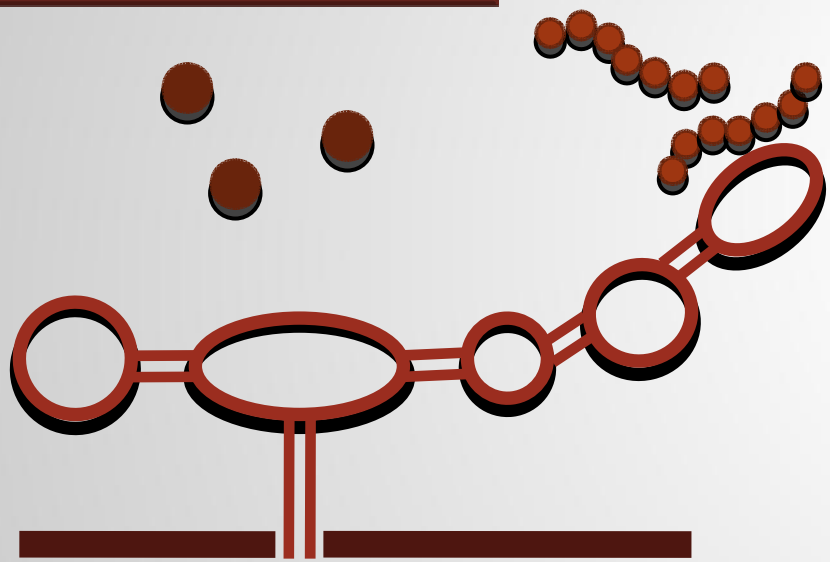
BREAKING IT DOWN

STRONG PROMOTER
ENDO180 RECEPTOR GENE
GFP FOR TESTING/DEBUG

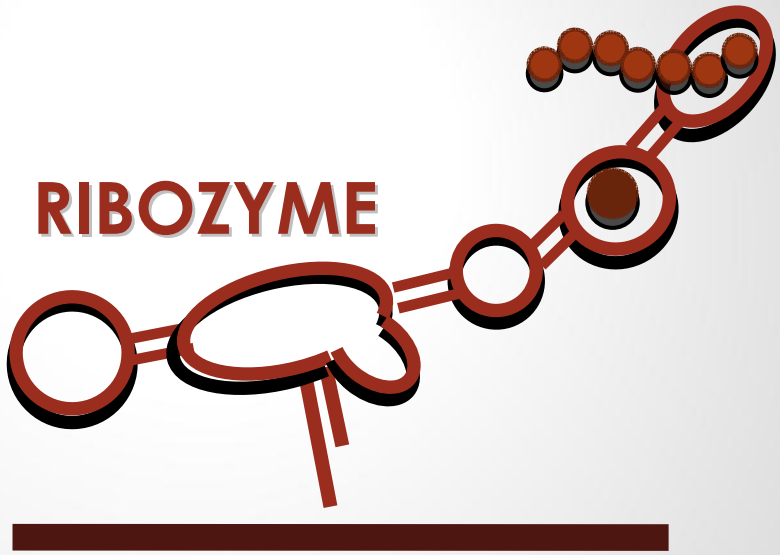
MCMV



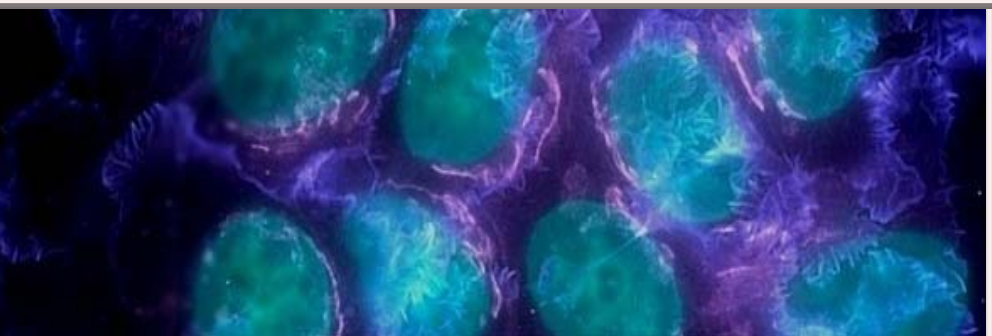
BREAKING IT DOWN



CLEAVAGE OF MRNA

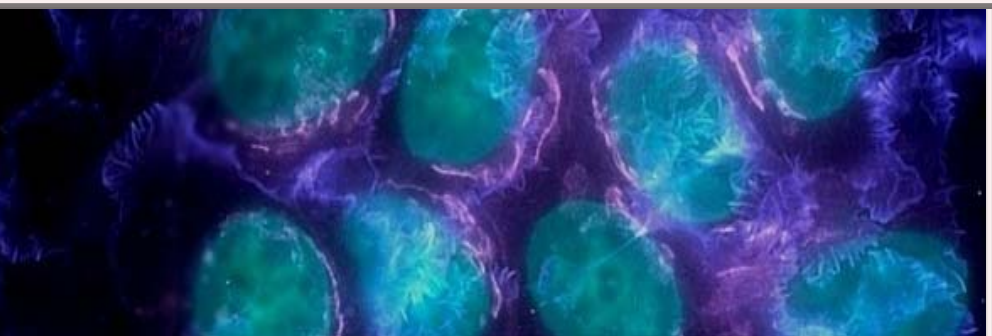


INHIBITION ENDS

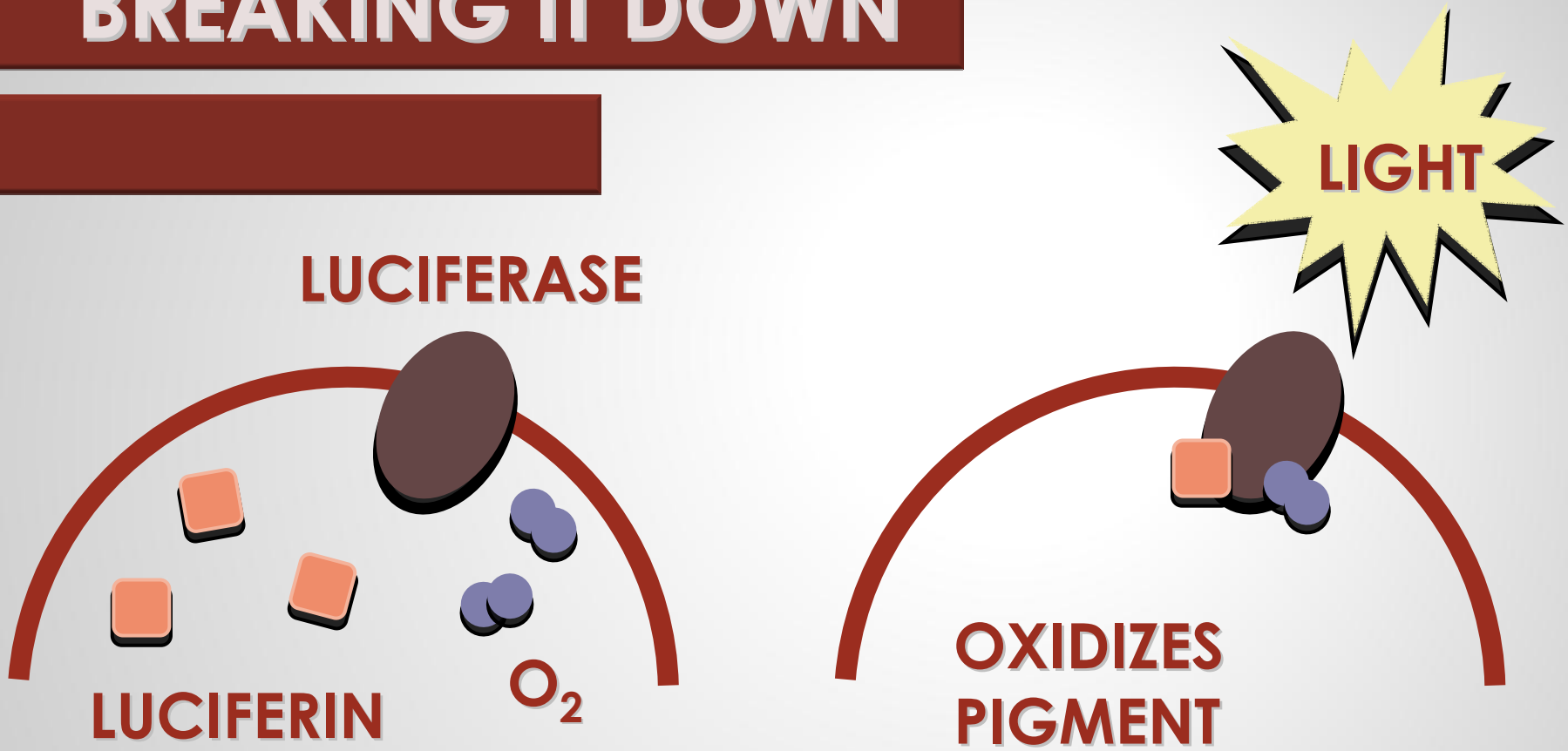


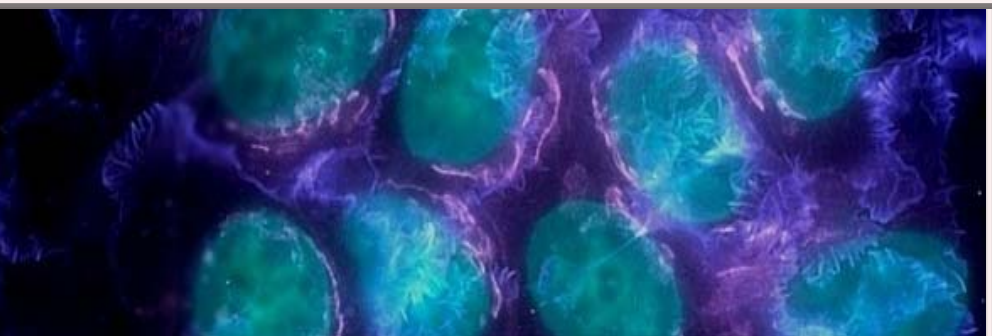
BREAKING IT DOWN

PROMOTER DEPENDENT ON LUCIFERASE
RIBOZYME GENE
DOUBLE APTAMER LOOP



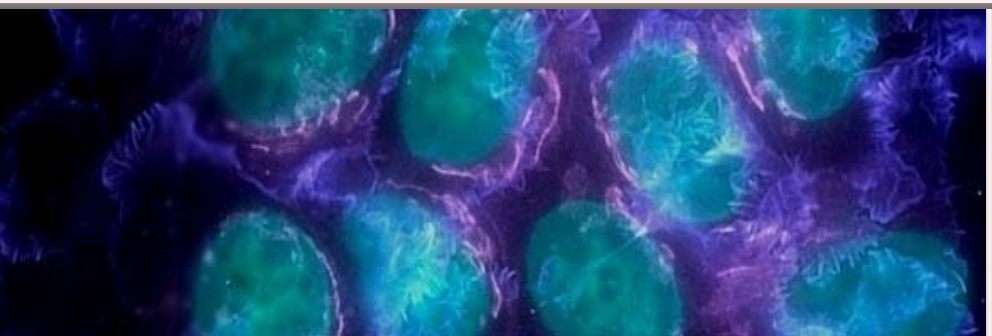
BREAKING IT DOWN



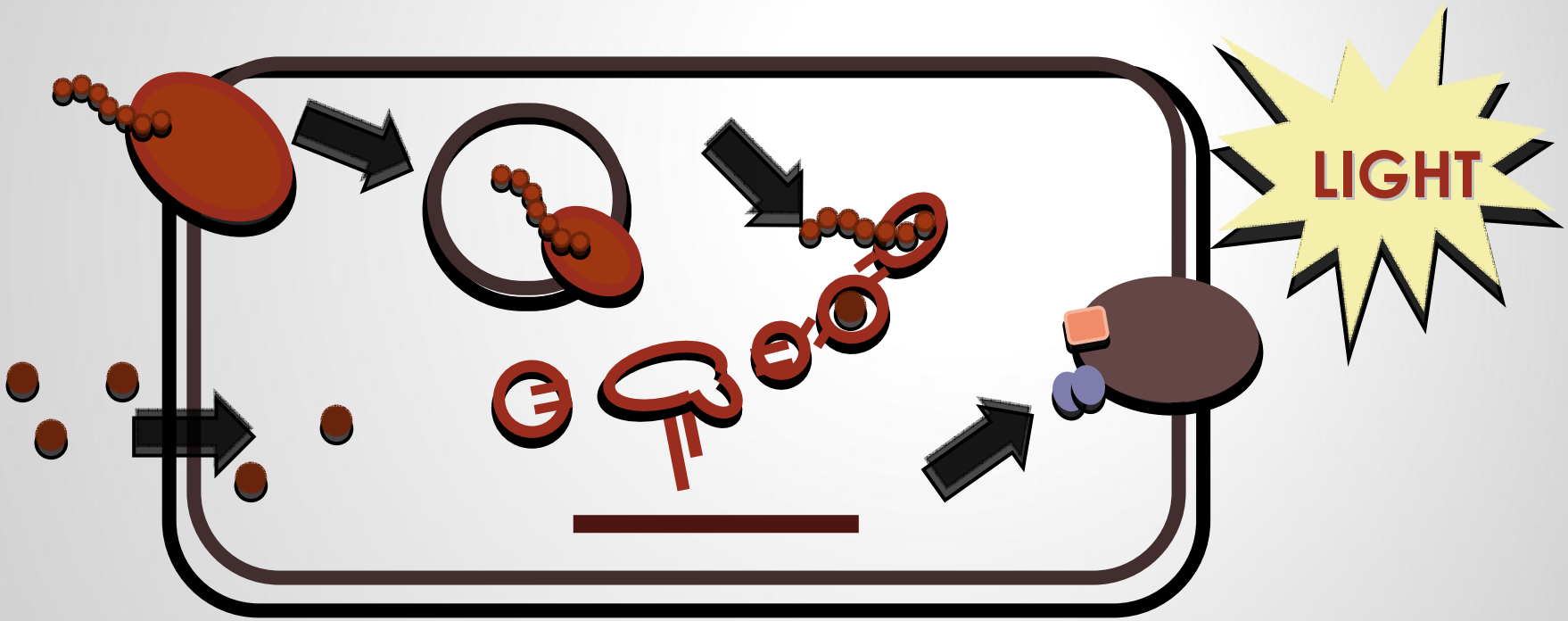


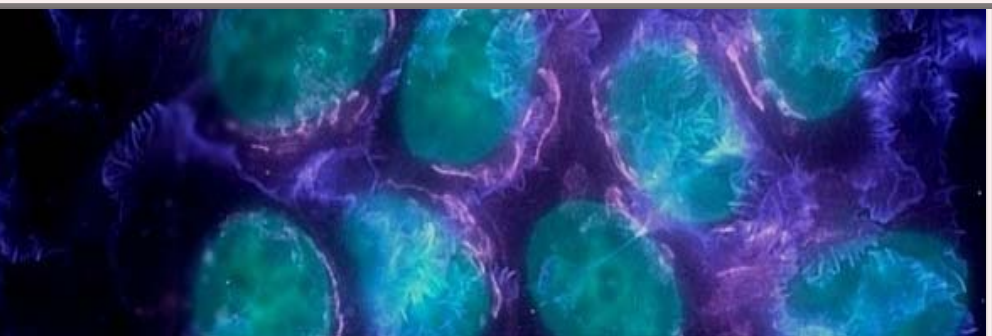
BREAKING IT DOWN

STRONGEST PROMOTER, COULD VARY
LUCIFERASE GENE
GFP FOR TESTING/DEBUG



PUTTING IT TOGETHER

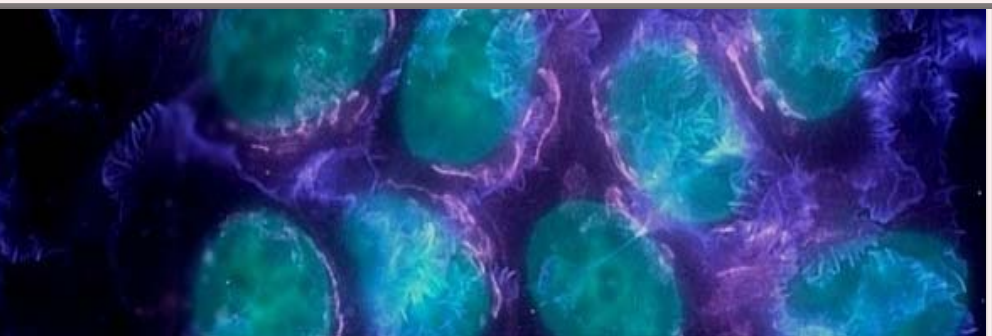




POTENTIAL PROBLEMS

DEGREE OF VISIBILITY
COLLAGEN DEGRADATION
IMMUNE RESPONSE

DIFFERENT RECEPTORS
LONGER DETECTION TIME
OTHER SIGNAL BESIDES LIGHT

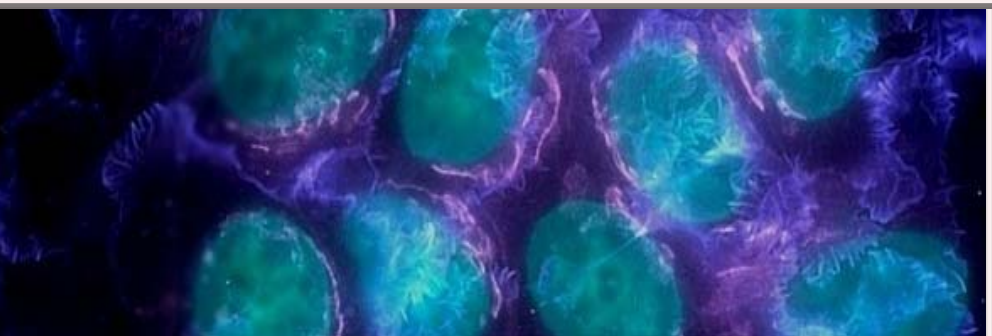


MAKING IT WORK

PROMOTER STRENGTH
IN-VITRO BINDING TO RIBOZYME
ENDOCYTOSIS EXPERIMENTS
EXPRESSION OF RECEPTOR/LUCIFERASE

PRESENCE OF LUCIFERIN
LUCIFERASE REACTIONS
USE OF GFP IN VITRO
FREEZE-FRACTURE METHOD

Image removed due copyright restrictions.
D-Luciferin Firefly vial from Caliper Life Sciences
(http://www.caliperls.com)

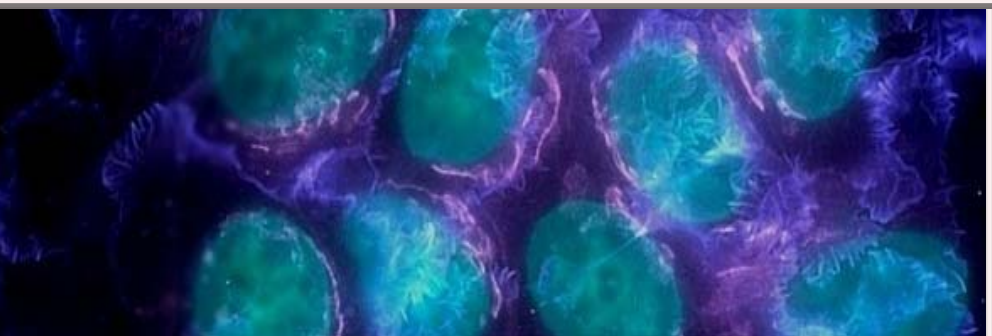


MAKING IT WORK

A PLAN

RECEPTOR EVOLUTION FOR SPECIFICITY
SLOW DEGRADATION
APTAMER DEVELOPMENT
IN VITRO BINDING/REACTIONS
LUCIFERIN ADDITION AND EFFECTS
IN VIVO TESTING/TRIALS

Image removed due to copyright restrictions.
"Firefly Luciferase antibody for ICC/IF (Rat)" by Mal Niladri.
http://www.abcam.co.jp/index.html?pageconfig=reviews&intAbID=21176&intAbReviewID=5843



QUESTIONS REMAINING

SAFETY

POSSIBILITY OF REJECTION
LUCIFERIN EFFECTS
TAXING ON BODY
DEGRADATION DELAY

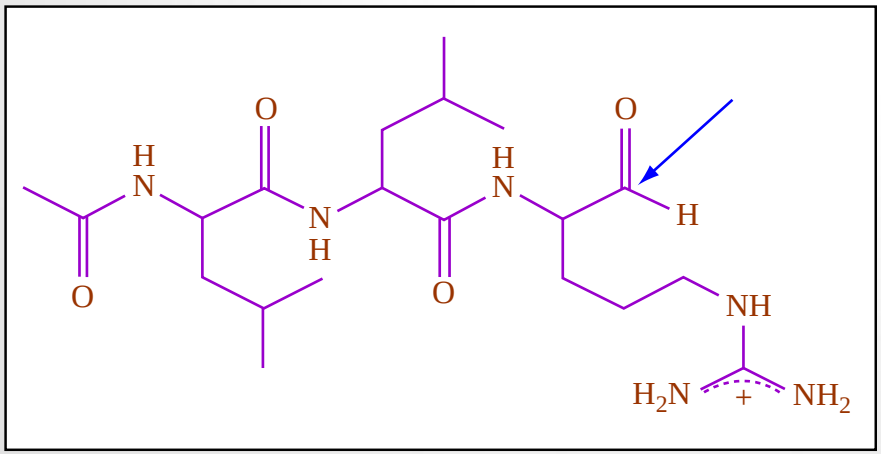
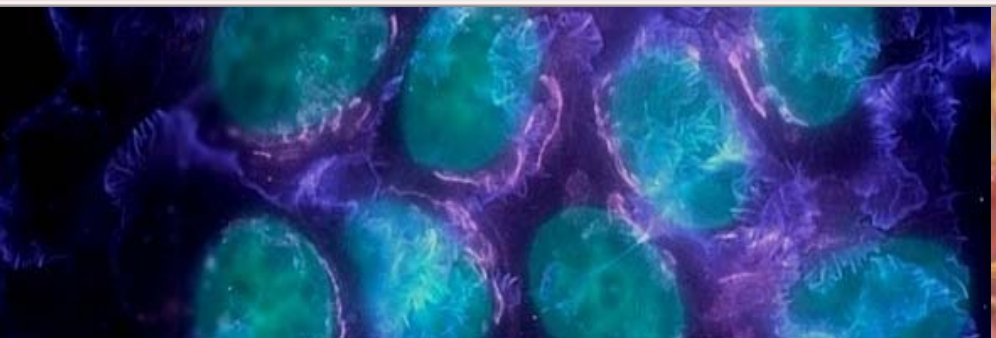
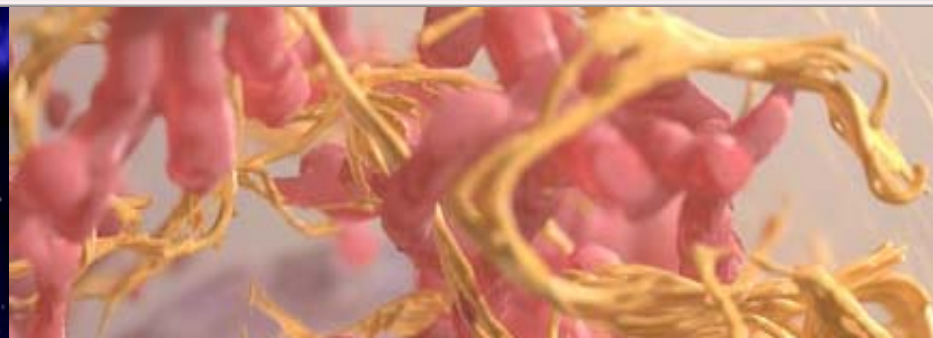


Figure by MIT OpenCourseWare.





QUESTIONS REMAINING

SECURITY

DESIGNED TO SURVIVE IN HUMAN
POSSIBLE TOXIN DELIVERY
SHOULD NOT MAKE PUBLIC
T-CELL ENGINEERED TO DIE

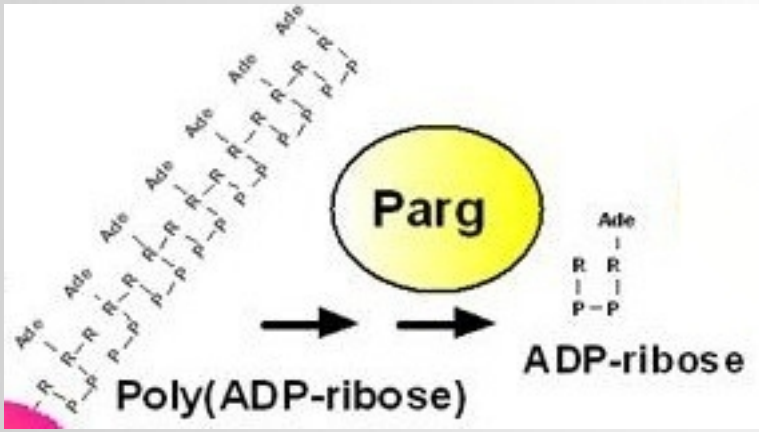
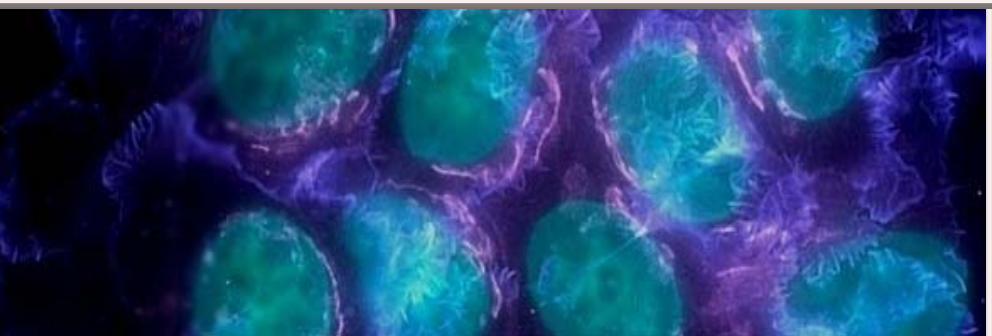


image source: http://www.ncc.go.jp/
Courtesy of the National Cancer Center (Japan). Used with permission.

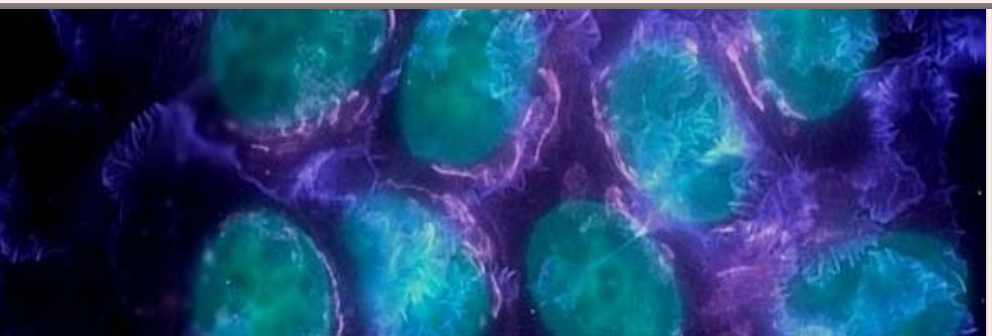
Electron microscope image removed due to copyright restrictions.



WOULD IT SELL

CCD CAMERA: ~$3,000
RIBOZYME SEQUENCING: $100+
RECEPTOR PLASMID AND
LUCIFERASE PLASMID: $1000+

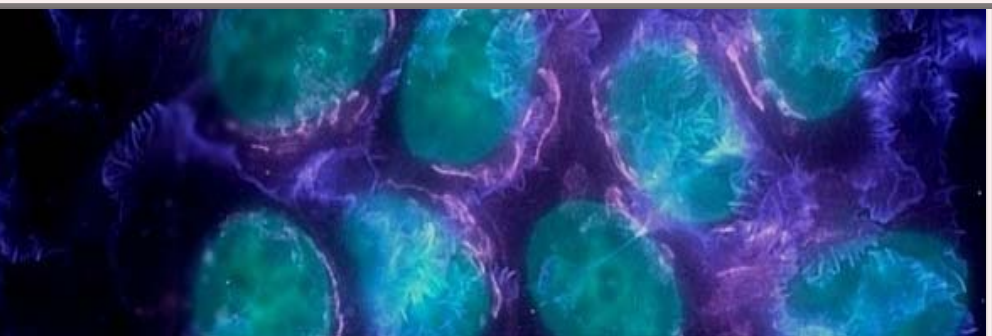
T-CELL HARVESTING: ~$700
DNA TRANSFECTION: ~$300
LUCIFERIN DOSE: $400 PER GRAM



WOULD IT SELL

GRADIENT OF LIGHT
DYNAMIC OVER A PERIOD OF TIME
SCALE AND 3D CLARITY

STATIC TESTS
CTC/TMEM BLOOD TESTS
LYMPH NODE SCREENING



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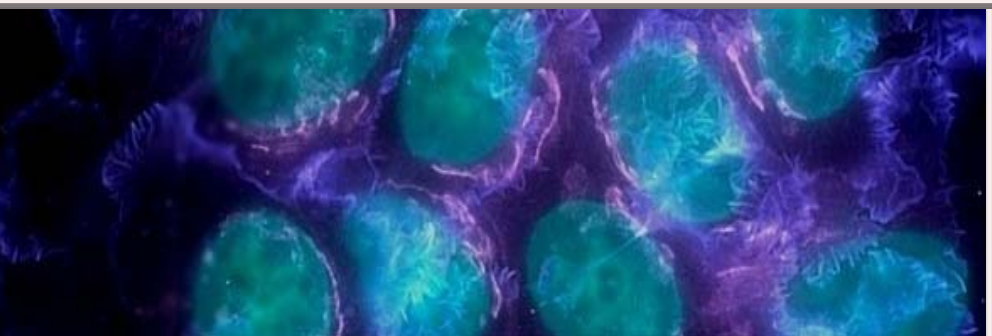
IN SUMMARY

CANCER DEATHS DUE TO METASTASIS
LACK OF KNOWLEDGE
NO ACCURATE, DETAILED TESTING

ACTIVE MAPPING OF METASTASIS
SHOWS PROBLEM AREAS
GIVES SENSE OF HOW/WHEN IT TRAVELS



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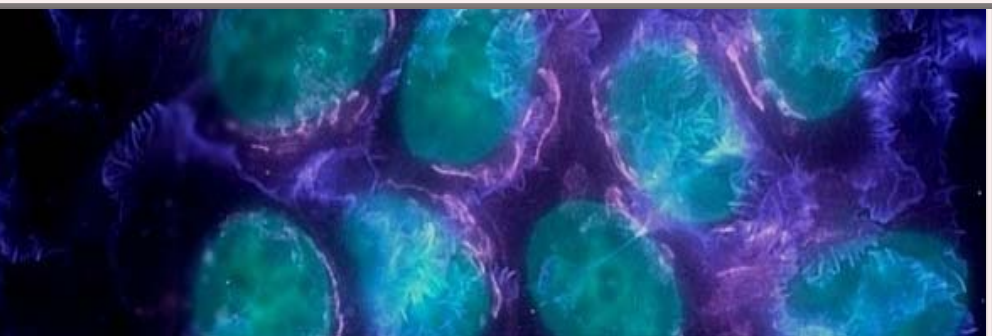
THANKS TO…

NATALIE KULDELL
MENTOR "RA" (anonymous)
DREW ENDY
ROGER KAMM

AGI STACHOWIAK
CHRISTINA SMOLKE
CHRIS ANDERSON

FOR THEIR HELP!



20.020 Introduction to Biological Engineering Design

Spring 2009