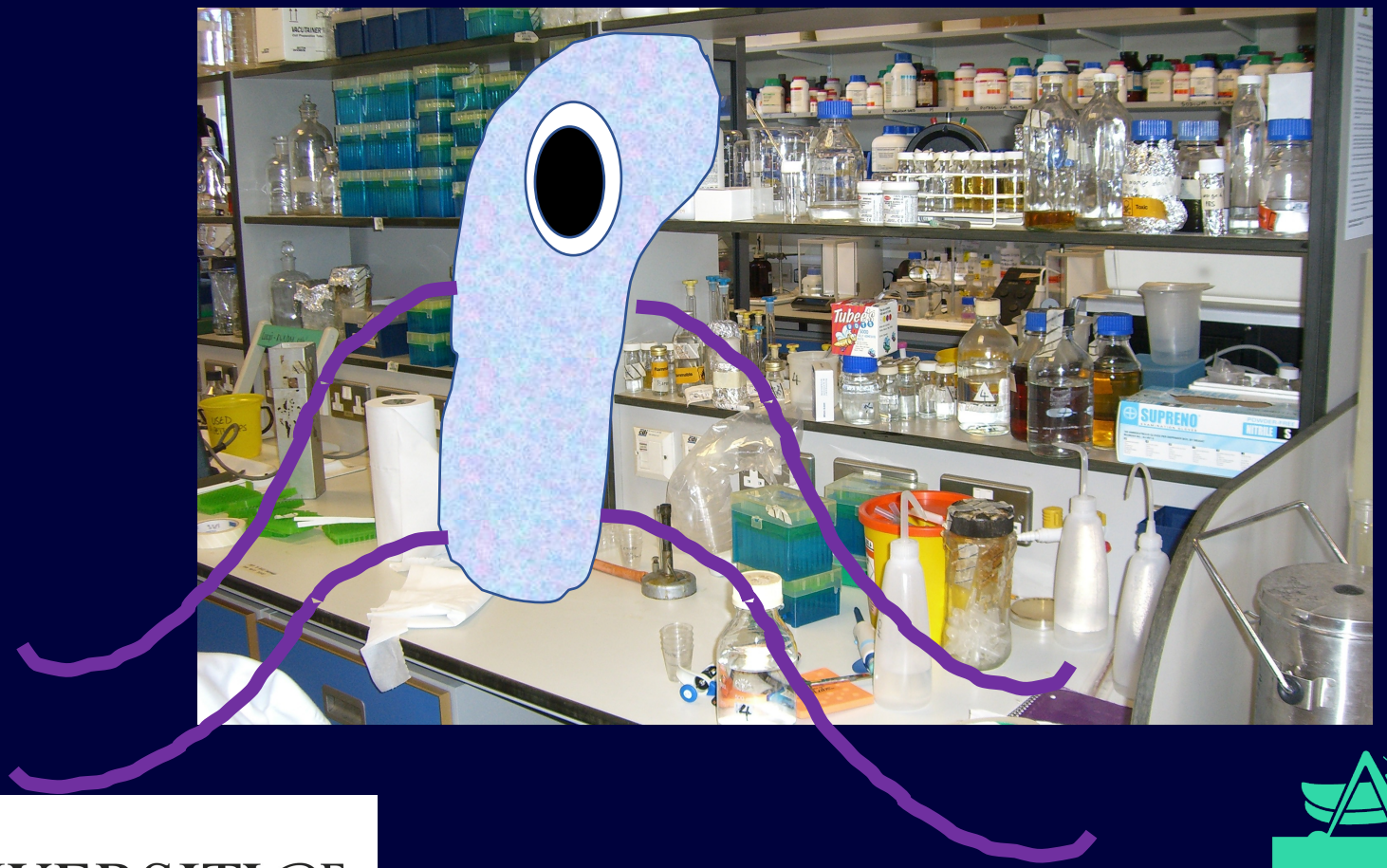
Microbial Master Chemists

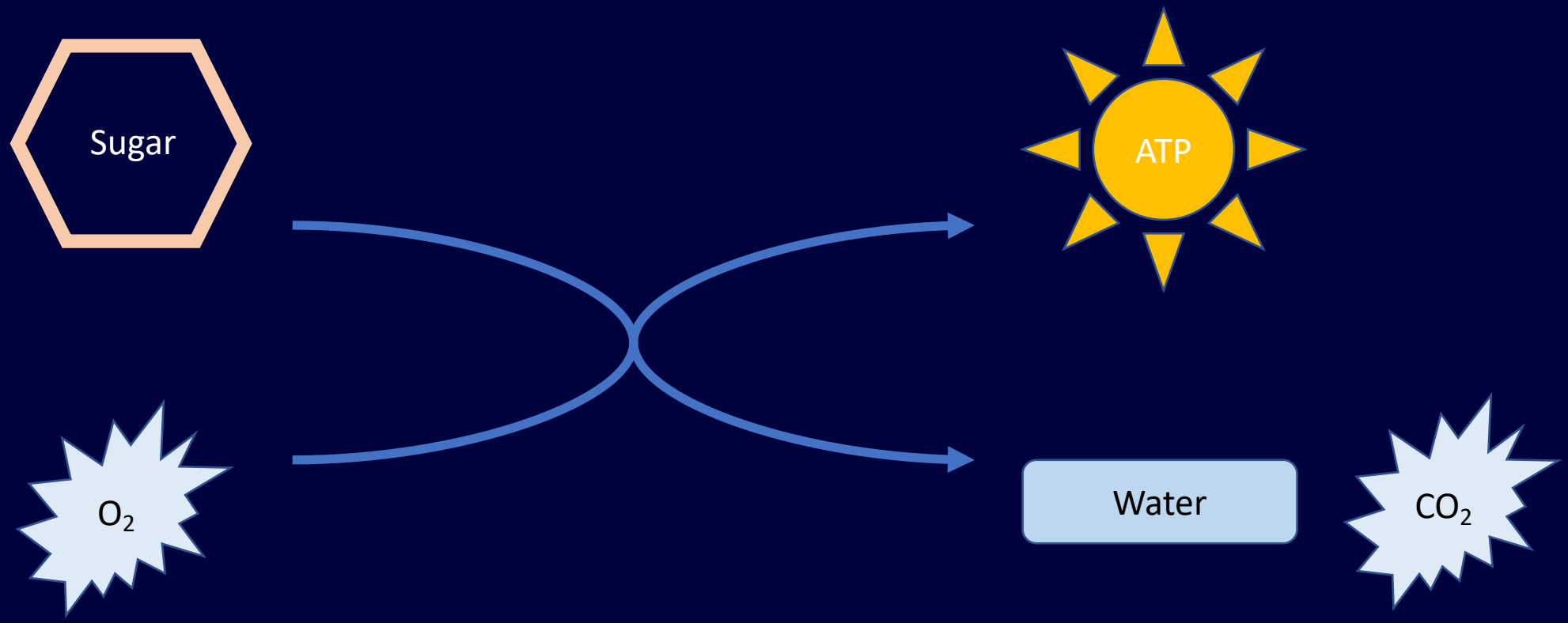


UNIVERSITY OF BIRMINGHAM

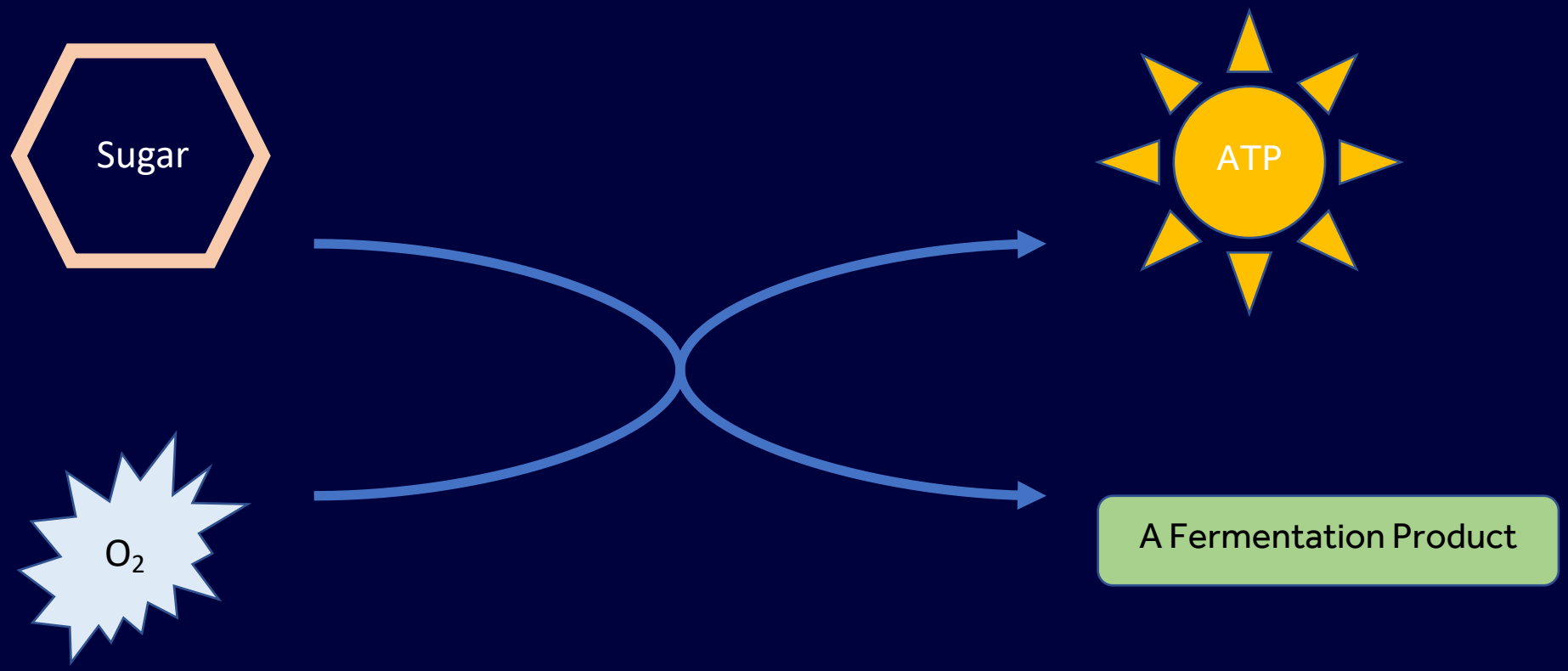
Robin May
@robinmay9

EST. 1597
GRESHAM
COLLEGE

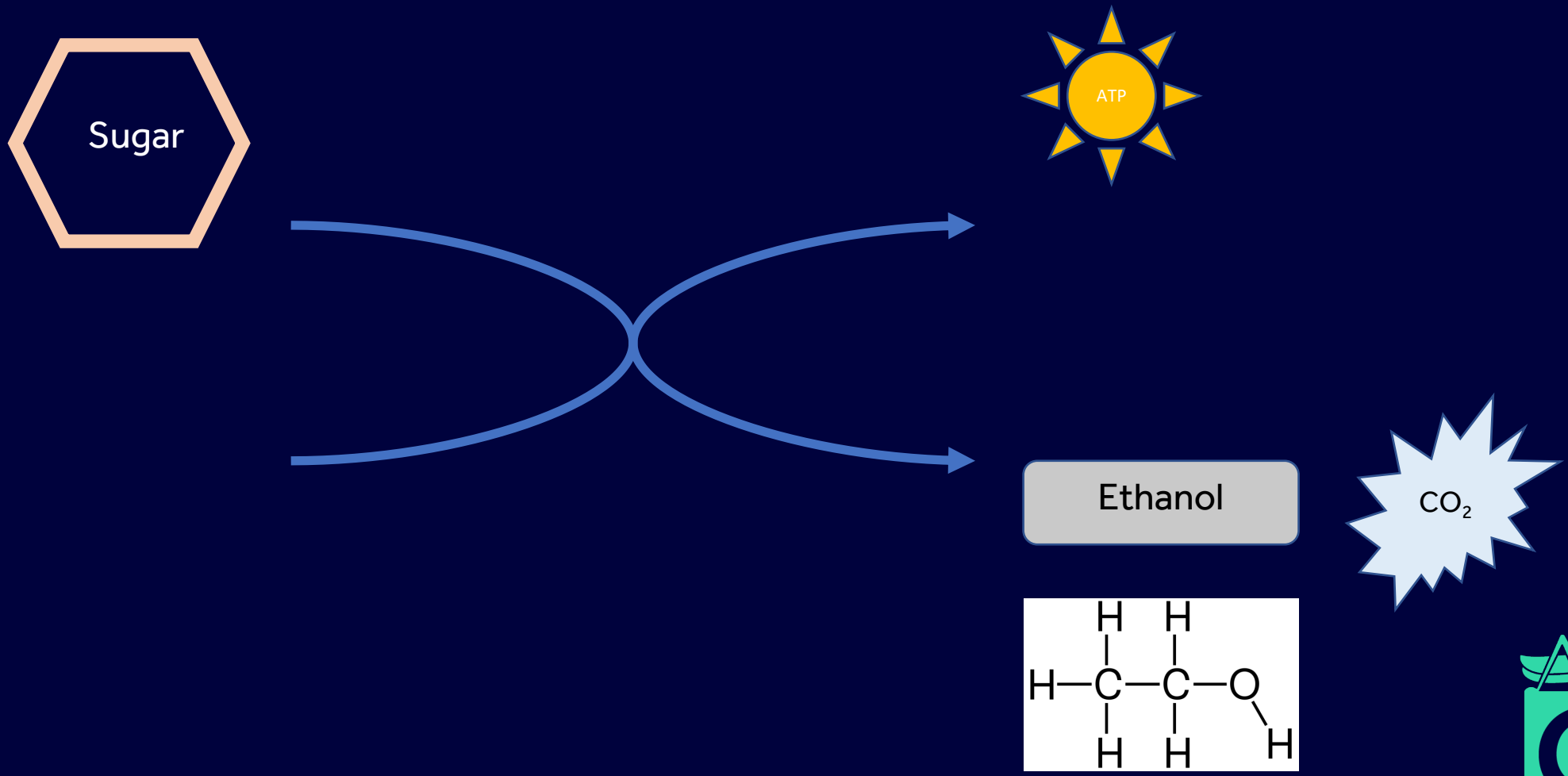
It's all about ENERGY!!



It's all about ENERGY!!



It's all about ENERGY!!



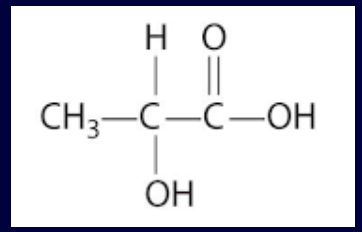

5 µm

It's all about ENERGY!!

Sugar

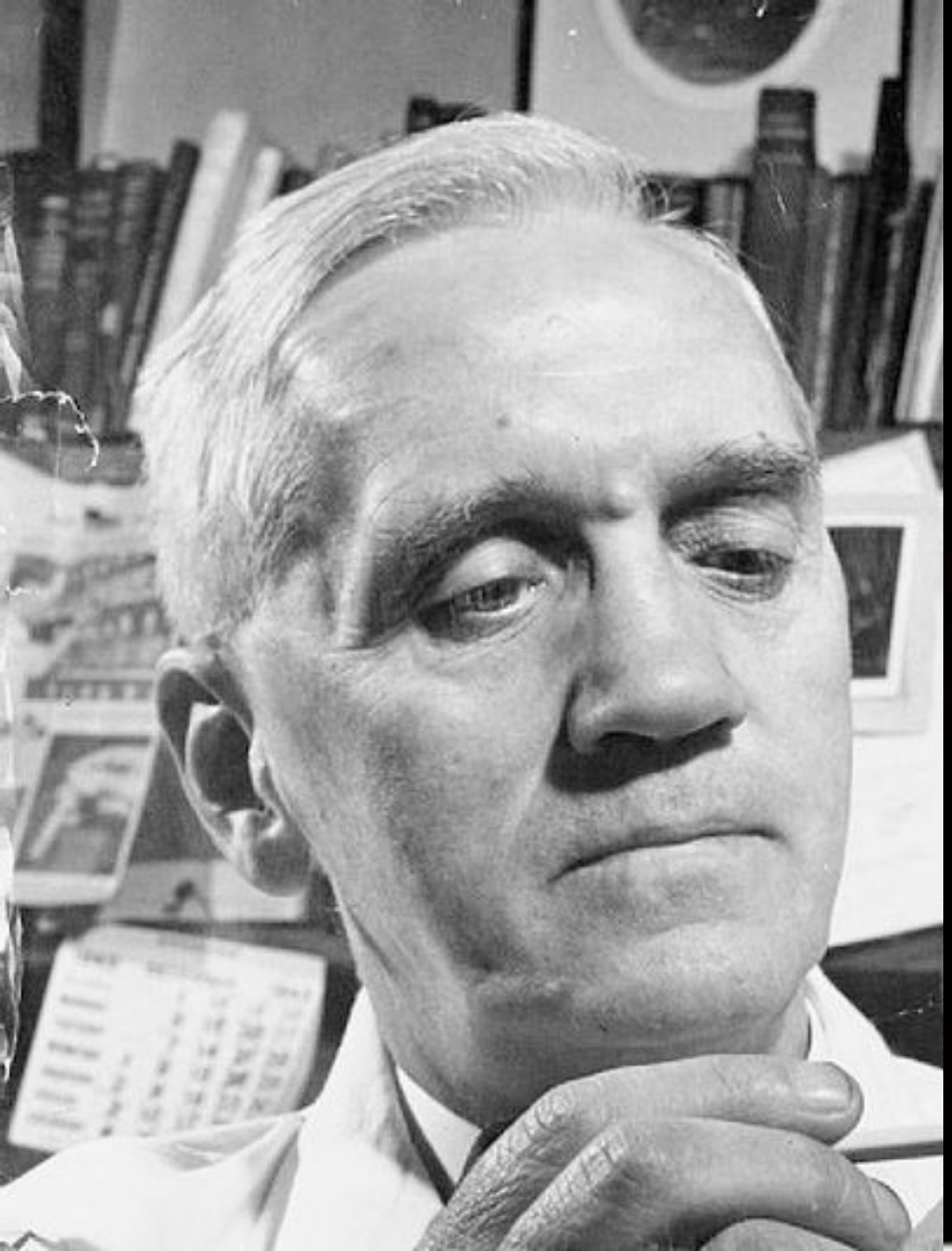
ATP

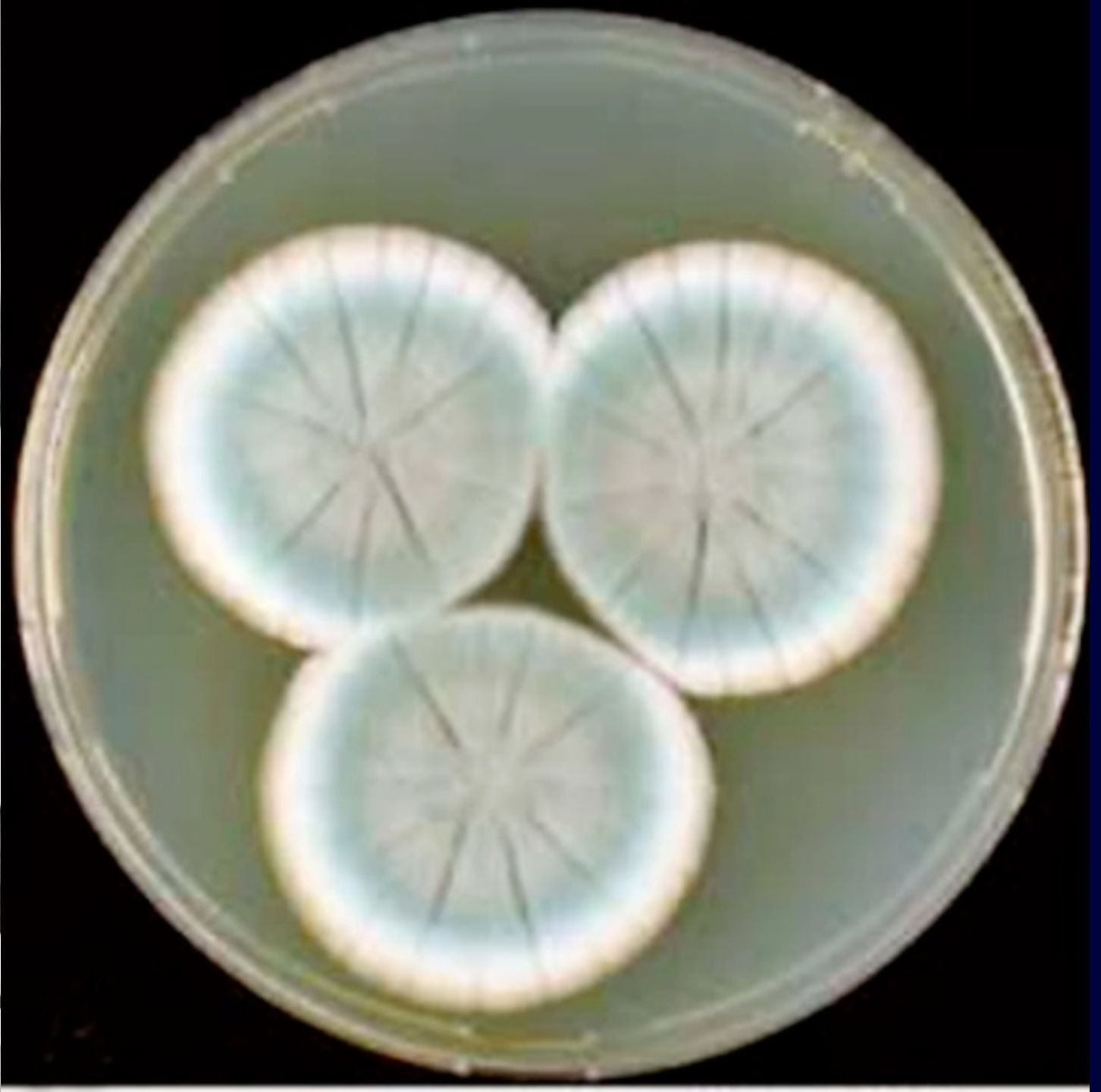
Lactic Acid



Chemical Warfare, Microbe-Fashion...

Stubbendieck and Straight, 2015





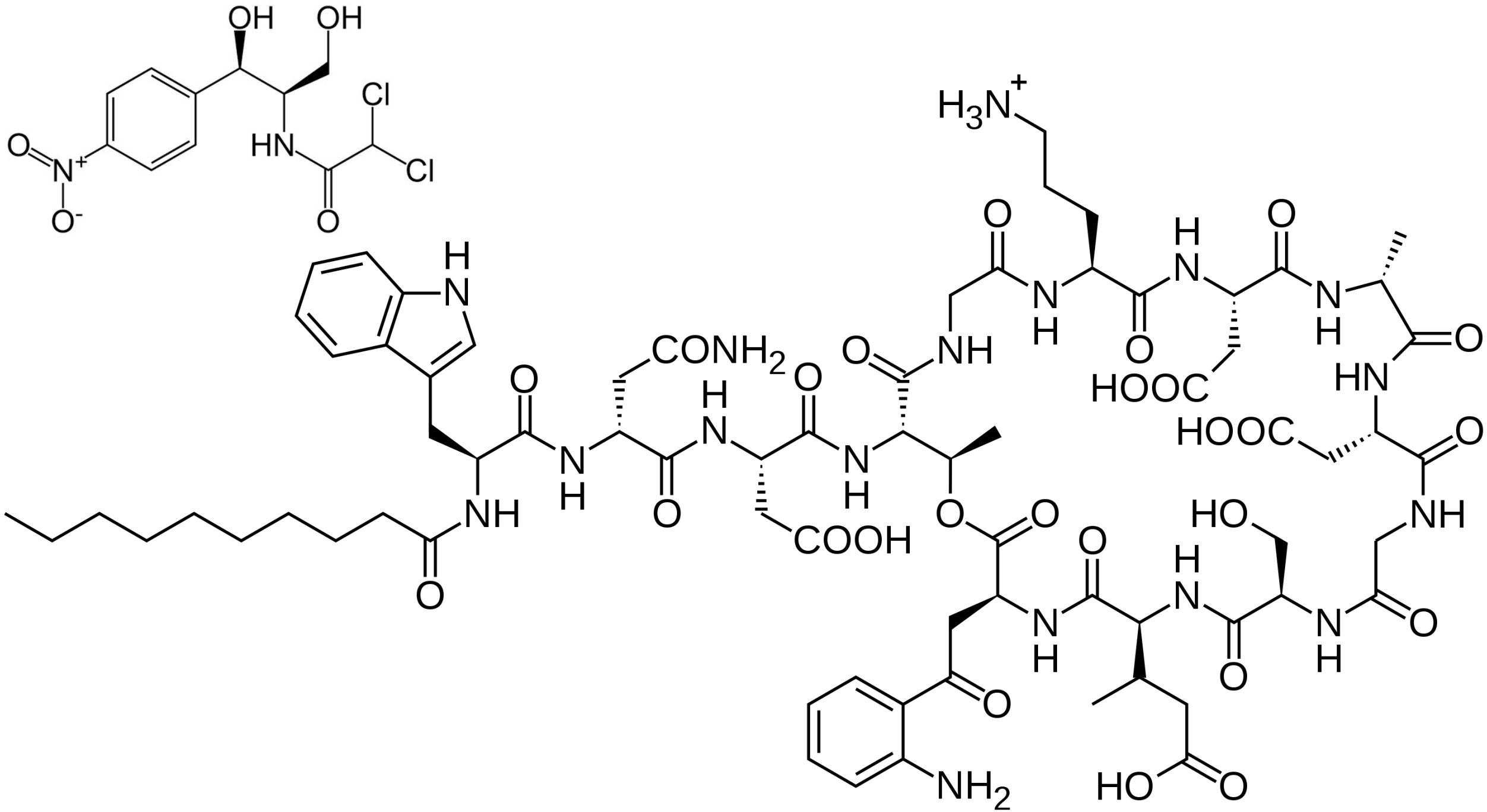


Figure 2. The synthesis of daconolic acid via fatty acid synthase and subsequent hydrolysis catalyzed by a thioesterase enzyme.

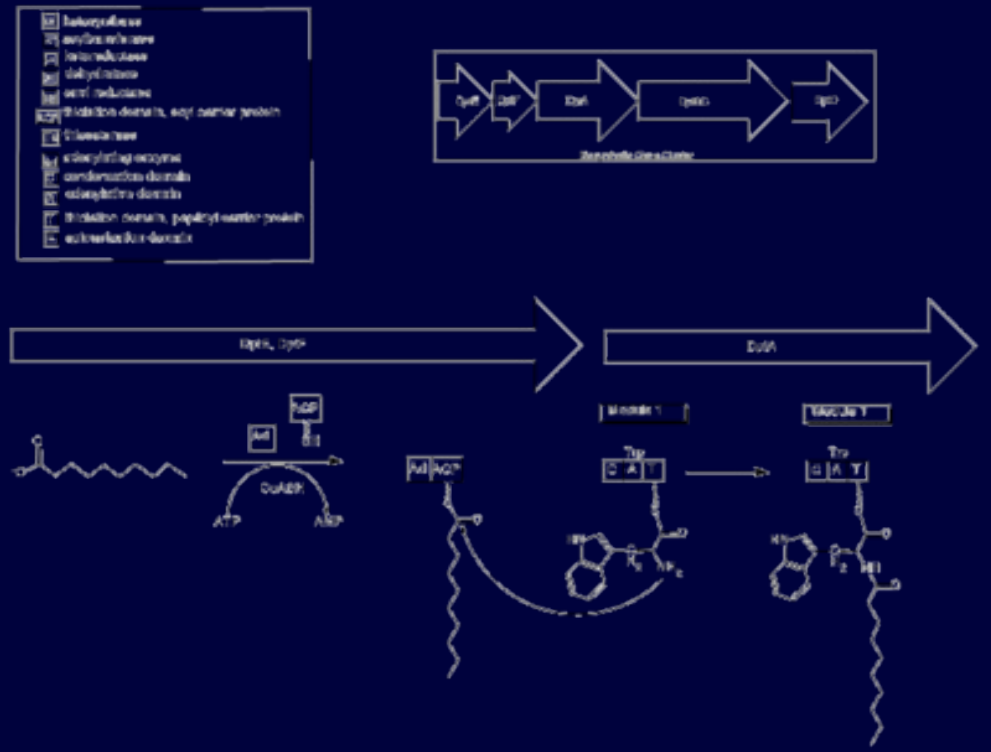


Figure 3. The coupling of daconolic acid to the N-terminal tryptophan residue on module 1 of the Daptomycin NRPS. The genes responsible for this coupling event are dptE and dptF, which are located upstream of dptA, the first gene of the Daptomycin NRPS biosynthetic gene cluster

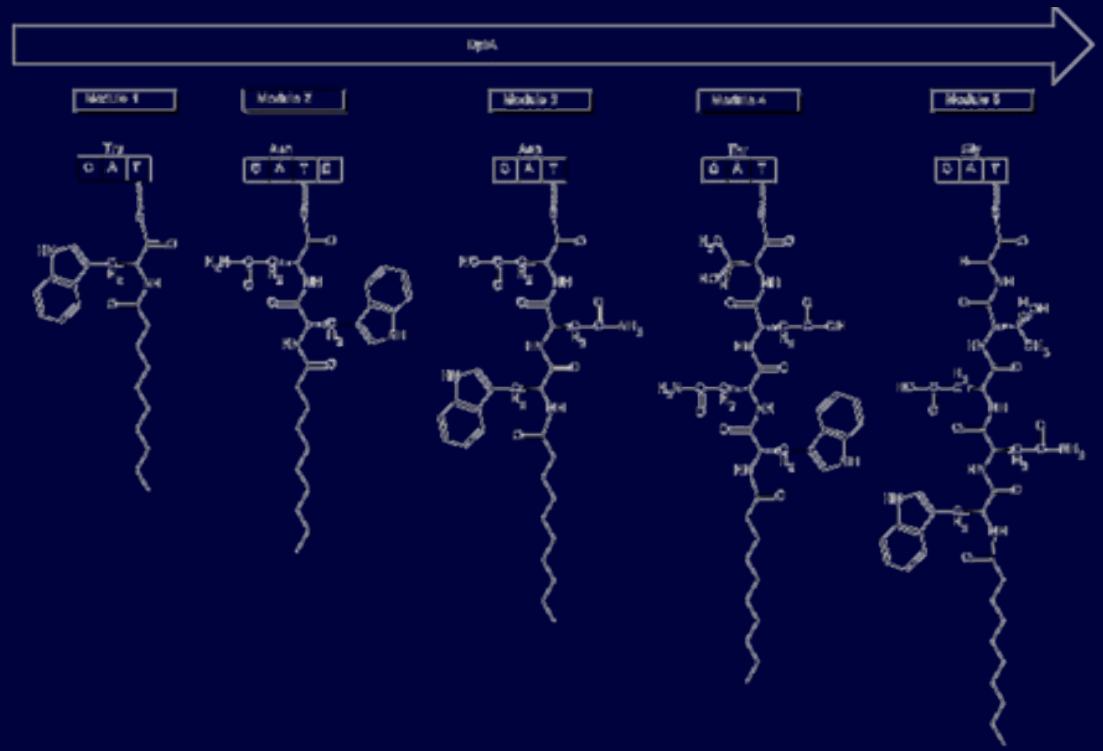


Figure 4. Daptomycin NRPS. DptA encodes modules 1-3, which catalyze the addition of L-tryptophan, D-asparagine, L-aspartate, L-threonine, and glycine to the growing peptide.

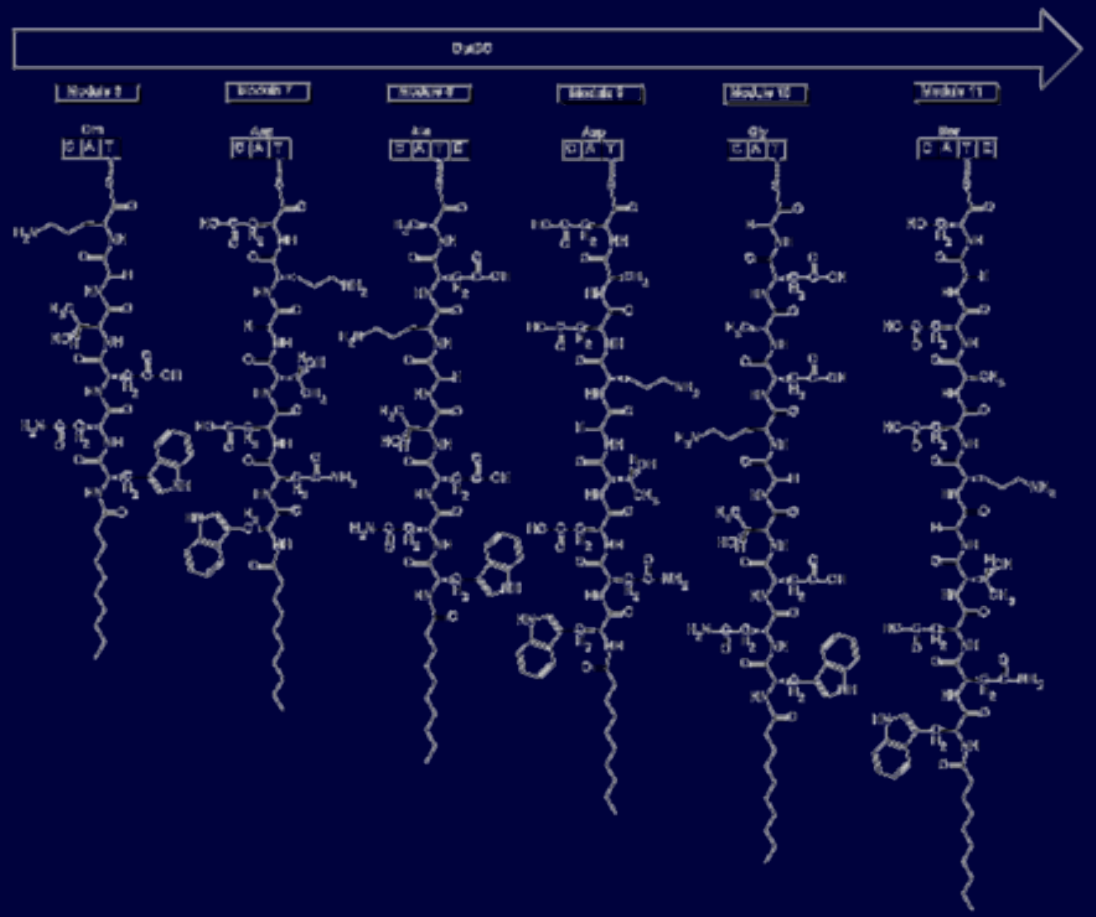


Figure 6. Daptomycin NRPS. The dptBC gene encodes modules 8-11 and catalyses the condensation of L-ornithine, L-aspartate, D-alanine, L-aspartate, glycine, and D-serine.

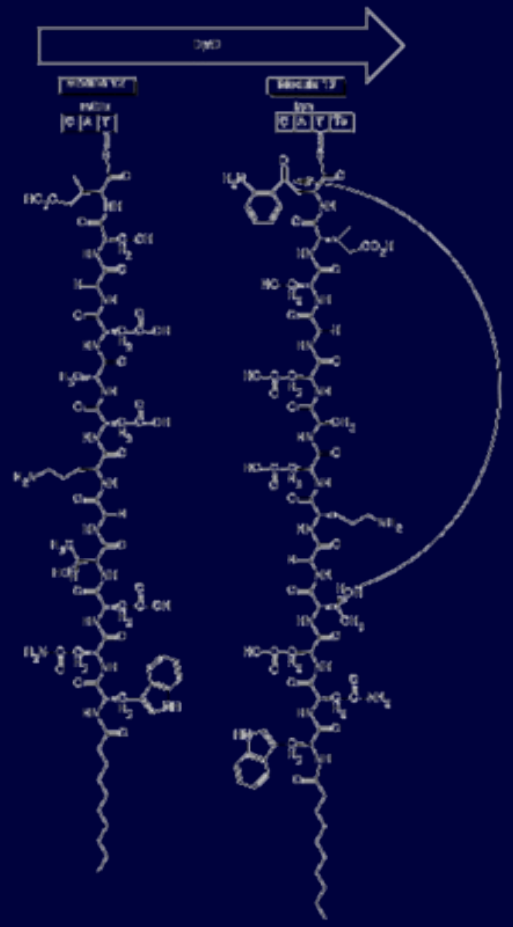
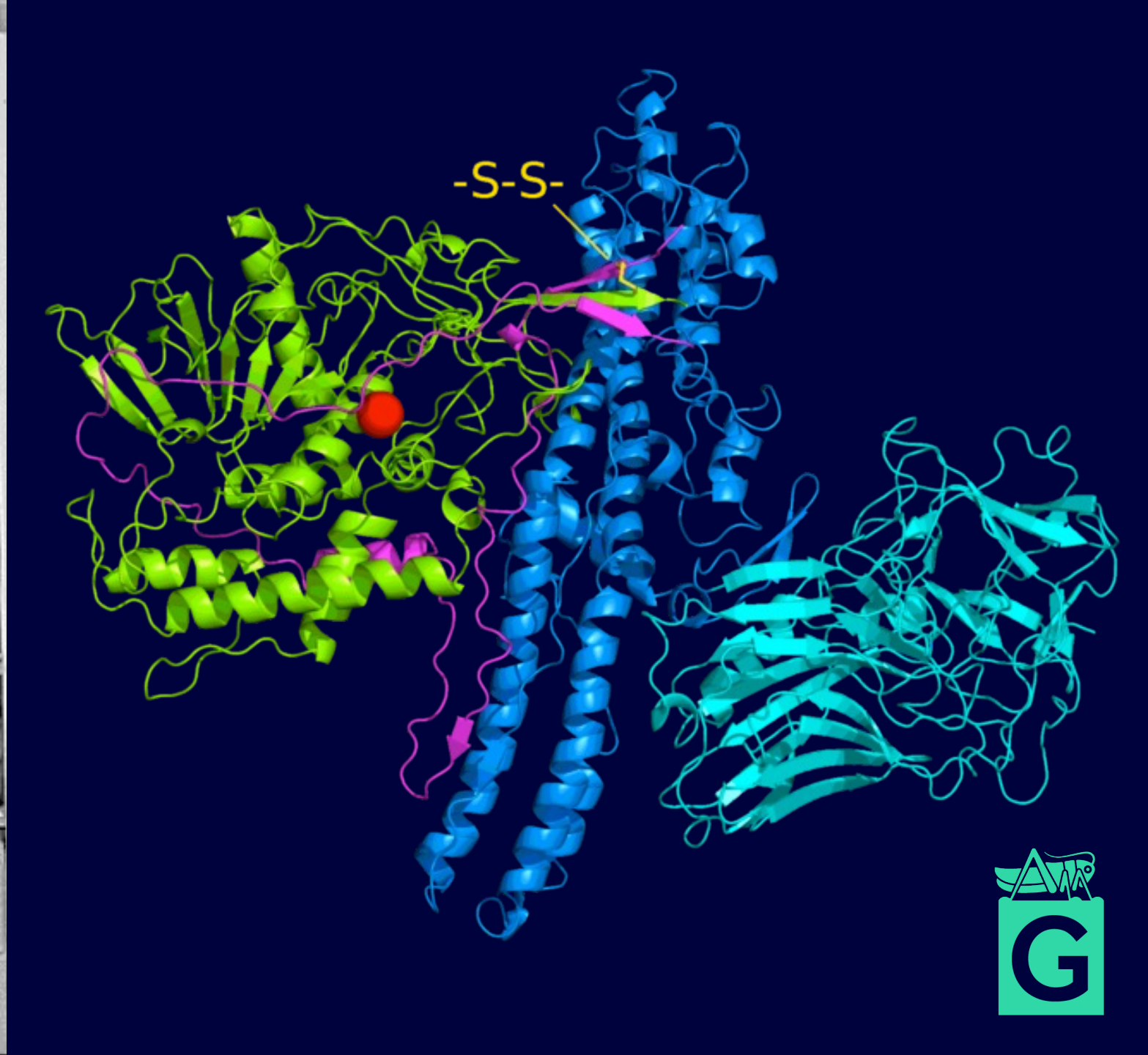
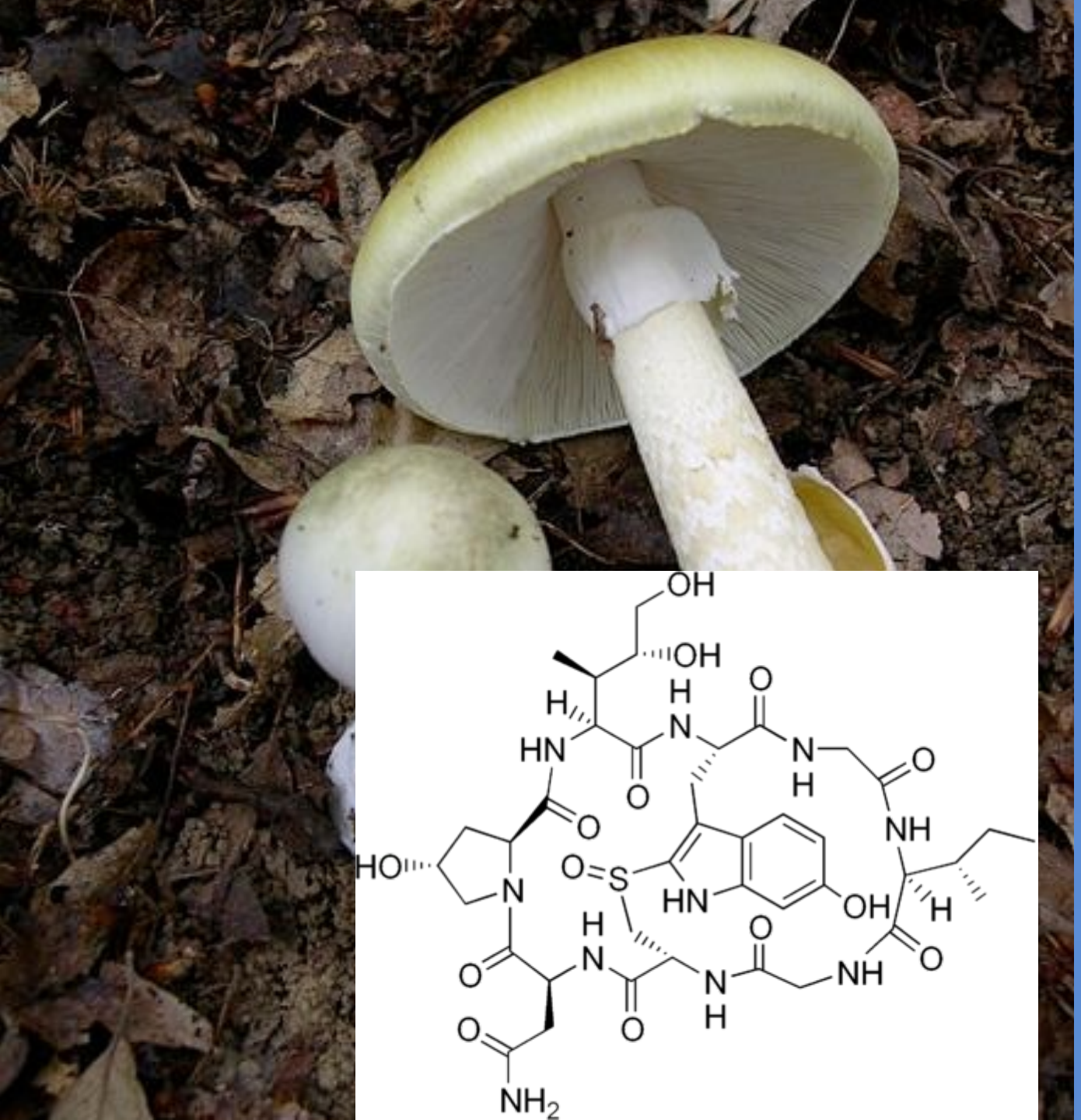


Figure 6. Daptomycin NRPS. DptD encodes modules 12-13, which catalyses the addition of L-Hpg and L-Kyn to the end of the peptide. A thioesterase enzyme catalyses ring formation via nucleophilic attack from a threonine side chain on the electrophilic center of L-Kyn.

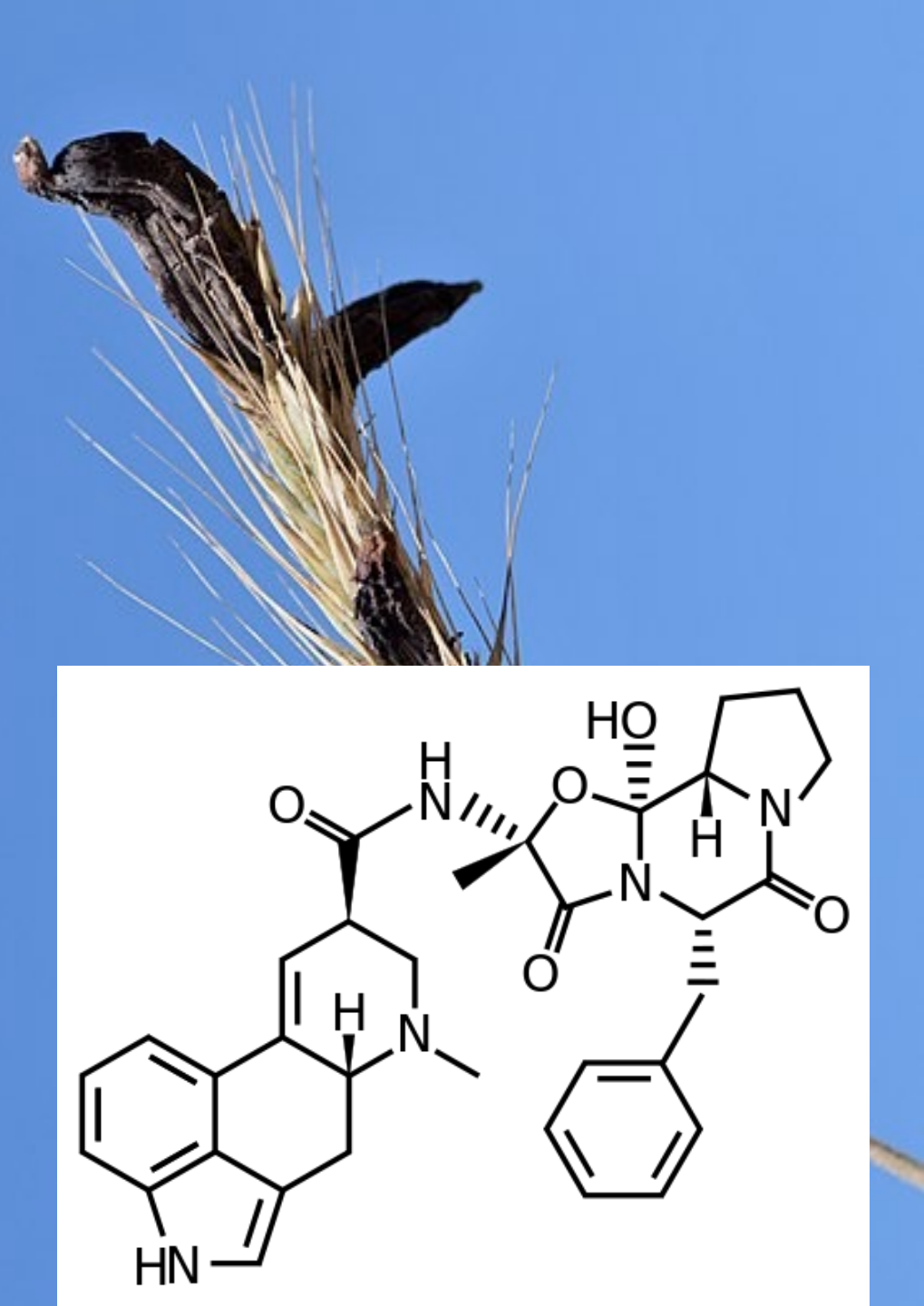
When microbes go bad...

TOXINS!


-S-S-

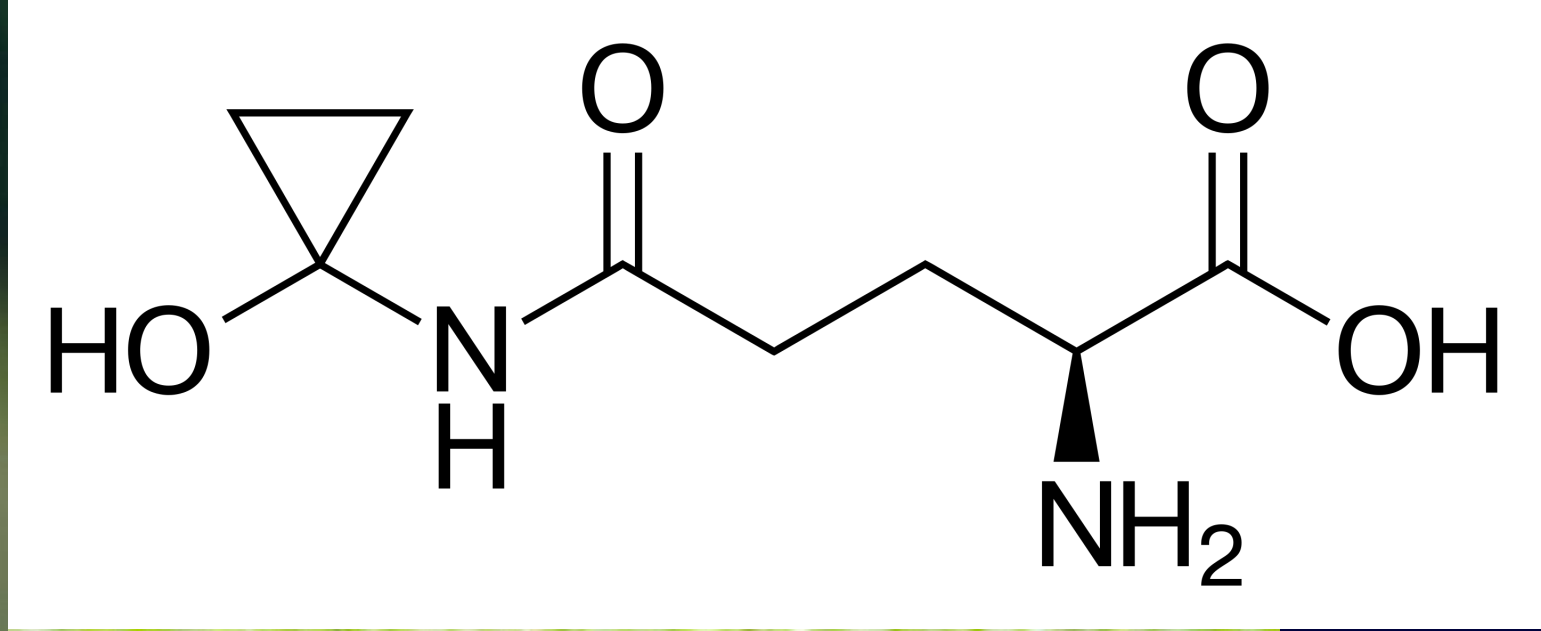


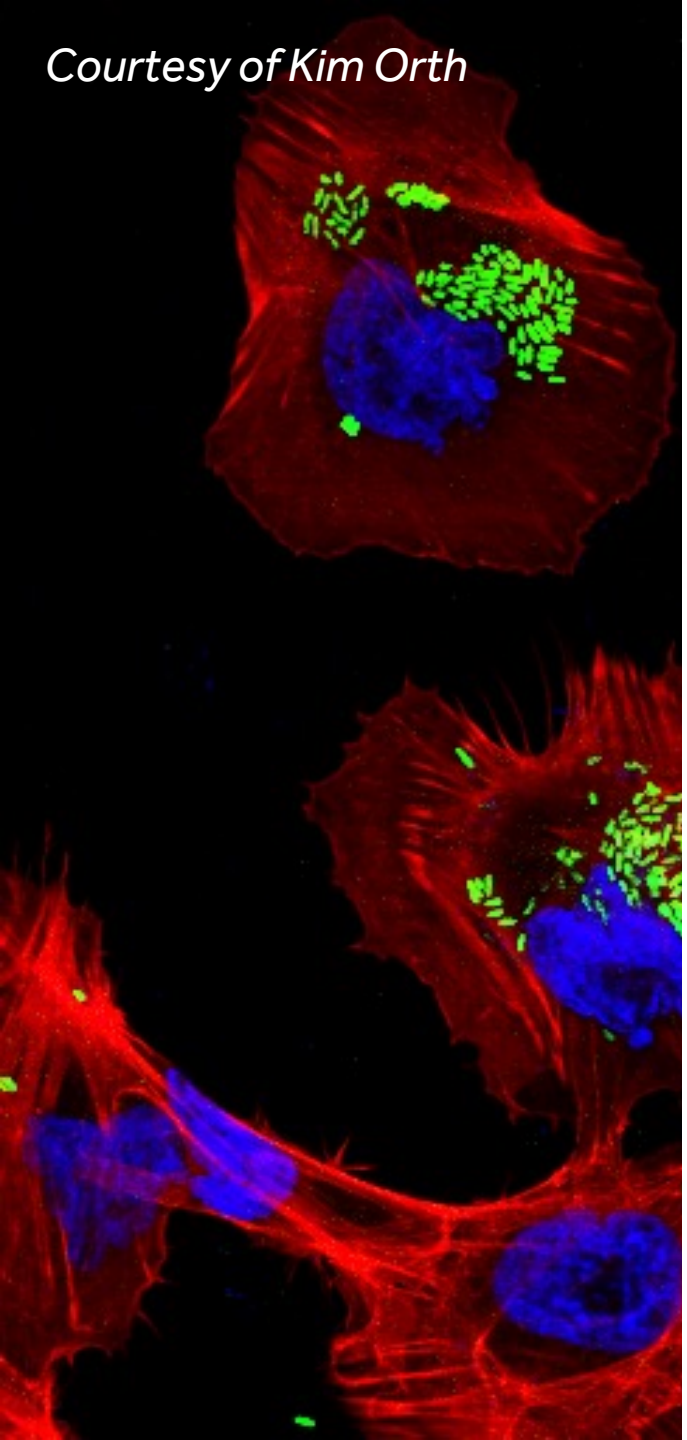
OH
OH
H
HN
N
H
O
N
H
O
O
NH
HO
N
O=S
HN
OH
H
O
N
H
O
NH
O
O
O
NH2

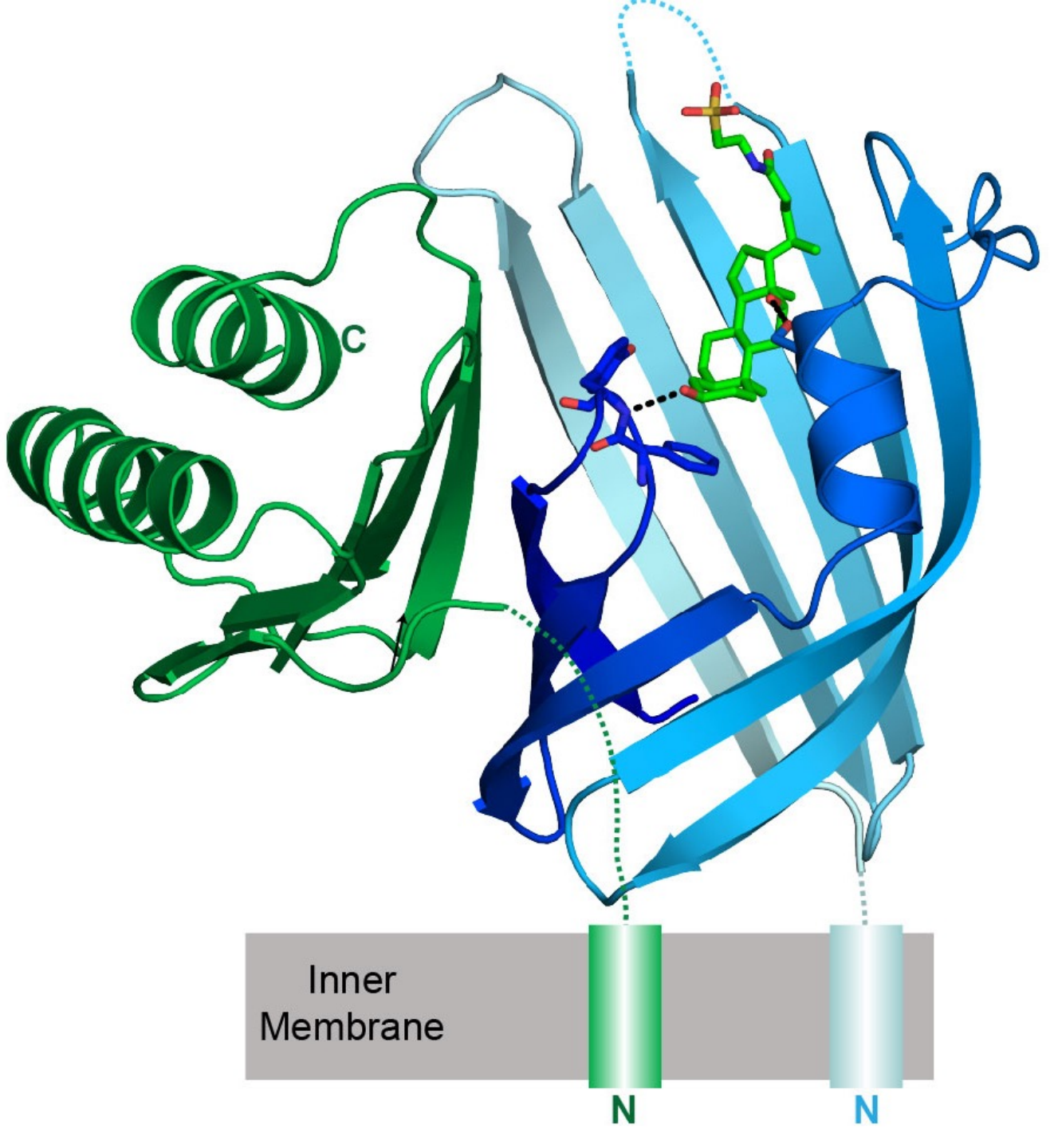


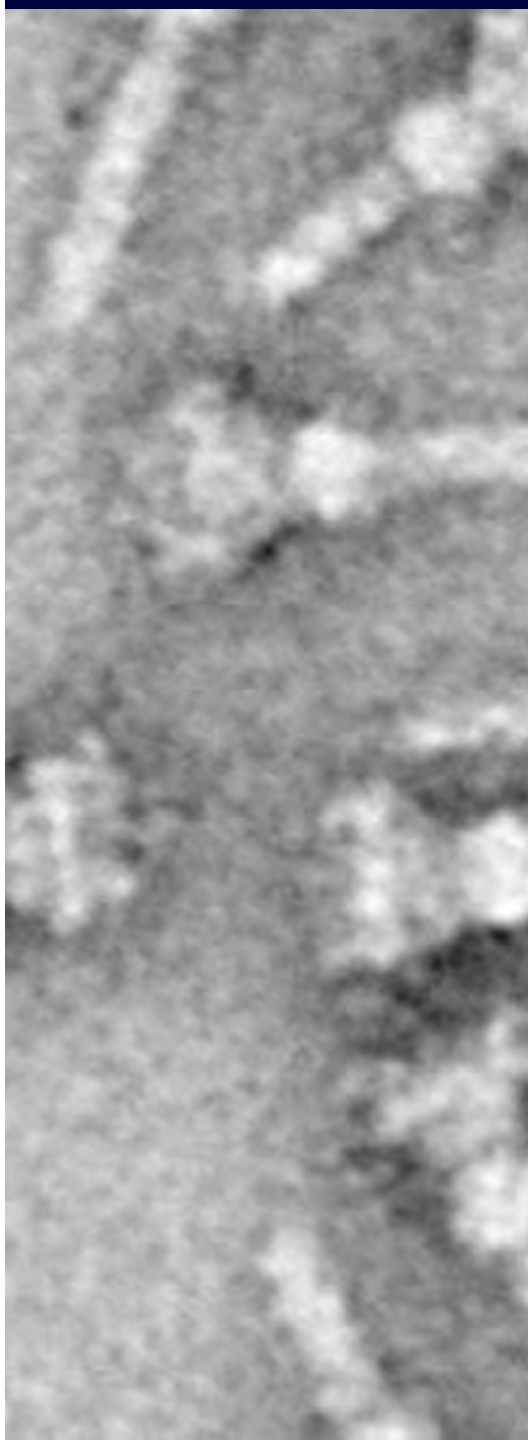
HO
H
O
N
O
N
H
O
O
H
N
HN

Microbial chemistry can be highly precise…

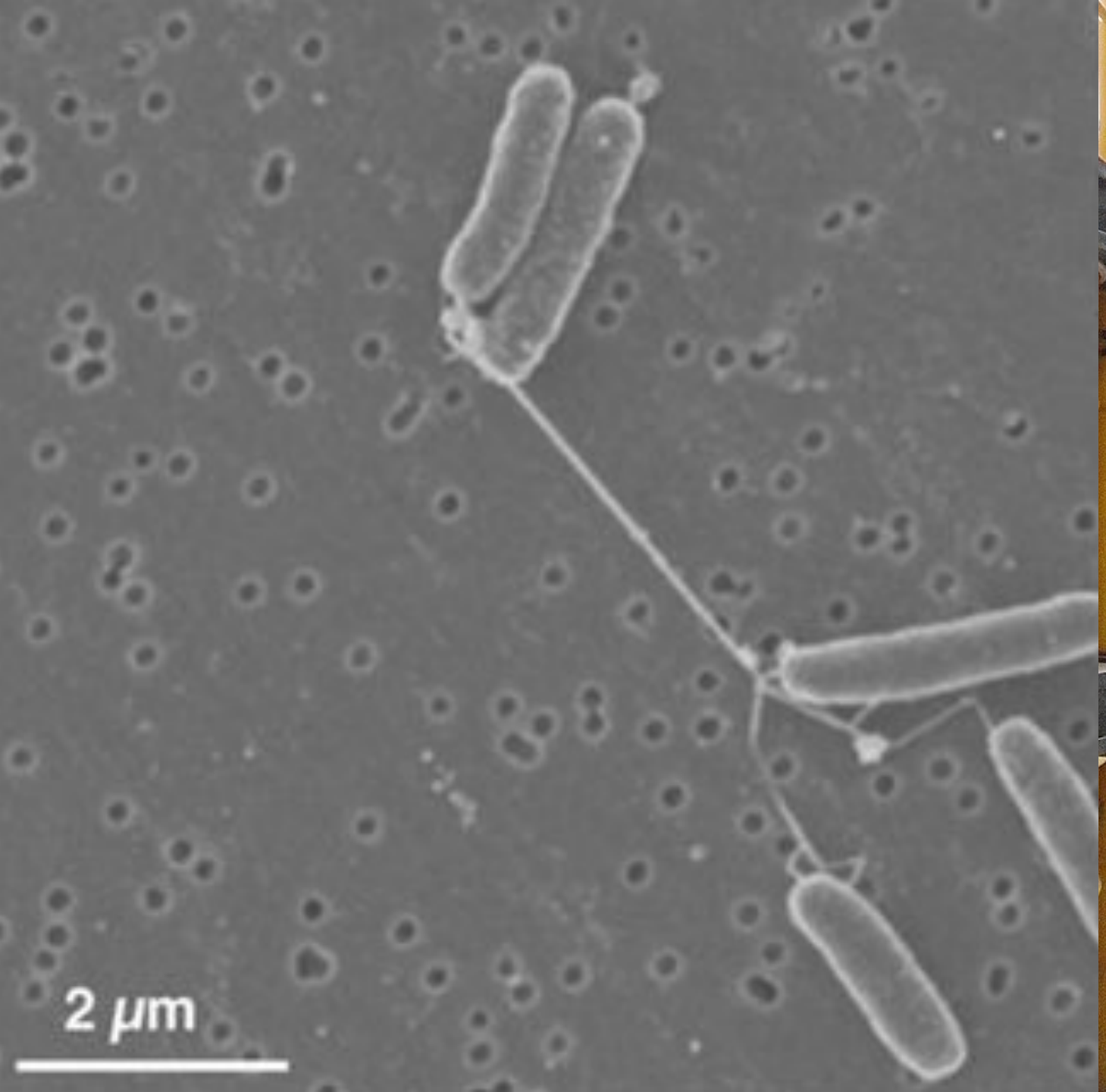

O
O
HO
N
H
OH
NH2


Courtesy of Kim Orth

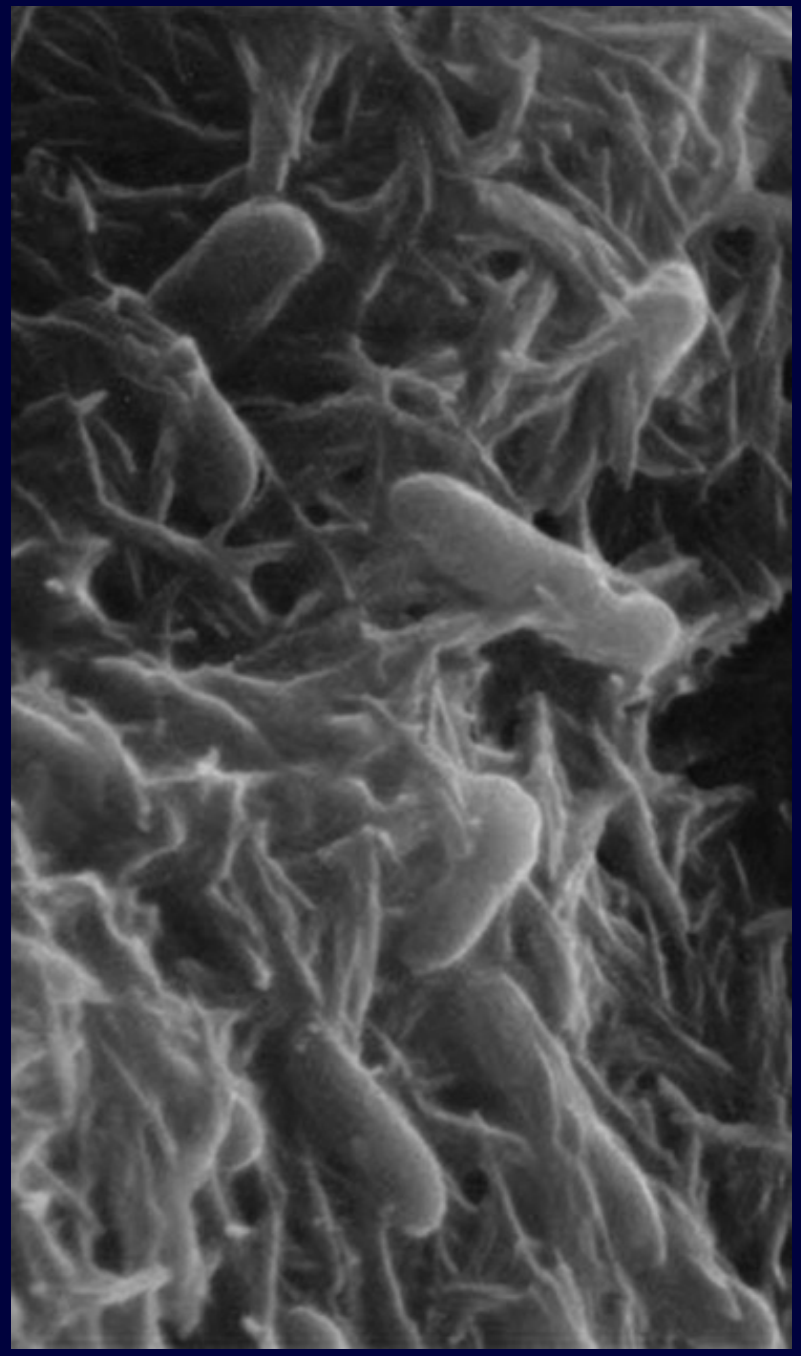

C
Inner
Membrane
N
N

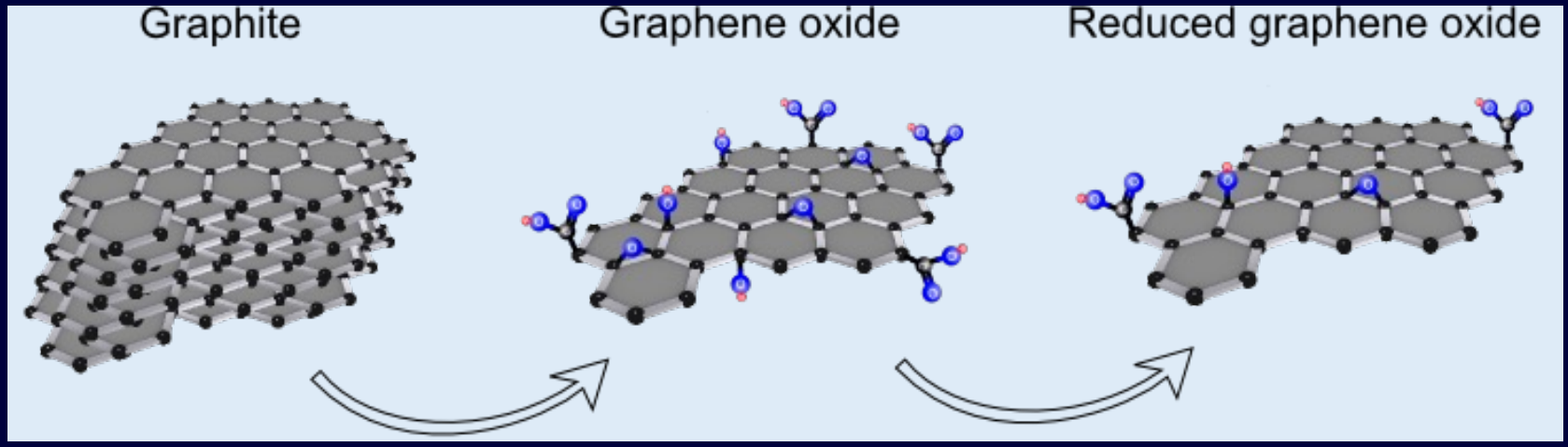


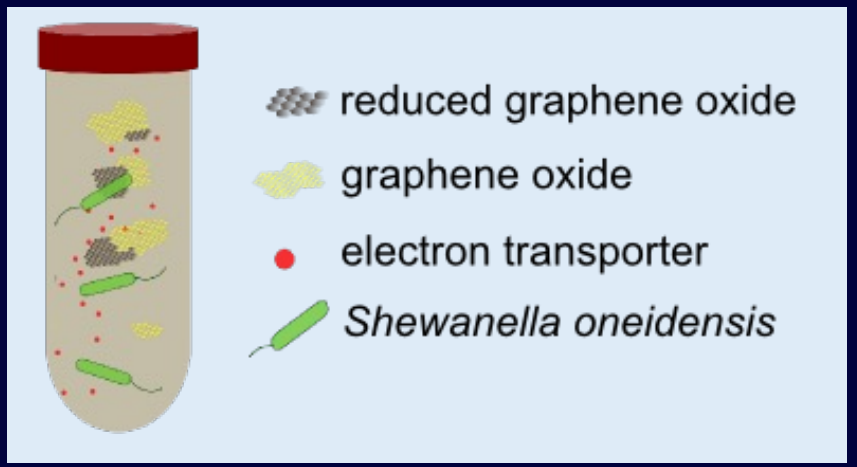
Microbes as Material Chemists...

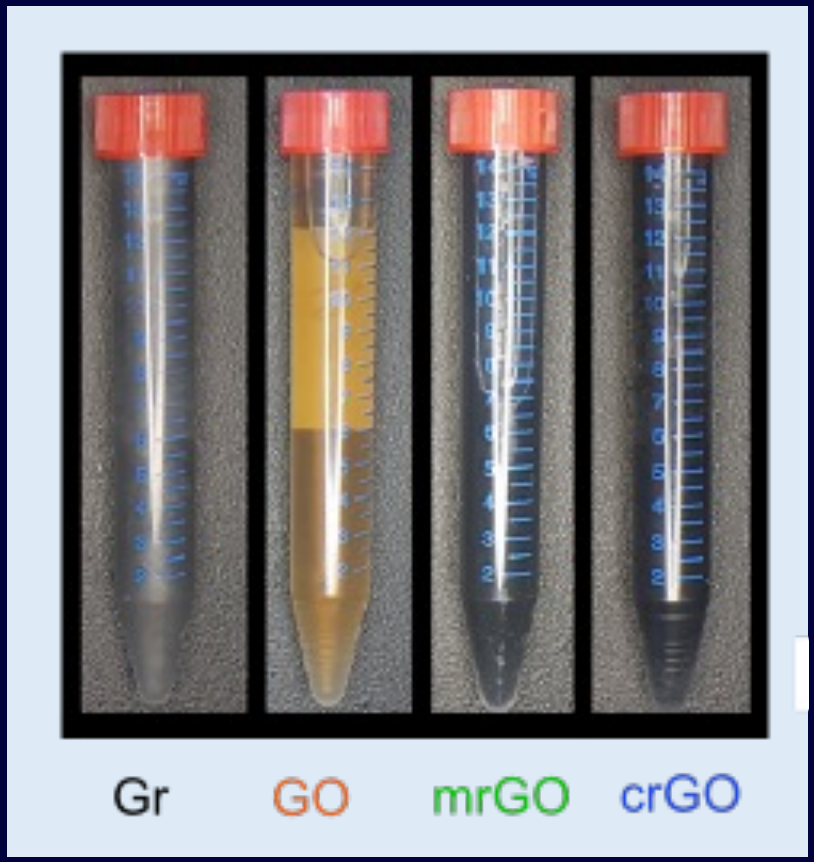

2 μm


OAEP
น้ำหนักรวม

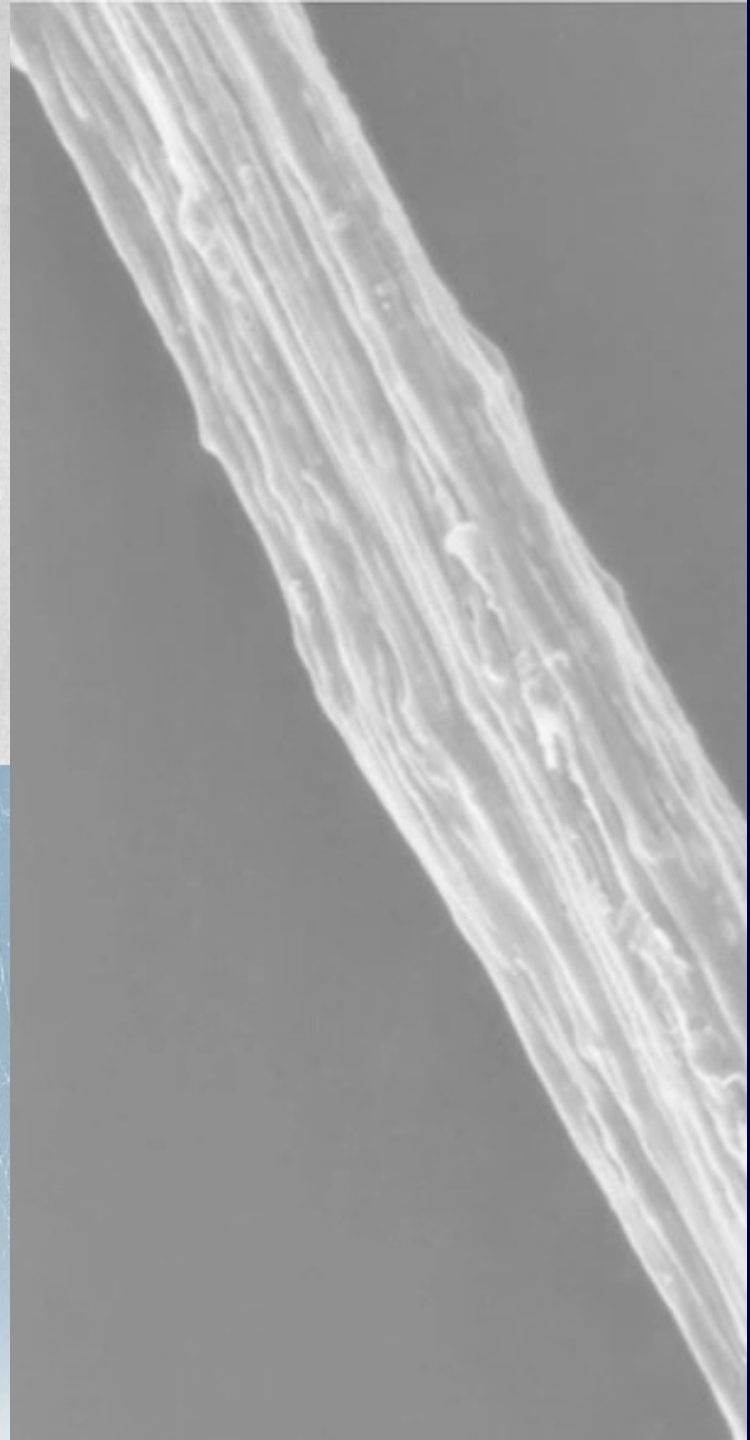








Courtesy of Anne Meyer



Kumar et al, 2014; Foong et al, 2020

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