

Quantitative Microbial Physiology

Jacopo Grilli
Lecture 5, Feb 21, 2025

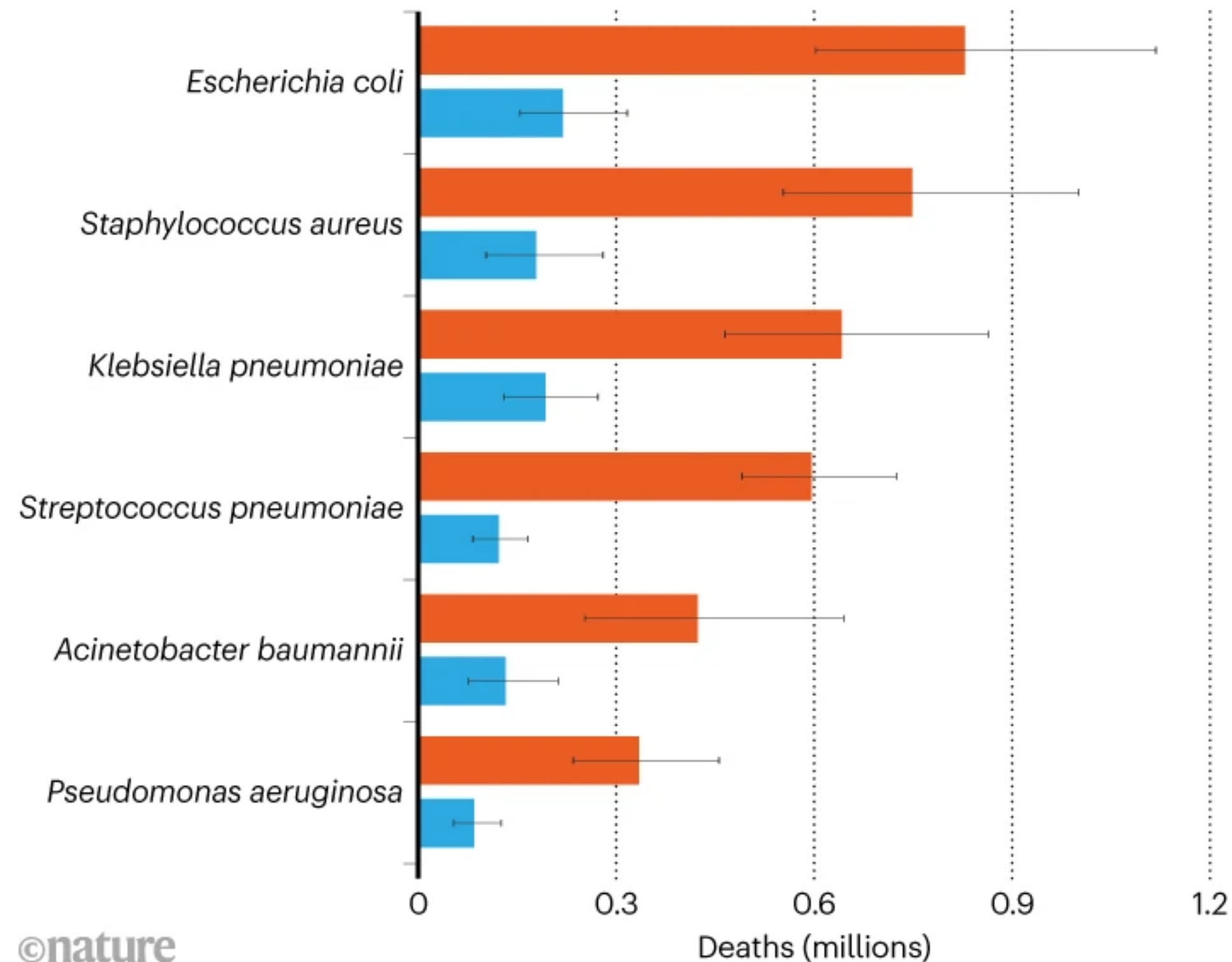
Antibiotics affect growth / kill bacteria

Antibiotics resistance is a real issue

DEADLY INFECTIONS

These 6 pathogens were responsible for almost 80% of the 1.27 million deaths attributed directly to antimicrobial resistance in 2019.

■ Associated with resistance ■ Attributable to resistance

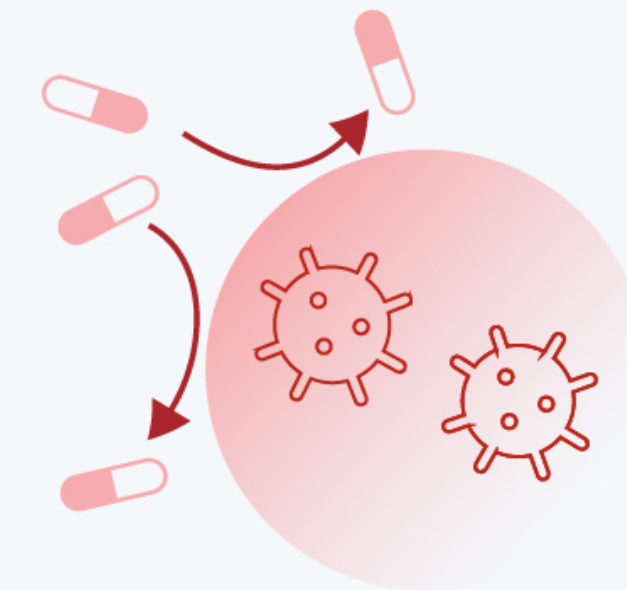
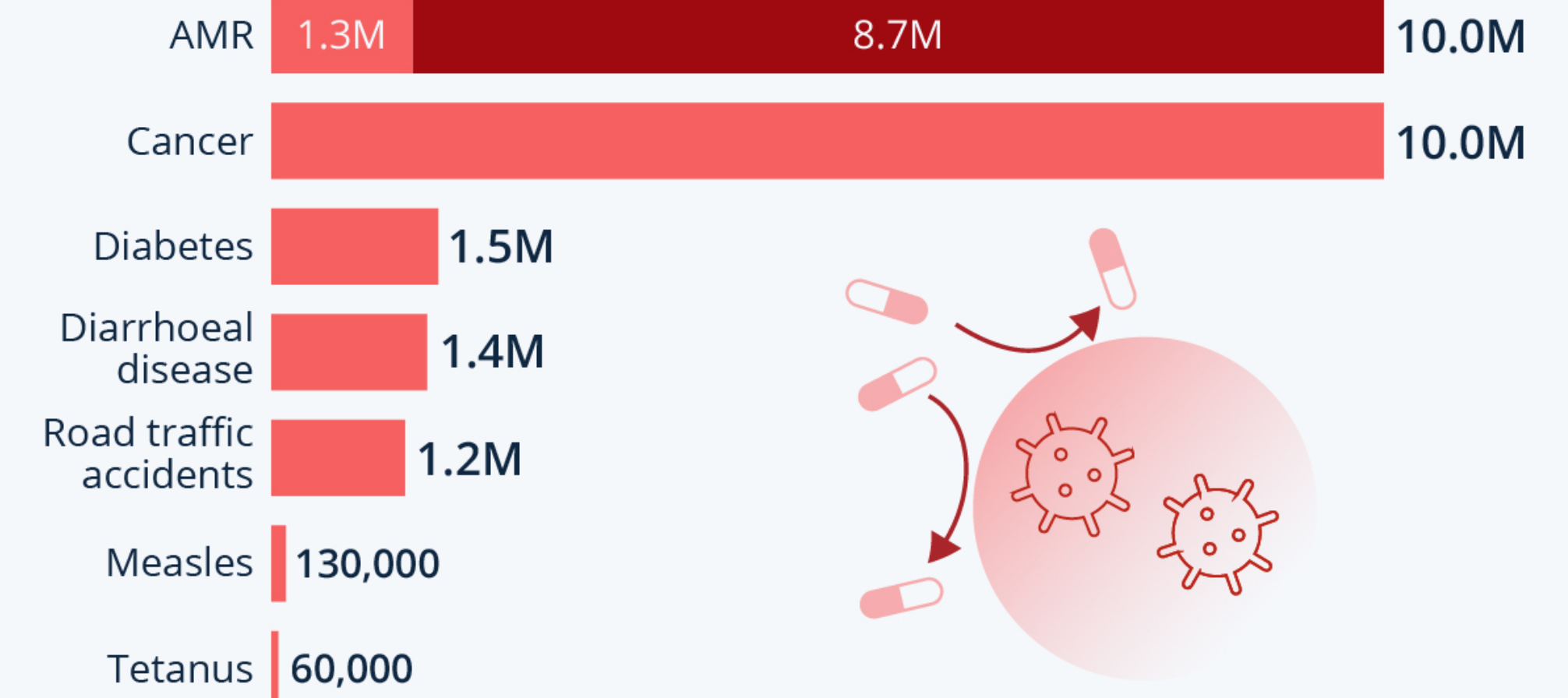


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Deaths From Drug-Resistant Infections Set To Skyrocket

Predicted mortality from antimicrobial-resistant* infections (AMR) versus today's common causes of deaths

■ 2020 ■ 2050

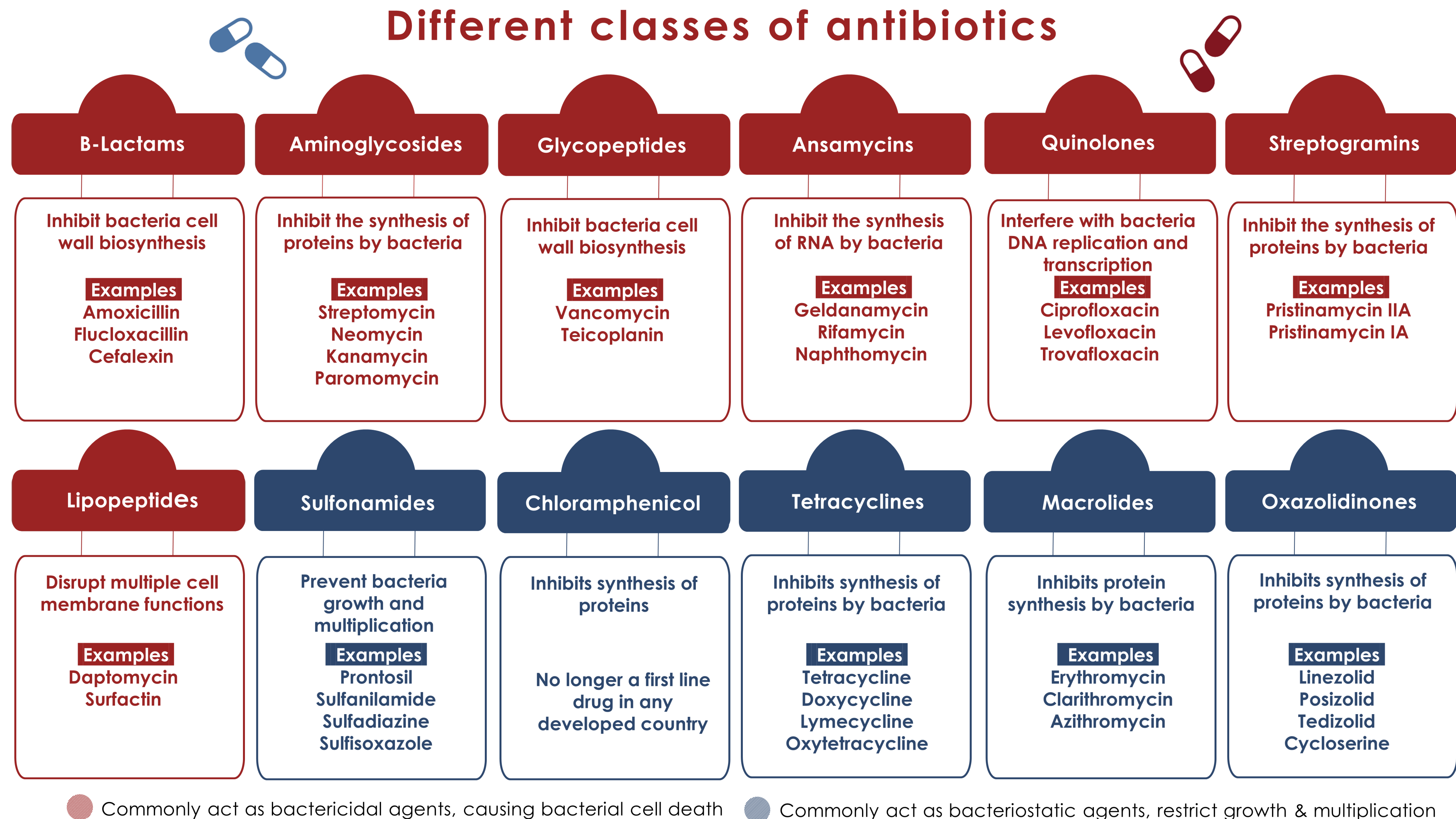


* resistant to antibiotics, antivirals, antifungals and antiparasitics
Source: Bracing for Superbugs 2023 (UN Environmental Programme)

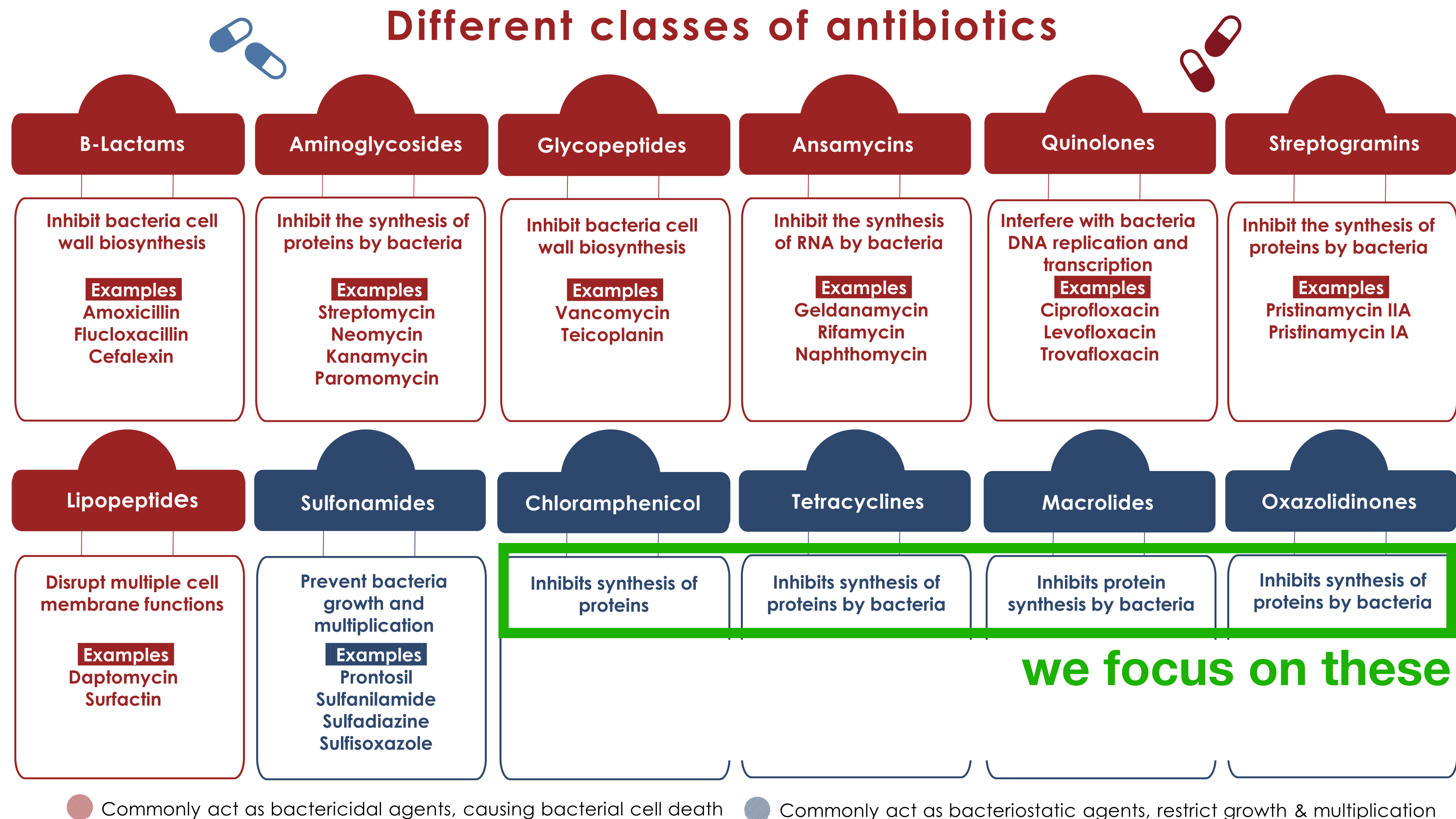


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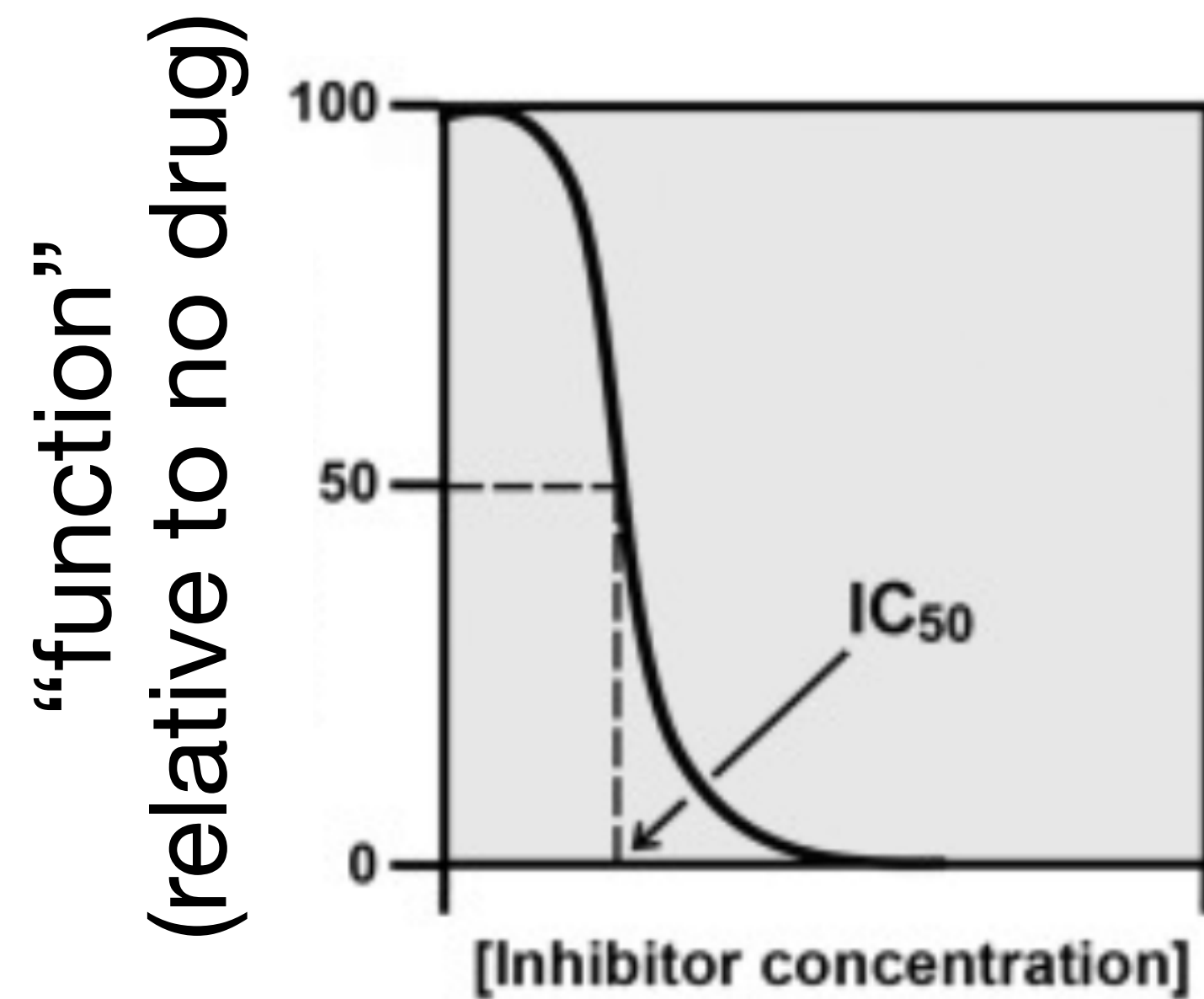
There are many mode of actions of antibiotics



There are many mode of actions of antibiotics



Measuring the effect of a drug

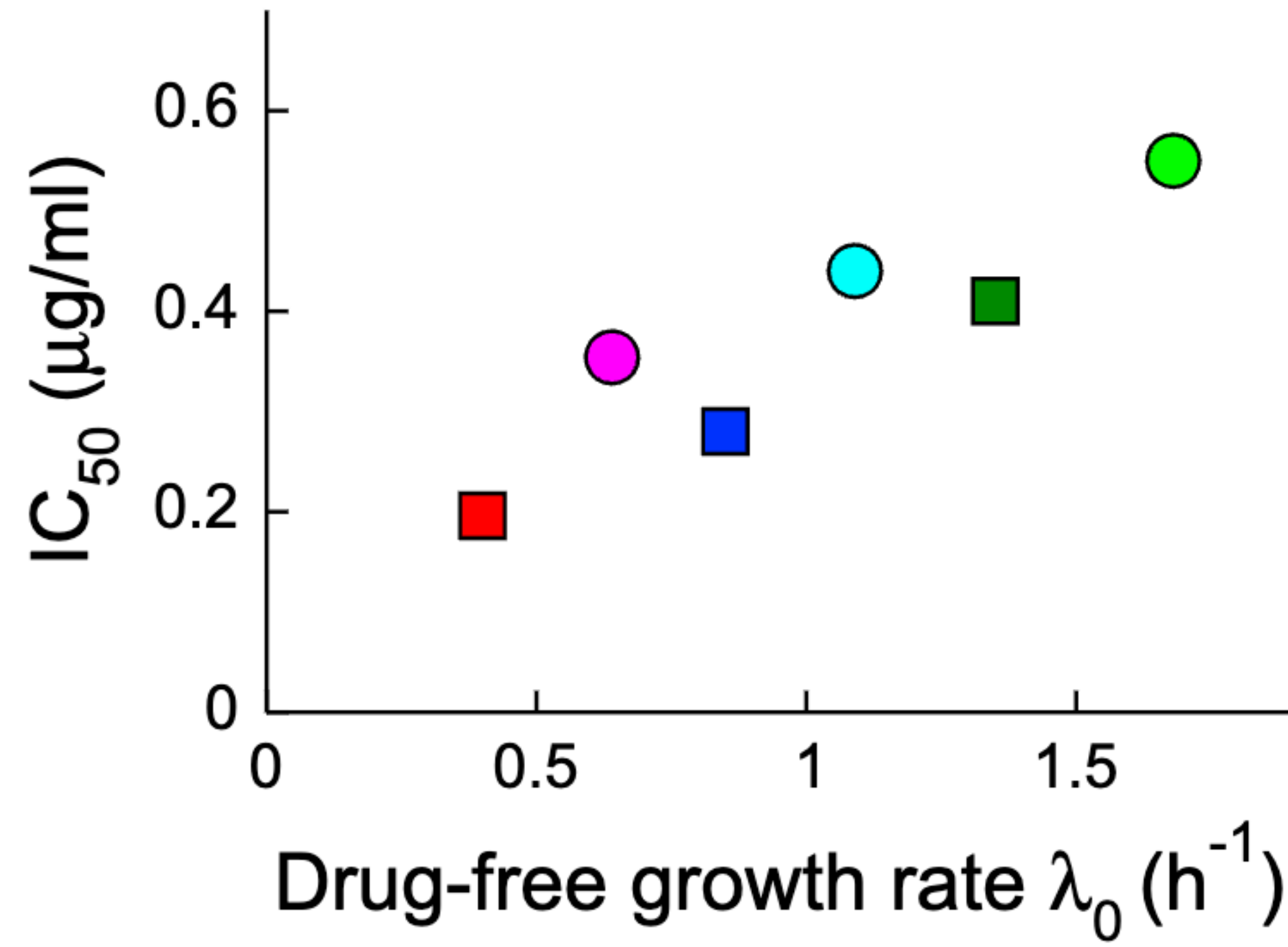
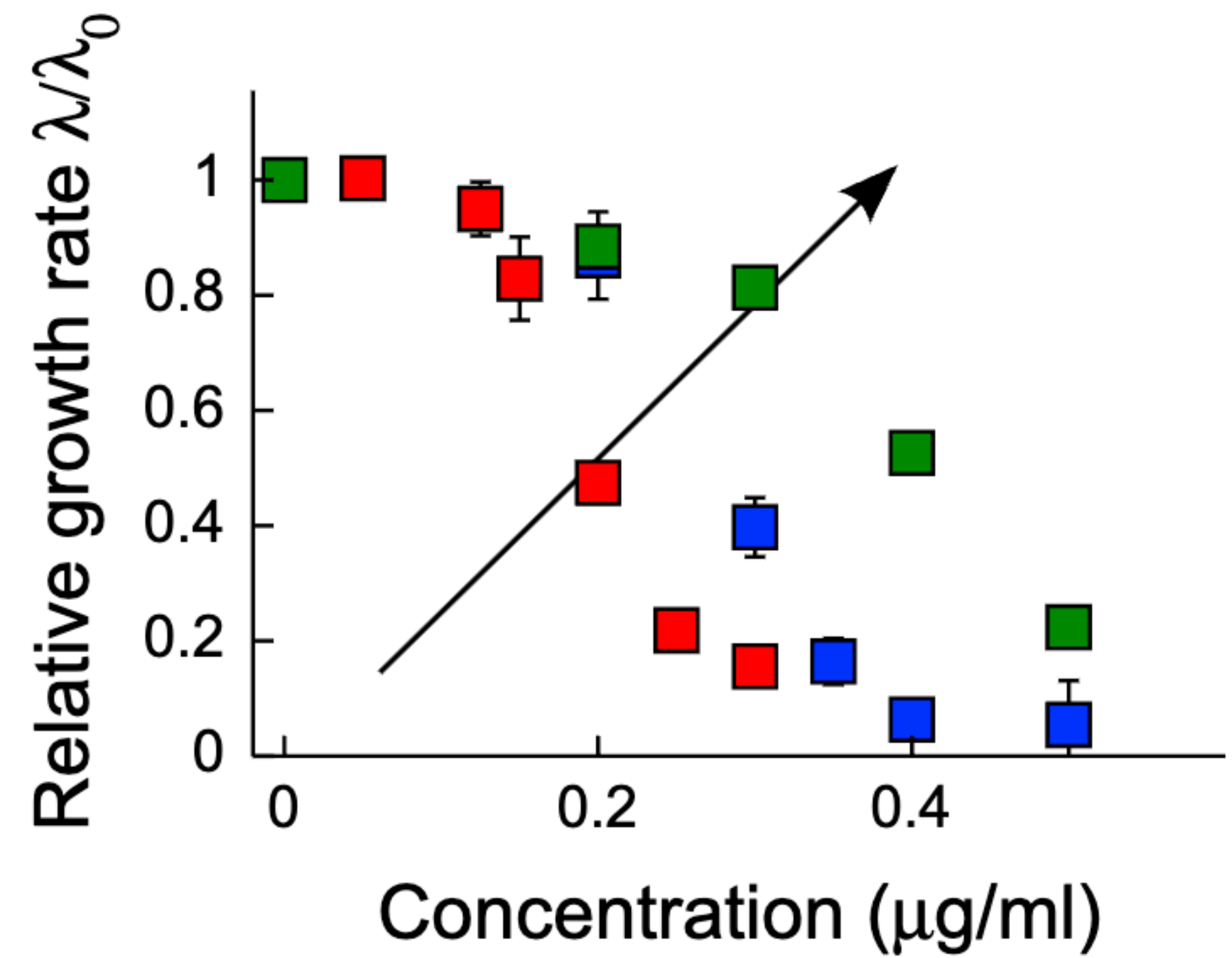


“function”

- % cells alive
- growth rate
- output flux
- ...

Measuring the effect of a drug

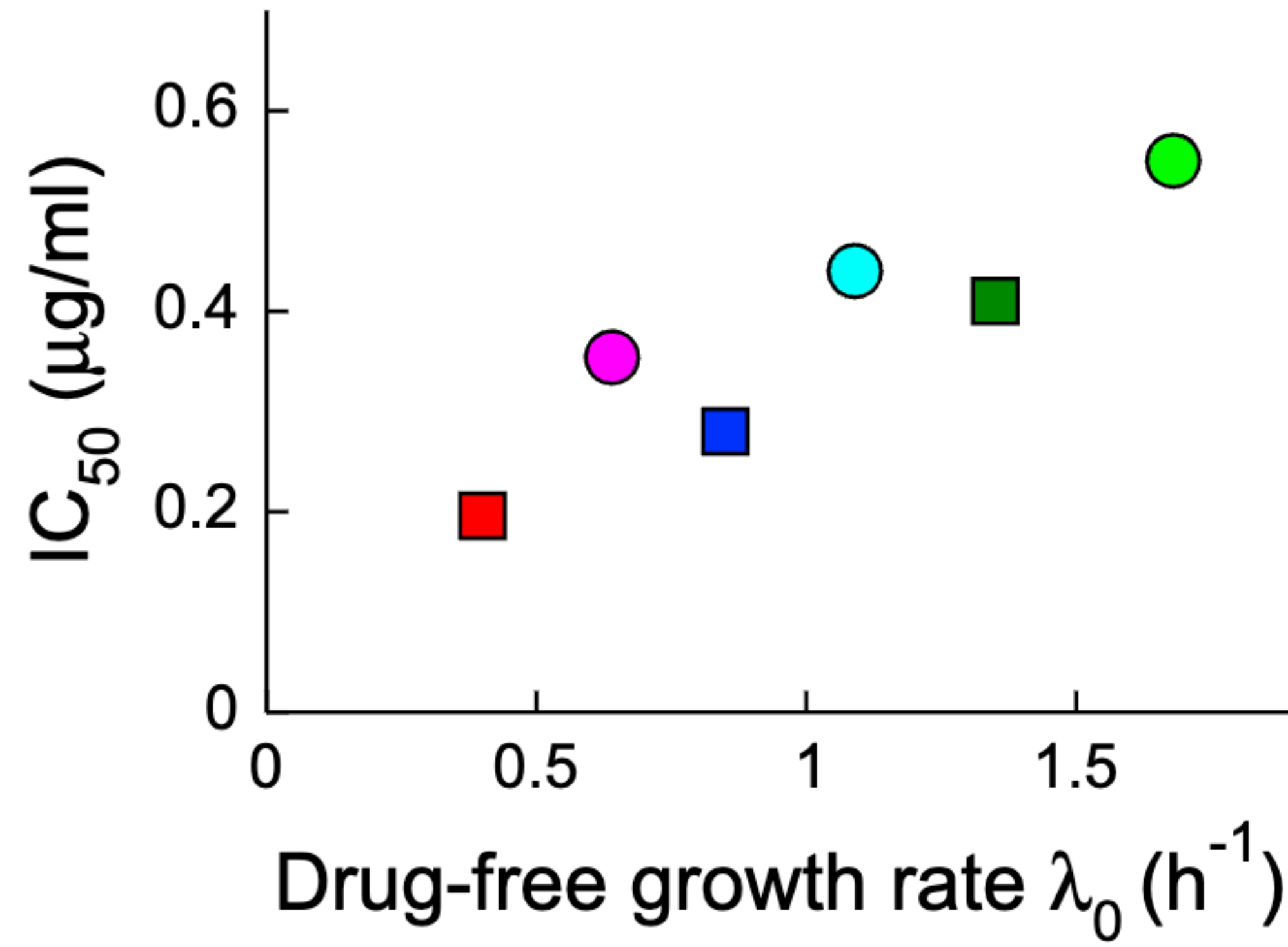
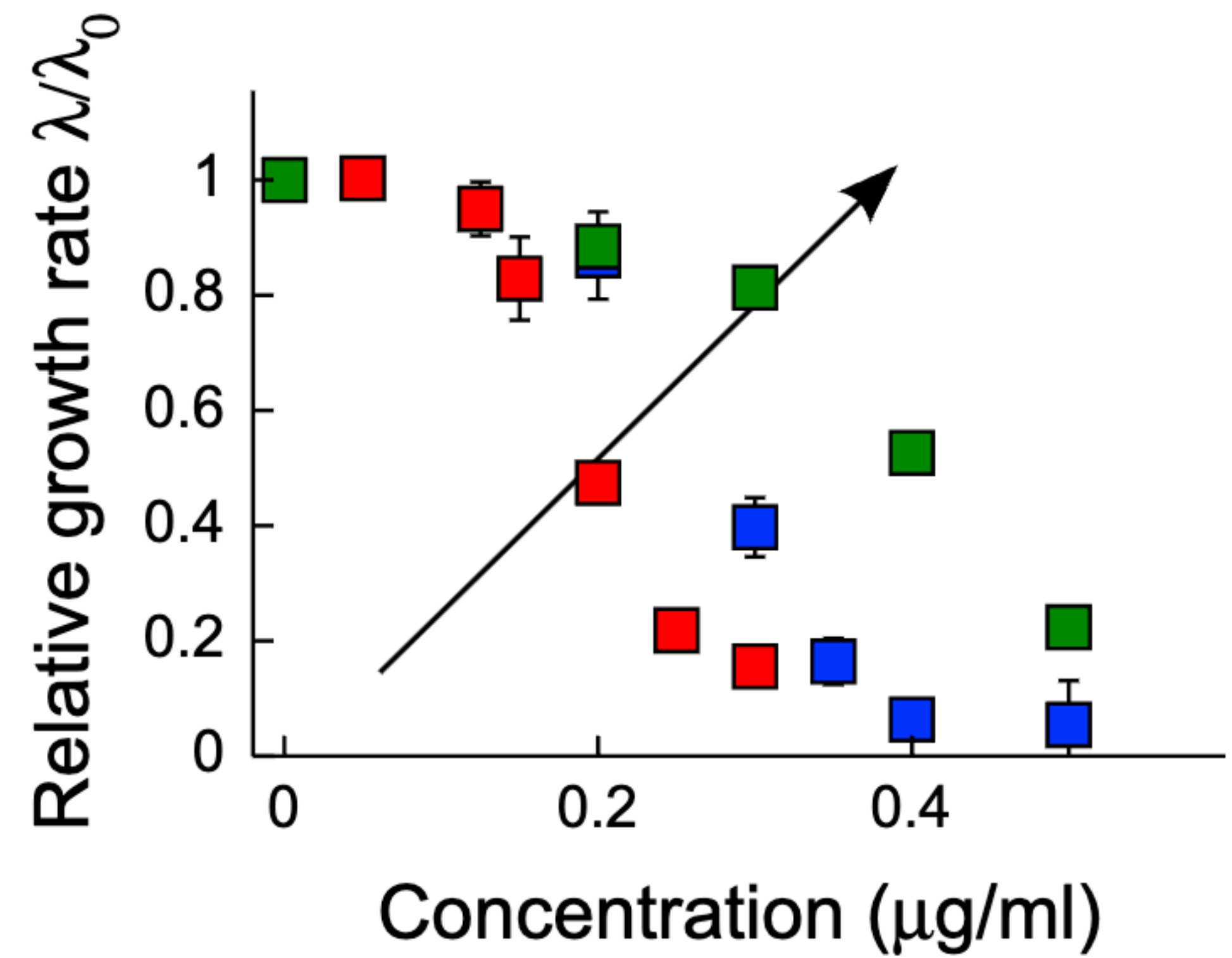
Streptomycin



	Gly	Glu	Gly _{CAA}	Glu _{CAA}	Gly _{RDM}	Glu _{RDM}
λ_0 (/h)	0.40	0.64	0.85	1.09	1.35	1.68

Measuring the effect of a drug

Streptomycin

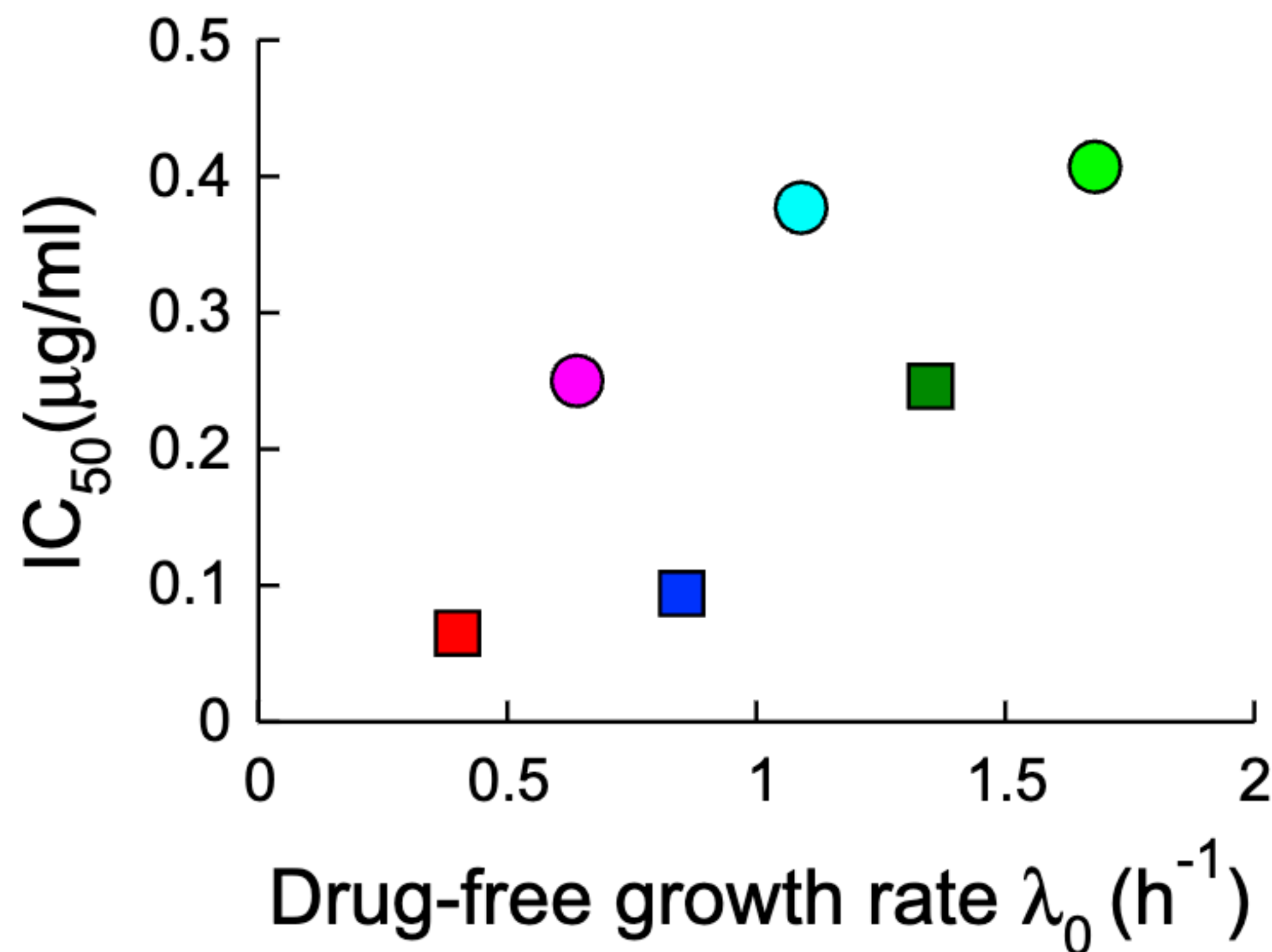
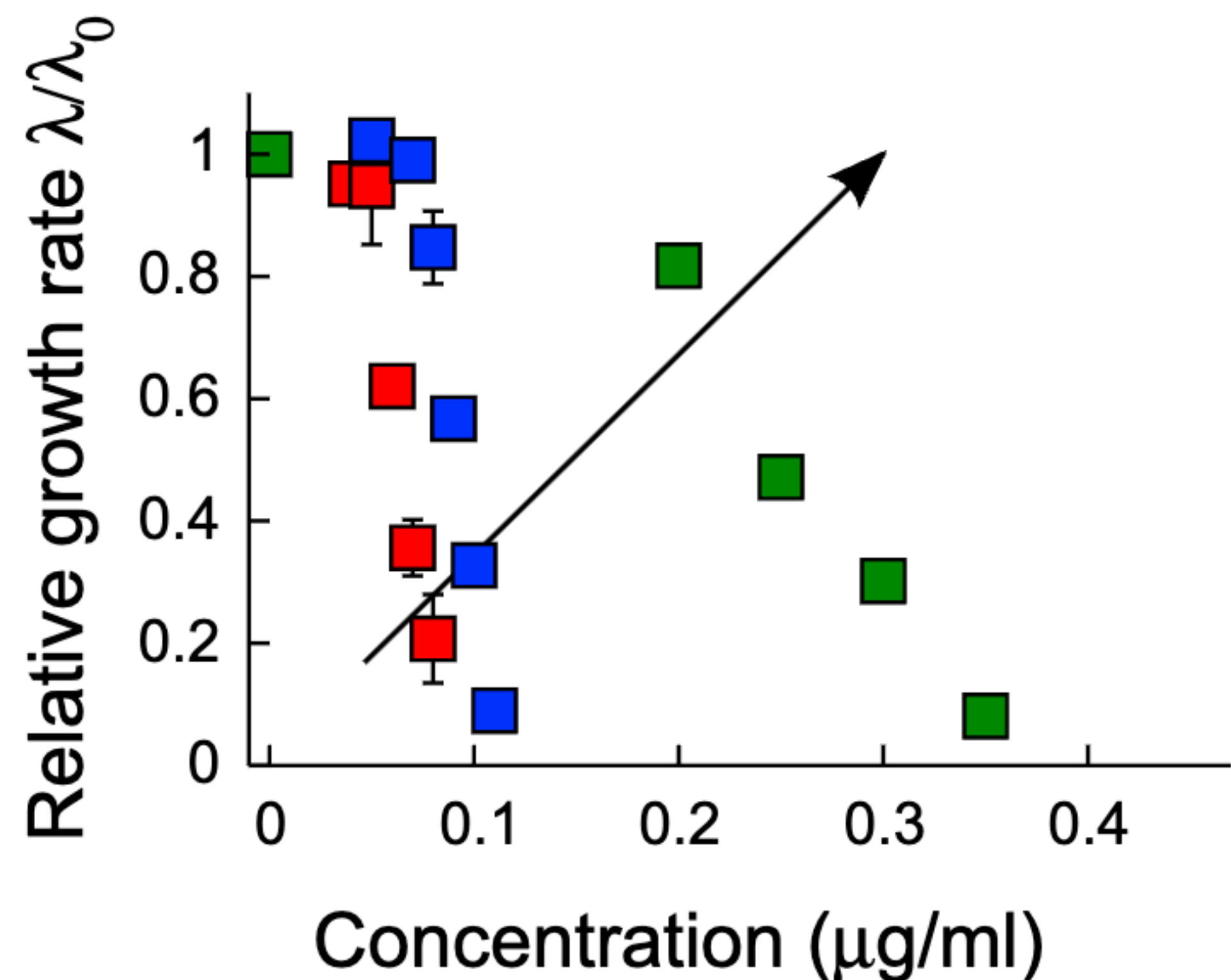


Greulich et. al (2015)

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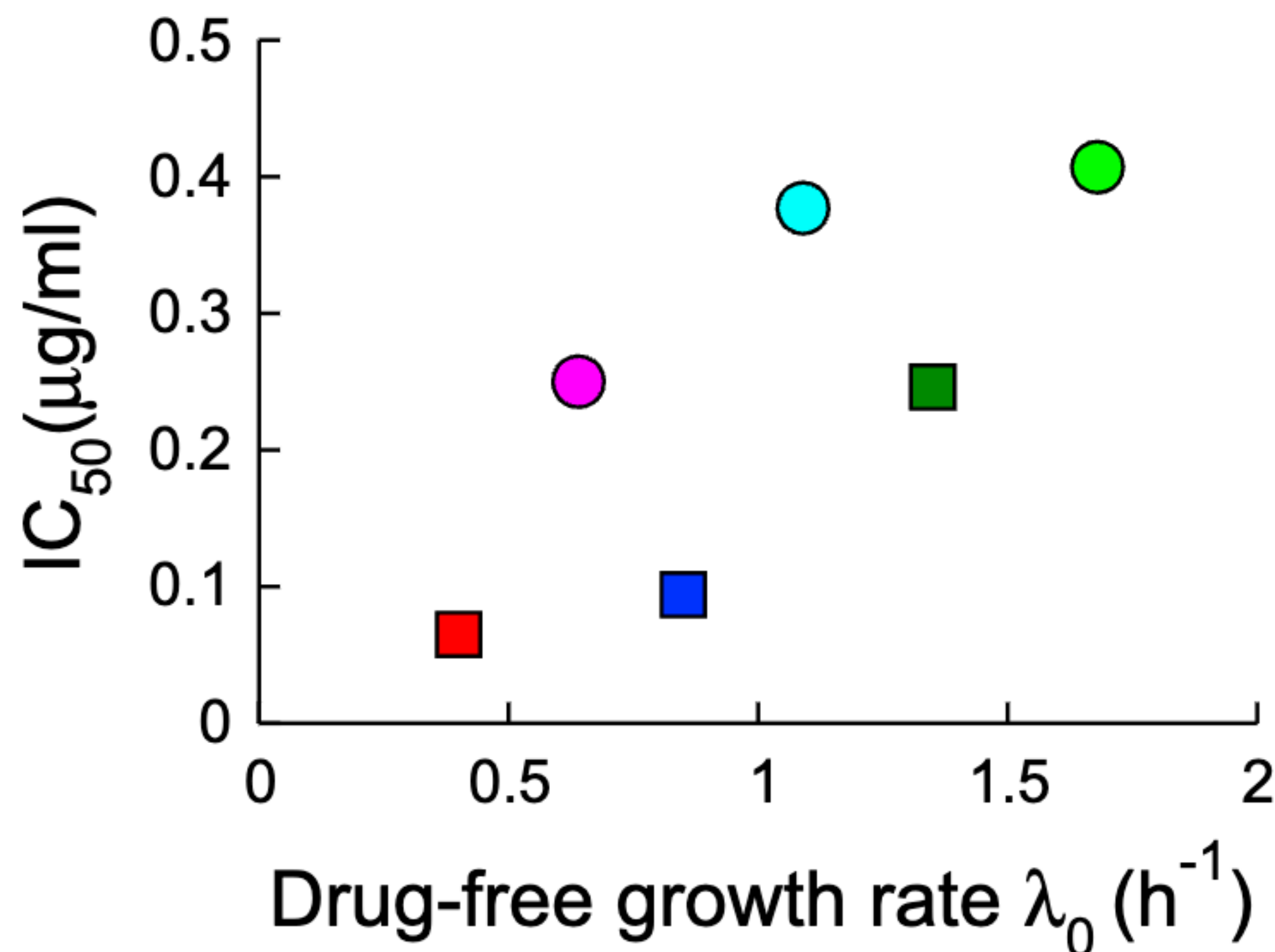
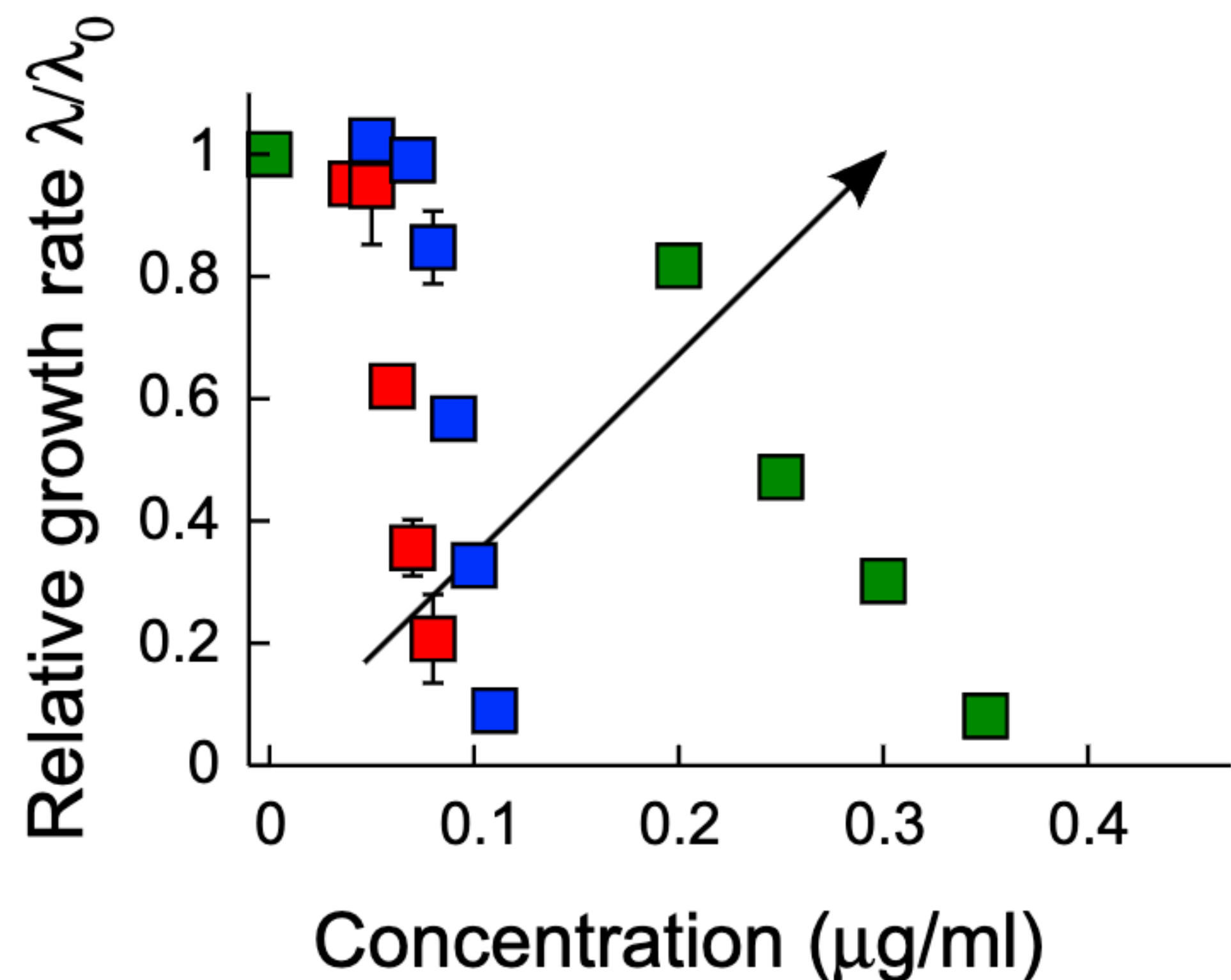
Measuring the effect of a drug

Kanamycin



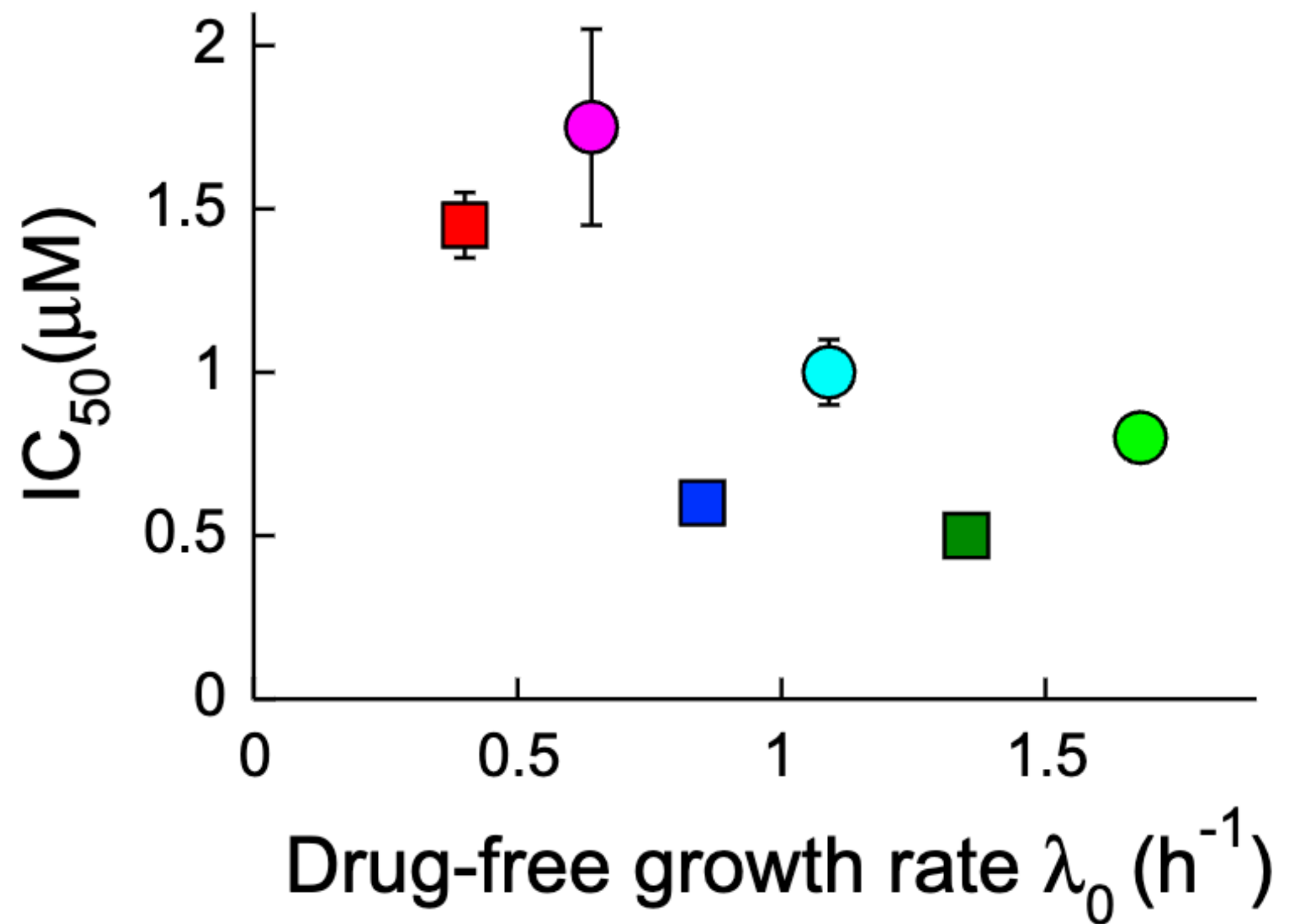
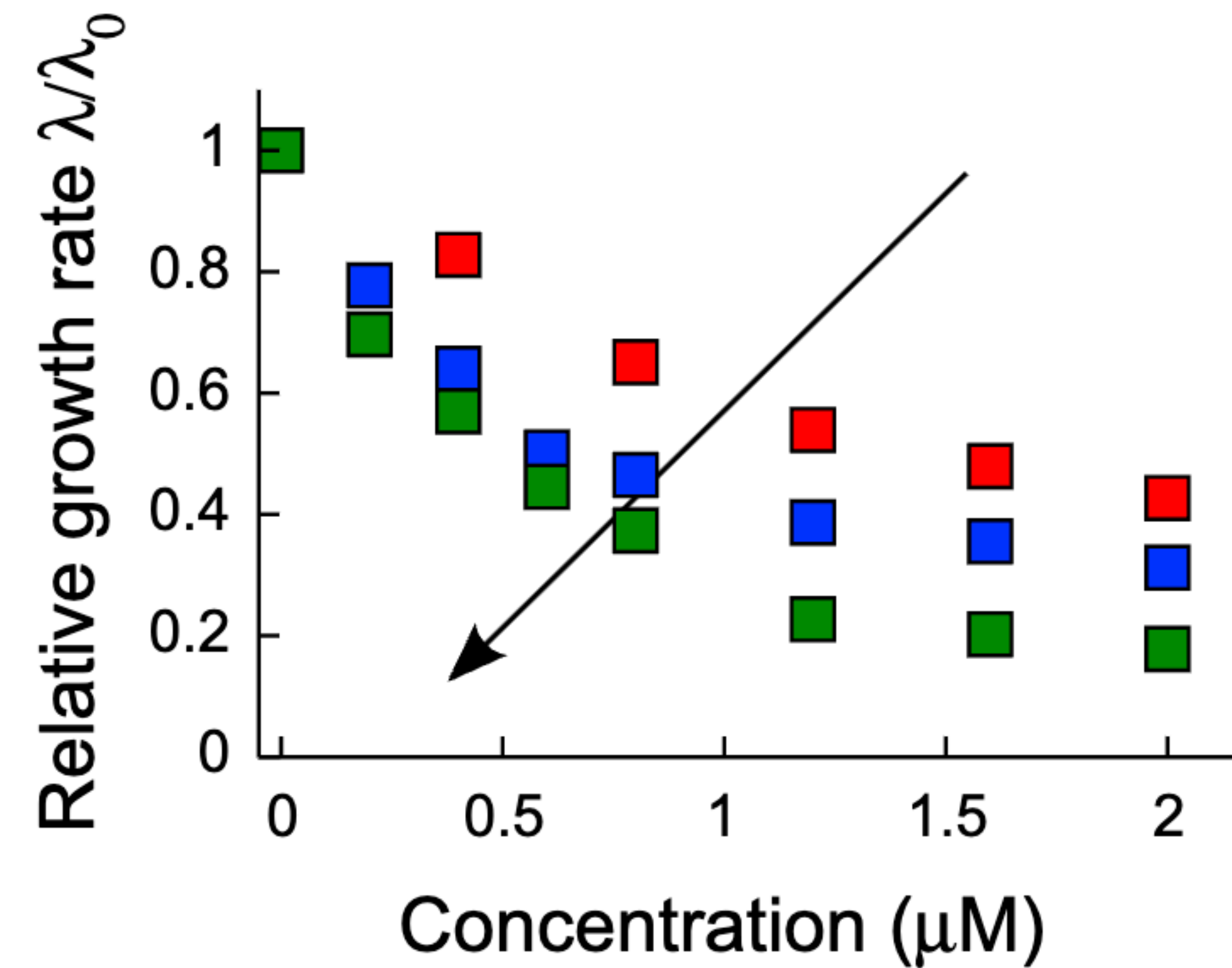
Measuring the effect of a drug

Kanamycin



Measuring the effect of a drug

Tetracyclin

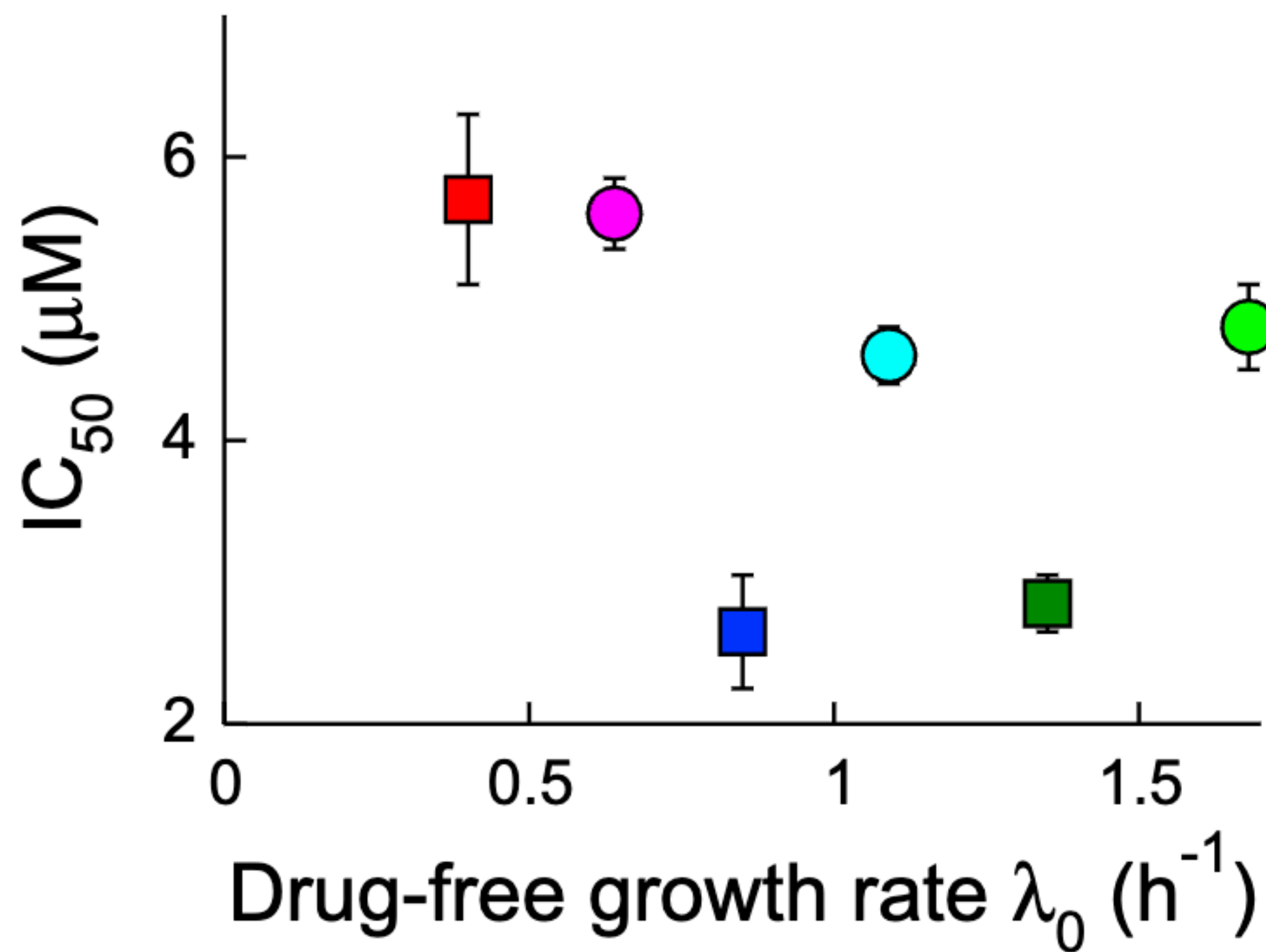
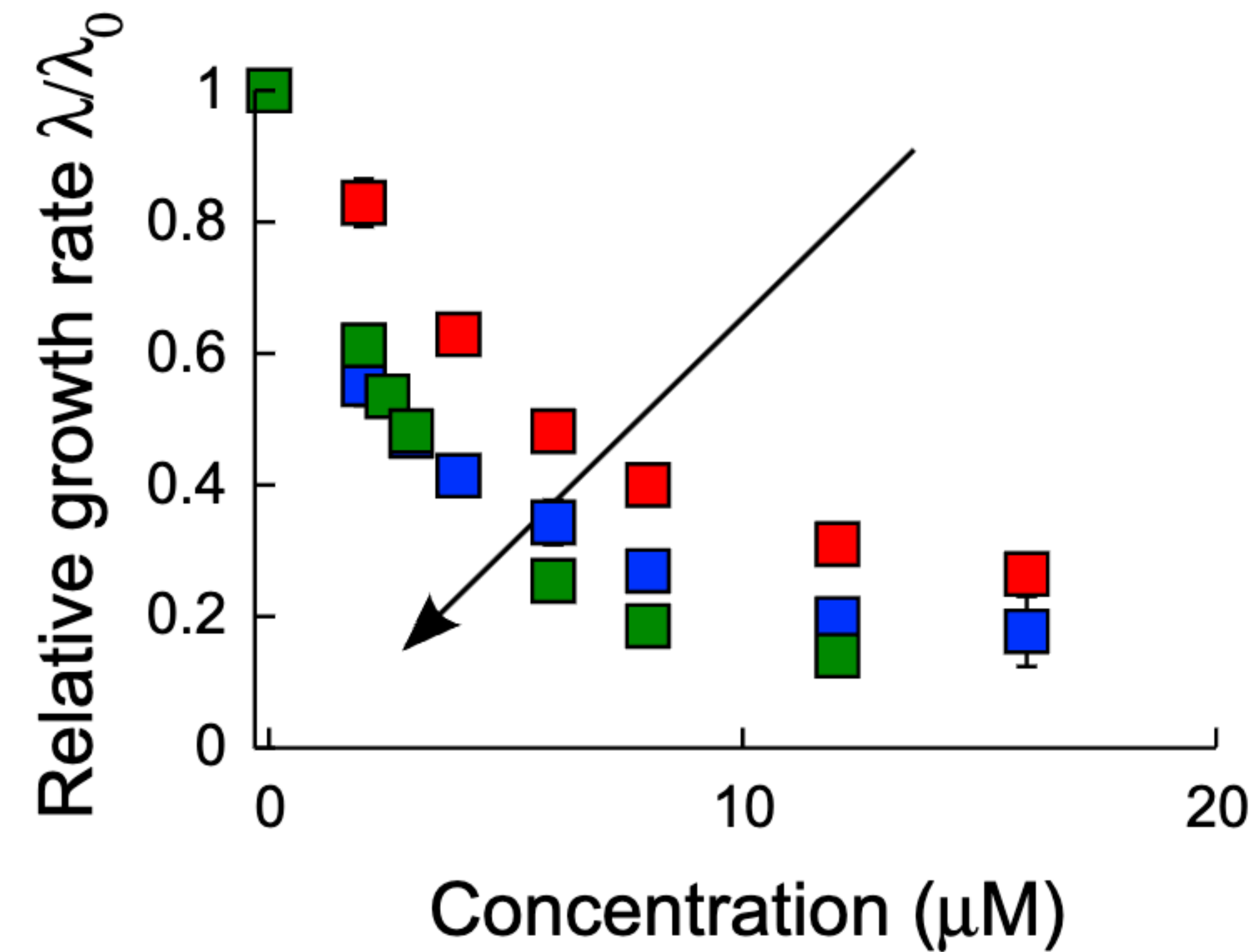


Gly Glu Gly_{CAA} Glu_{CAA} Gly_{RDM} Glu_{RDM}

$\lambda_0 (/h)$ 0.40 0.64 0.85 1.09 1.35 1.68

Measuring the effect of a drug

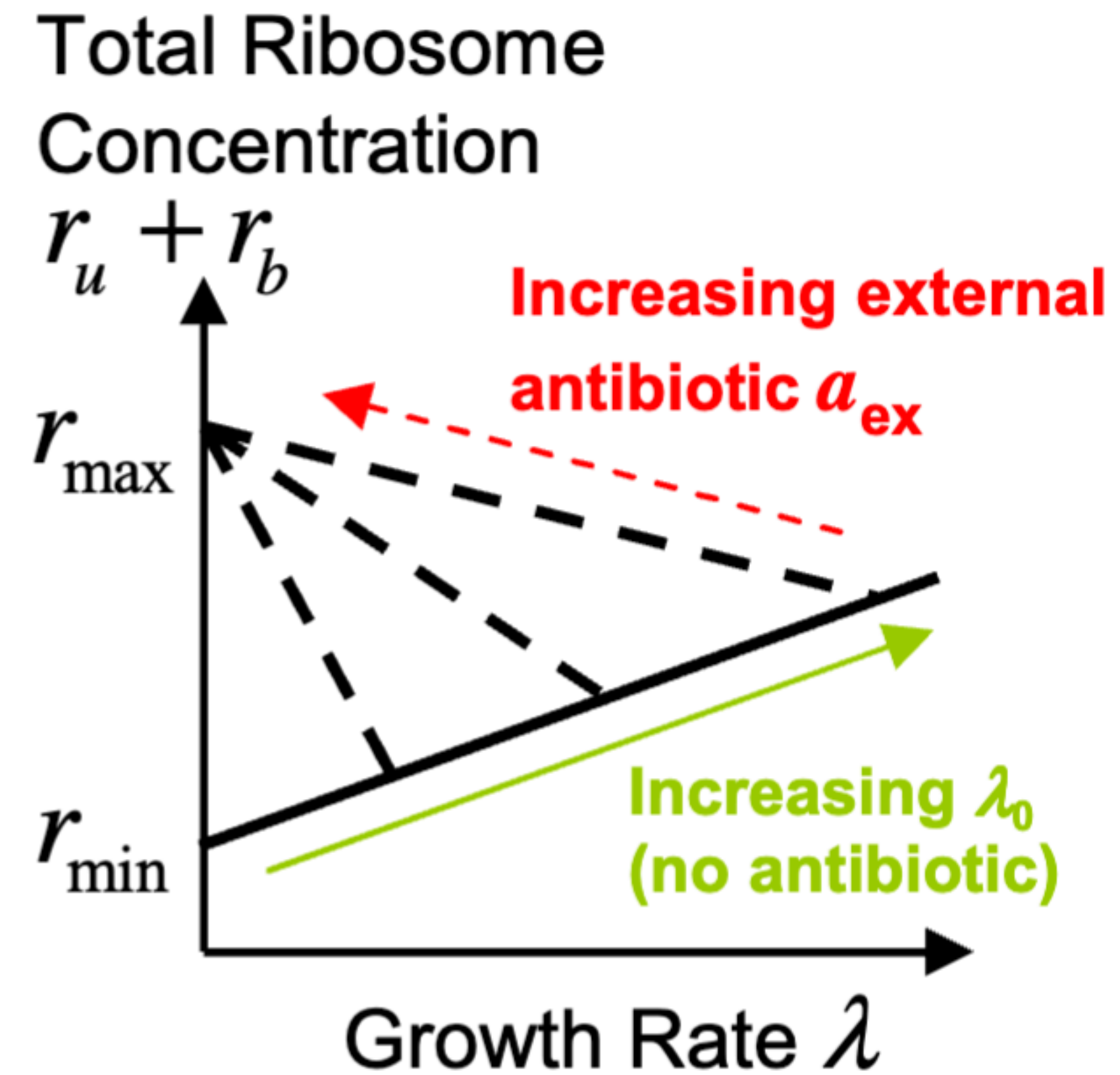
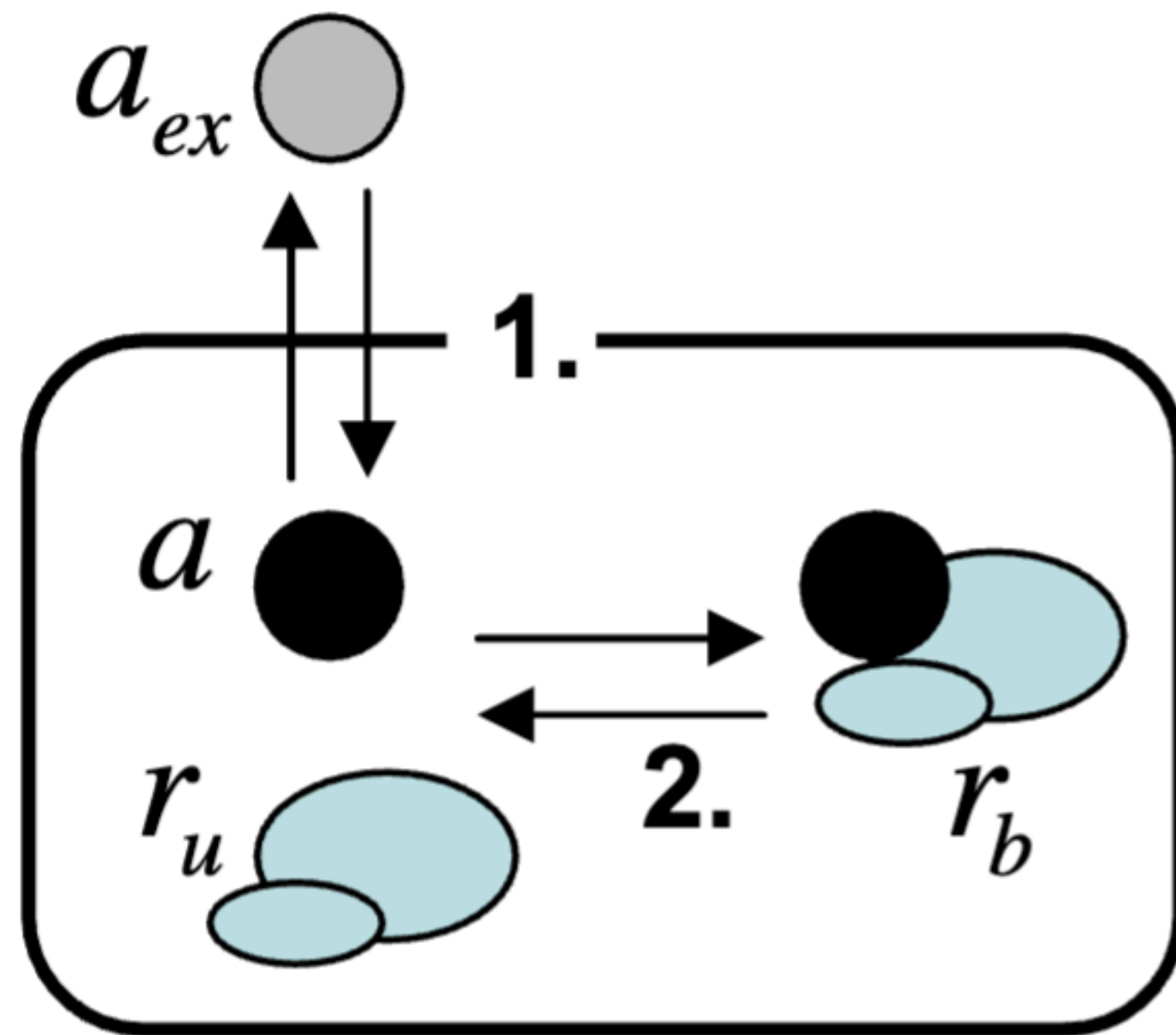
Chloramphenicol



Greulich et. al (2015)

	Gly	Glu	Gly _{CAA}	Glu _{CAA}	Gly _{RDM}	Glu _{RDM}
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Model effect of antibiotics



References

Jun et al., 2018 Rep. Prog. Phys. 81 056601

Brock Biology of Microorganisms

Greulich et al., 2015