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Journal of Theoretical Biology 232 (2005) 71–81
Journal of Theoretical Biology
www.elsevier.com/locate/yjtbi

Network theory and SARS: predicting outbreak diversity

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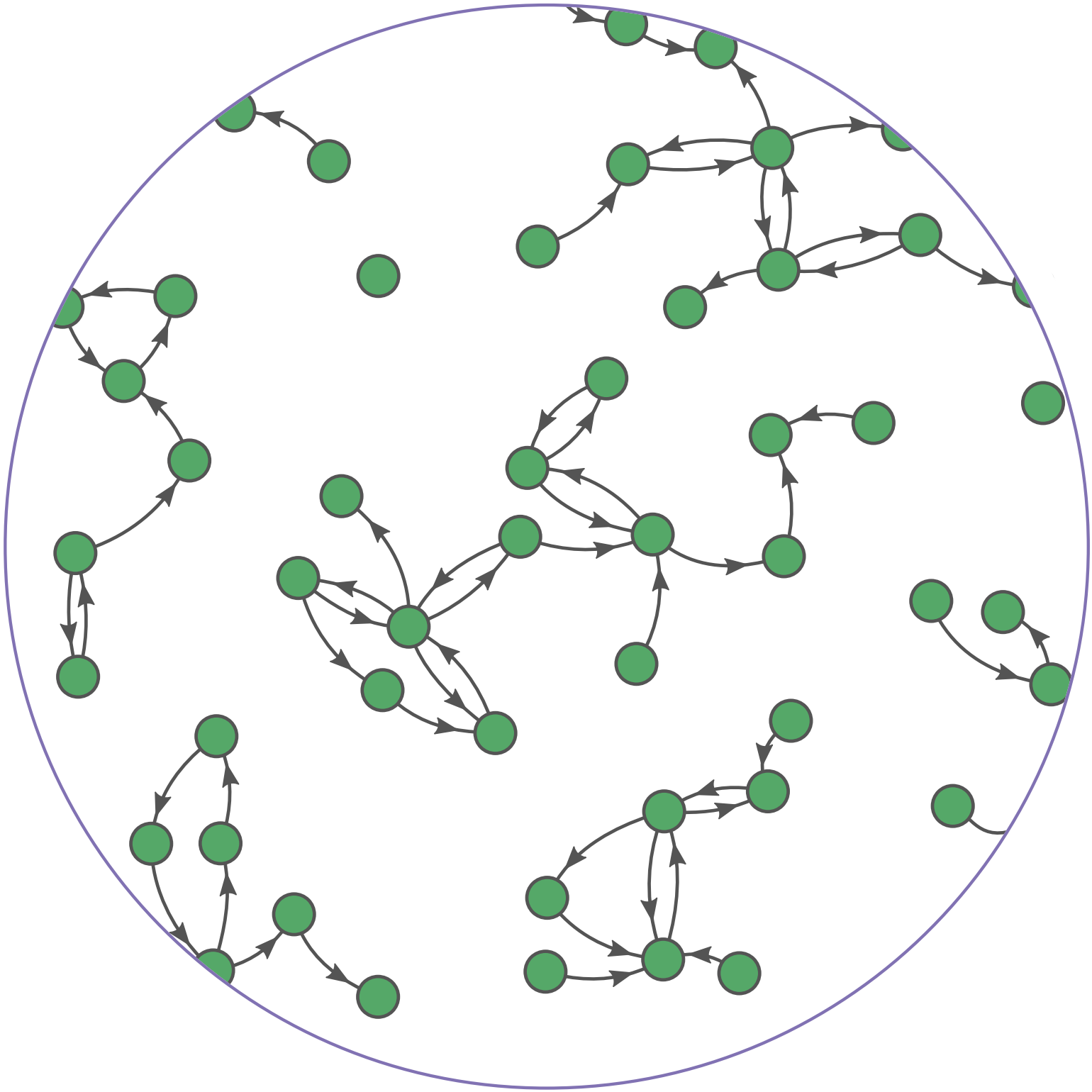

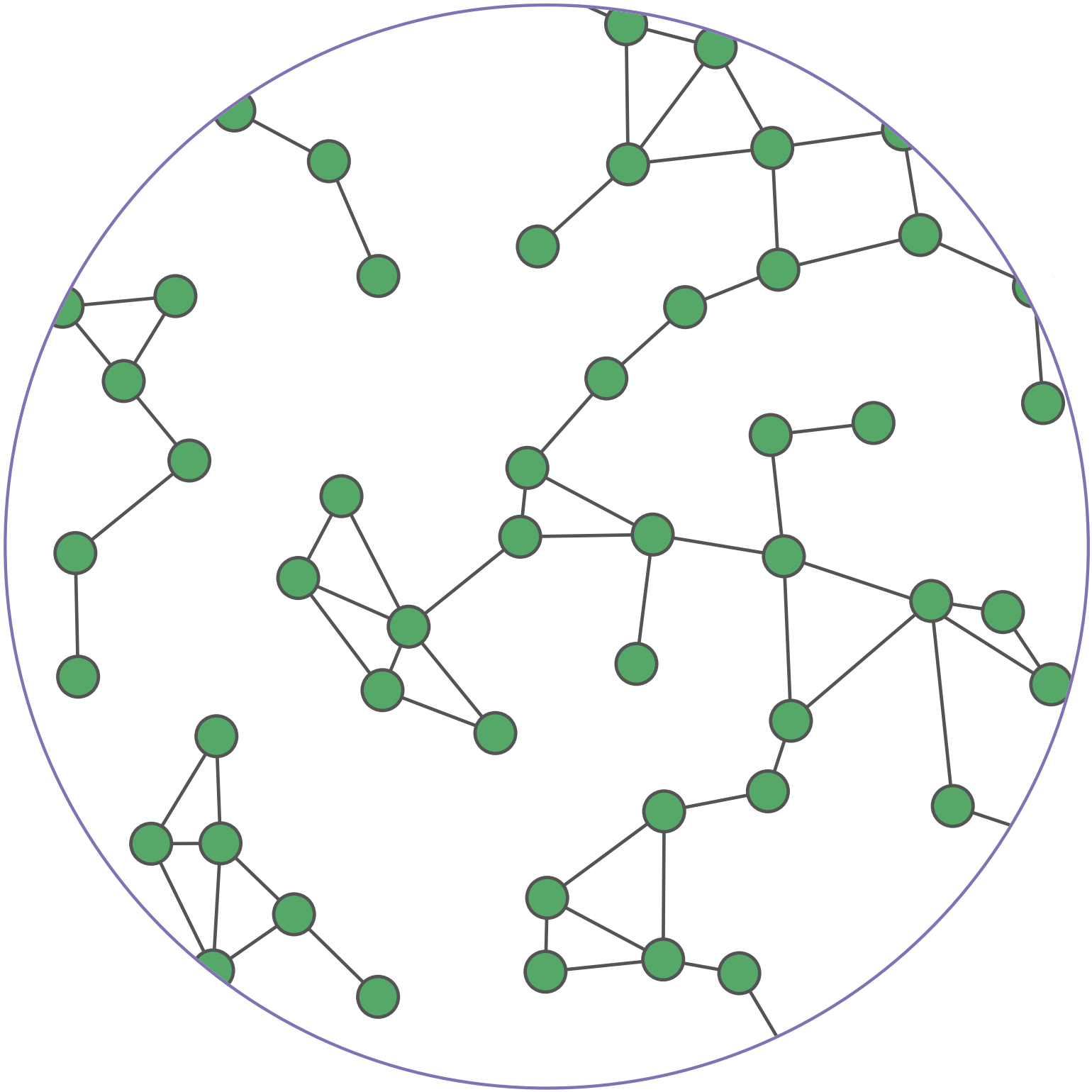

Answer in the form of a question : How correlated are the in- and out-degrees?

1. R_0 depends on the correlation between in-and out-degrees

$$R_0 = \frac{\langle k_{\text{in}} k_{\text{out}} \rangle}{\langle k_{\text{in}} \rangle}$$

2. Expected probability of an epidemic is mainly governed by the *forward* friendship paradox (out-degrees)

3. Expected outbreak size is mainly governed by the *backward* friendship paradox (in-degrees)

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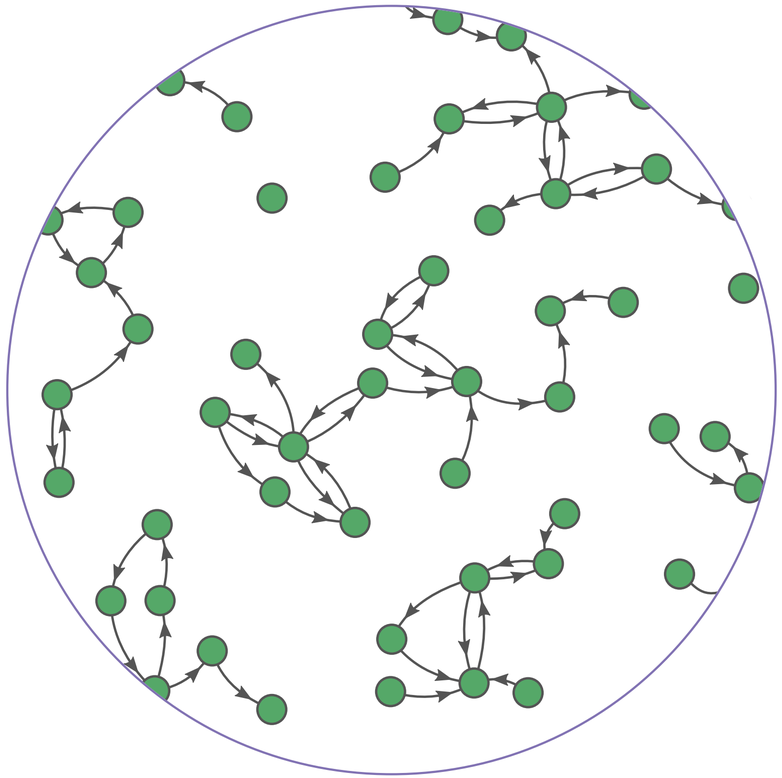

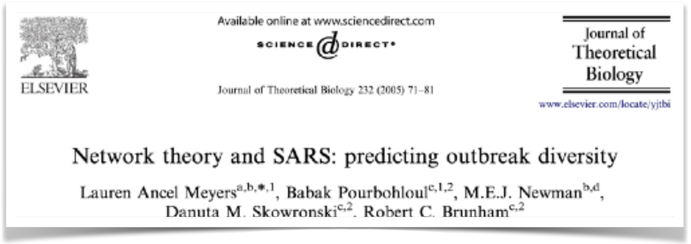

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Message #1 : distinction between “risk” and “spread”

- risk : contacts through which an individual can become infected (in-degree)
- spread : number of potential secondary infections if infected (out-degree)
- correlation between risk and spread greatly affects the likelihood of an epidemic as well as its size