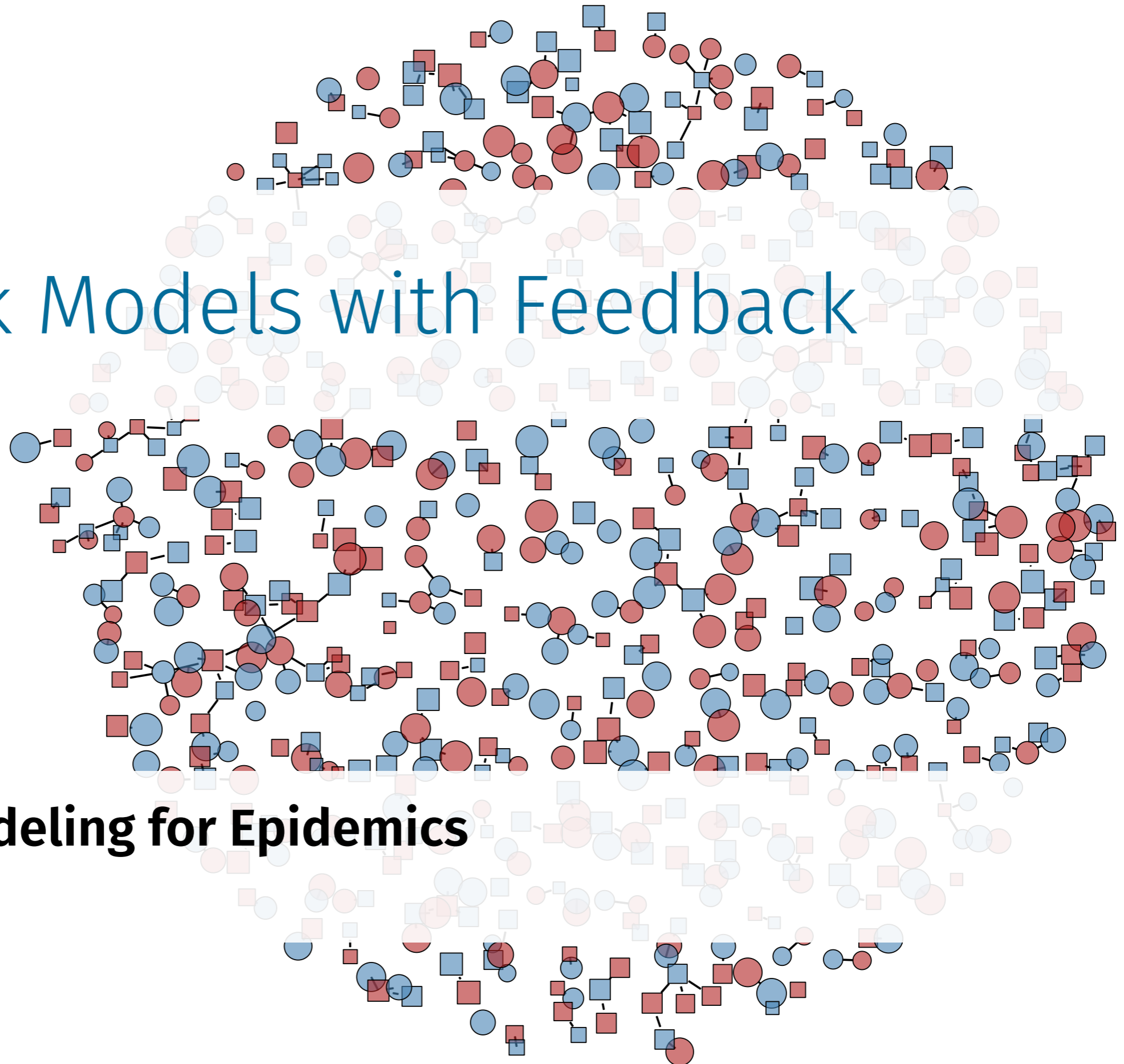


Network Models with Feedback

Network Modeling for Epidemics

Day 4



Outline for Rest of Week

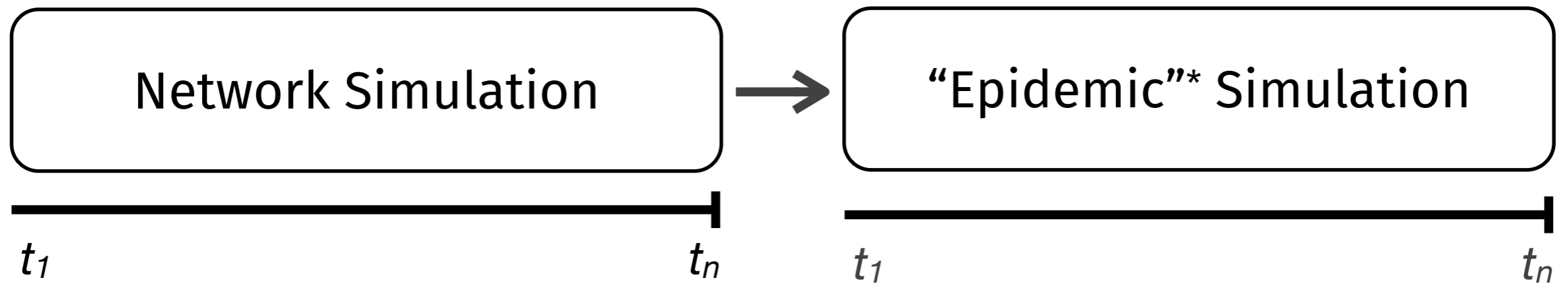
- Wednesday
 - Modeling epidemics + networks = modeling epidemics over networks
 - Core assumption: no feedback of epidemiology on networks
 - One important implication: closed populations
 - Still feedback: *network structure* \implies *epidemiology* and *incidence* \implies *prevalence*
 - Built-in **epidemiology** types (SI, SIR, SIS)
 - Working with nodal attributes, with heterogeneity in network structure and epidemiological parameters
- Thursday
 - Feedback: epidemiology \implies network structure
 - Vital dynamics, “sero-sorting” (edge formation based on changing nodal attributes)
 - Simple vaccine intervention
 - Built-in **epidemiology** types (SI, SIR, SIS), then getting started with extensions
- Friday
 - Getting comfortable with extensions
 - Building a network-based extension model for COVID, step-by-step...

Causes of Model Feedback

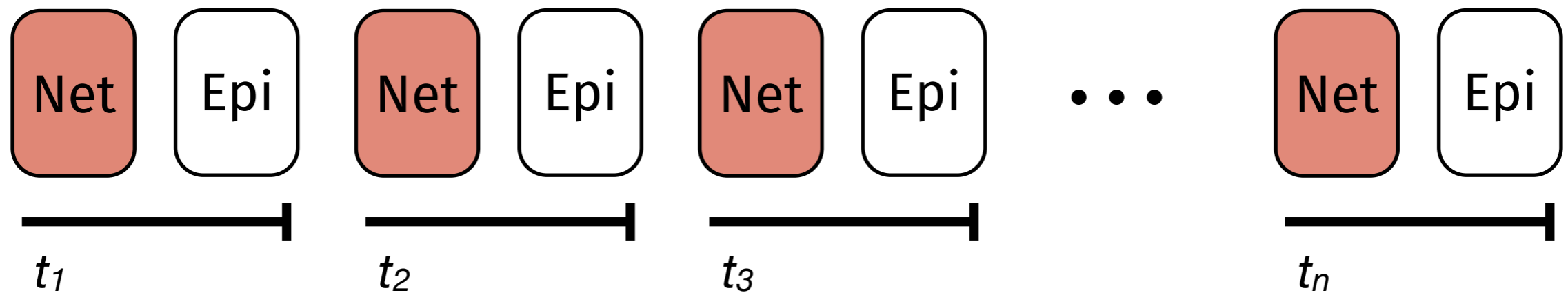
- Changes to the node set
 - Demographic churn (birth, death, migration)
 - Deaths and out-migration result in inactive nodes, which also dissolve edges
 - Births and in-migration result in newly active nodes, open for new edges
 - Sometimes, entry and exit from the epidemic-relevant network means something other than birth and death
 - e.g., initiation and cessation of sexual activity
 - We use the terms arrival and departure accordingly
- Changes to nodal attributes
 - Simulating from an ERGM involves evaluating current nodal attributes reference in formula
 - e.g., preferential mixing on age and disease status with `absdiff` and `nodematch` terms
 - These attributes may change over time, in different ways
- Broader temporal shifts in behavior or biology
 - Monotonic increases in sexual partnership rates
 - Social distancing!

Model Feedback

Models without Feedback

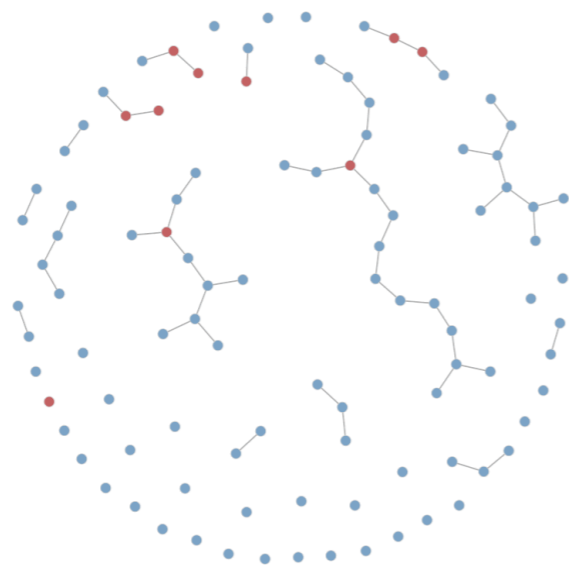


Models with Feedback



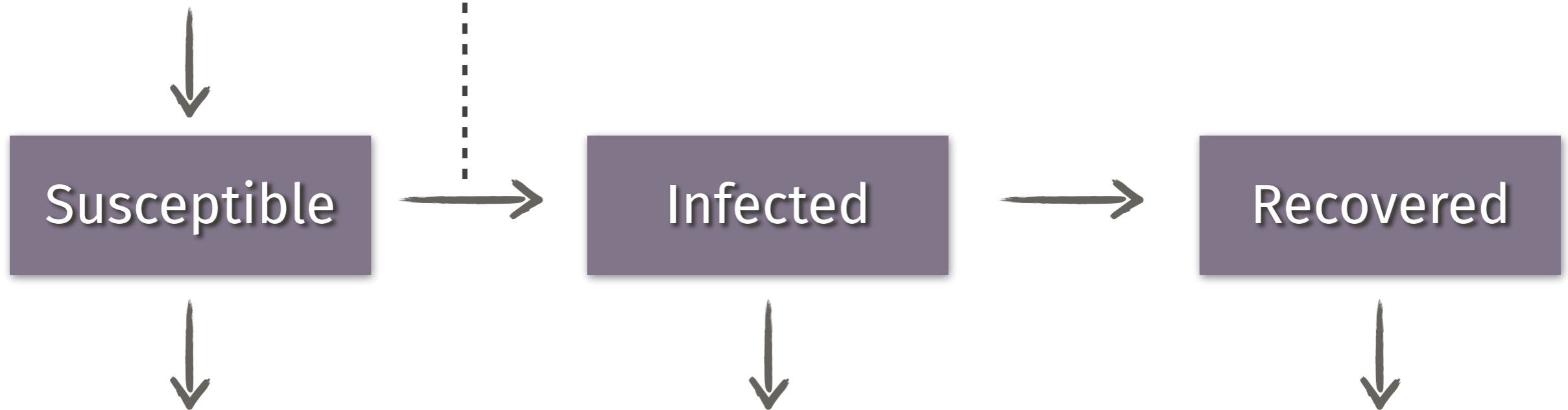
"Epidemic"* = biological, behavioral, demographic, etc., changes

“Built-in Epidemiology”

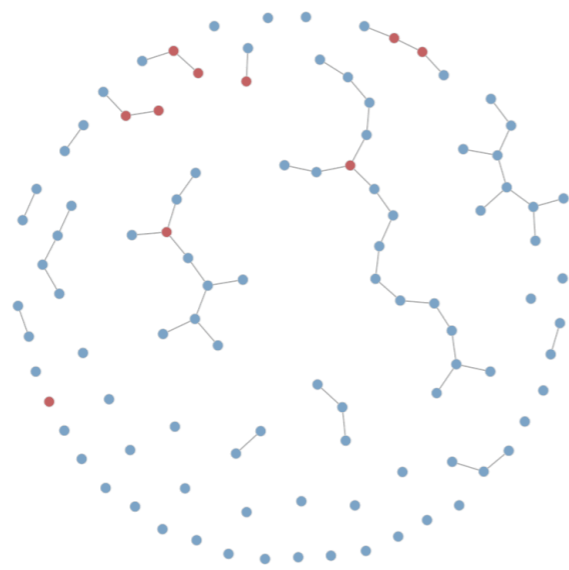


Fixed
Basic structure of states and flows

Modifiable
Epidemic parameters
Dynamic network structure

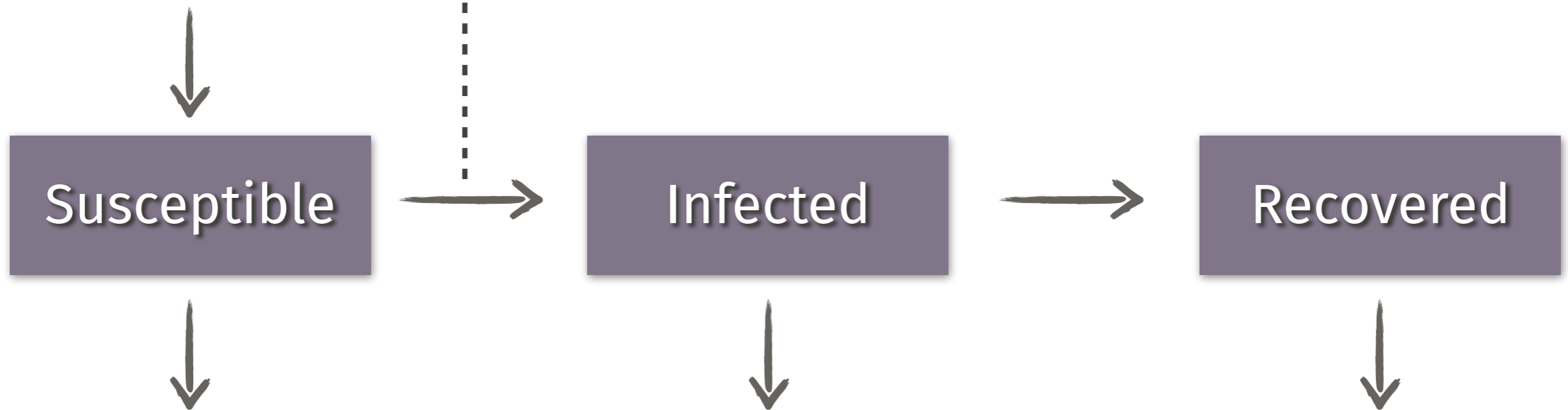


EpiModel Extensions

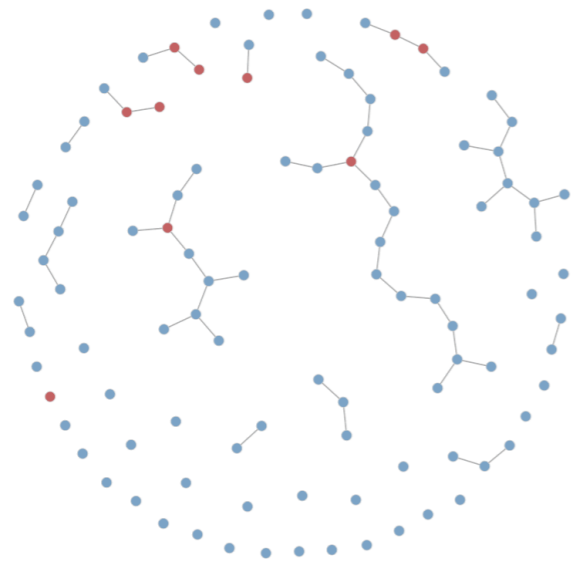


Modifiable
Basic structure of states and flows

Modifiable
Epidemic parameters
Dynamic network structure

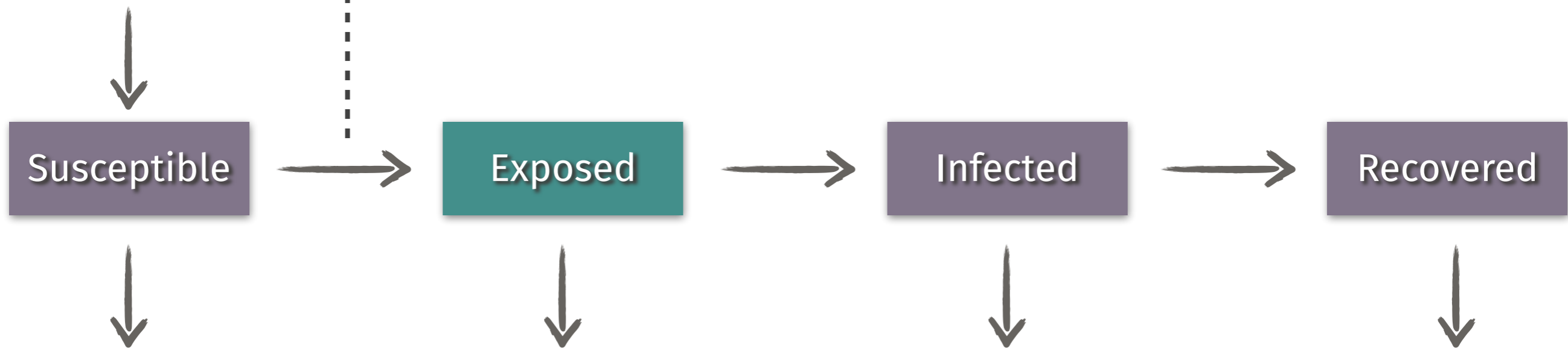


EpiModel Extensions



Modifiable
Basic structure of states and flows

Modifiable
Epidemic parameters
Dynamic network structure



Schedule for Thursday

(approximate)

Session	Type	Title	Start (PST)	End (PST)
0	Disc		8:00	8:15
D3S8	Tut/Lab	Dynamic network viz	8:15	8:45
1	Lec	Overview of D4	8:45	8:55
2	Lec	Dynamic Nets with Feedback	8:55	9:25
		break	9:25	9:35
3	Tut	Epi Models with Demography	9:35	10:05
4	Lab	Adding Demo	10:05	11:00
		lunch	11:00	12:00
5	Tut	Feedback Serosort	12:00	12:30
6	Tut	Simple Vax	12:30	12:45
7	Lab	Putting it Together	12:45	1:45
		break	1:45	1:55
8	Lec	Epi Model Extensions	1:55	2:10
9	Tut	Building an SEIR	2:10	3:00
10	HW	Practice with SEIR		