

# Brain Network

**Students:** Davide Bazzani, Daven Speranza

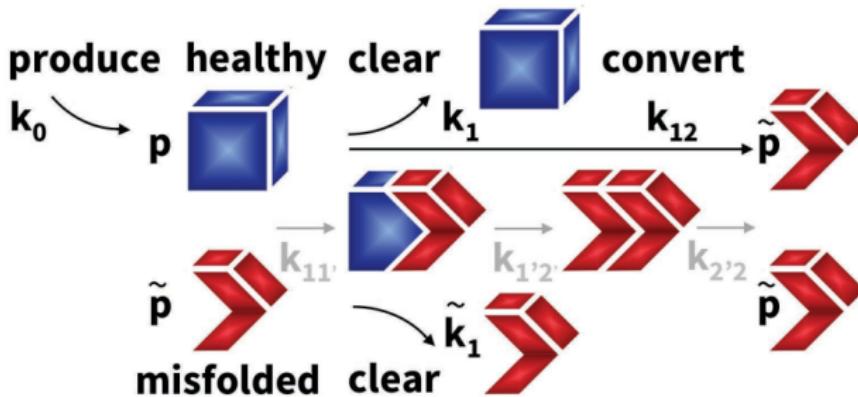


## Modelli in letteratura

## Modello Eterodimero:

$$\frac{\partial p}{\partial t} = \nabla \cdot (\mathbf{D}_p \nabla p) + k_0 - k_1 p - k_{12} p \tilde{p},$$

$$\frac{\partial \tilde{p}}{\partial t} = \nabla \cdot (\mathbf{D} \nabla \tilde{p}) + k_1 \tilde{p} + k_{12} p \tilde{p}.$$

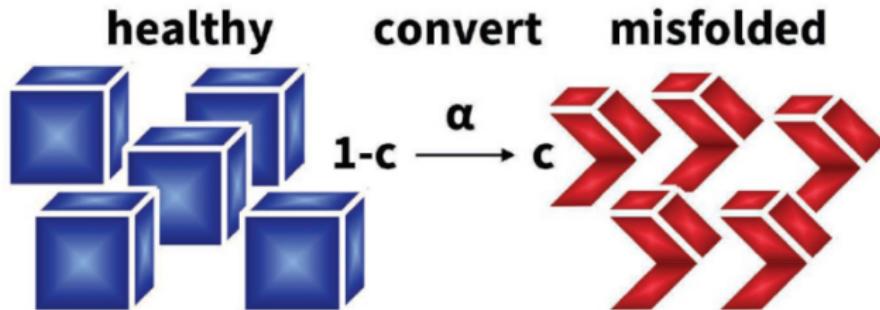


# Modelli in letteratura

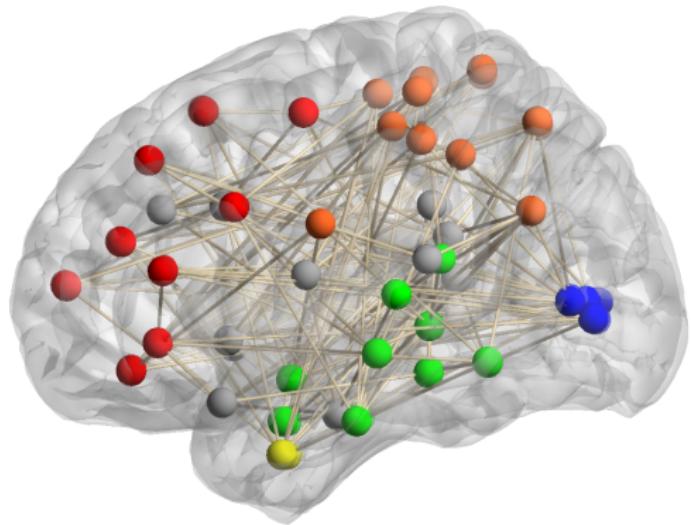
## Modello Fischer-Kolmogorov:

sarebbe il *fast-reaction limit* del modello Eterodimero (assumo la formazione di eterodimeri istantanea)

$$\frac{\partial c}{\partial t} = \nabla \cdot (\mathbf{D} \nabla c) + \alpha c (1 - c)$$



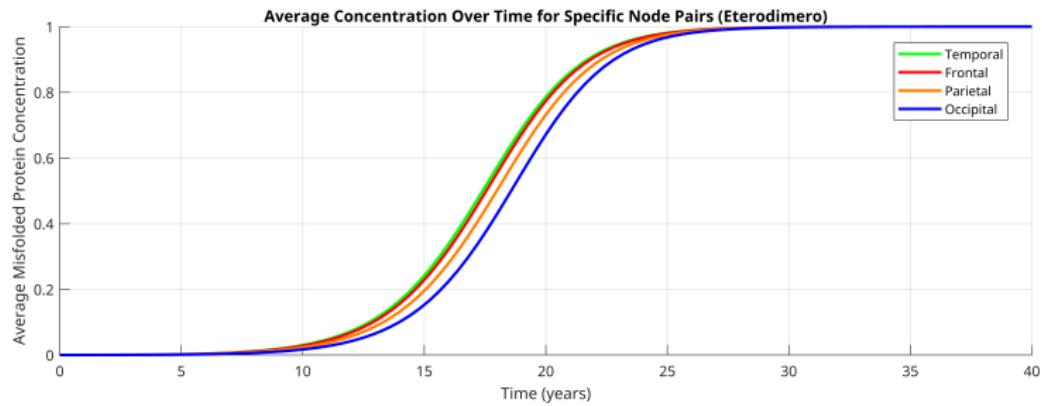
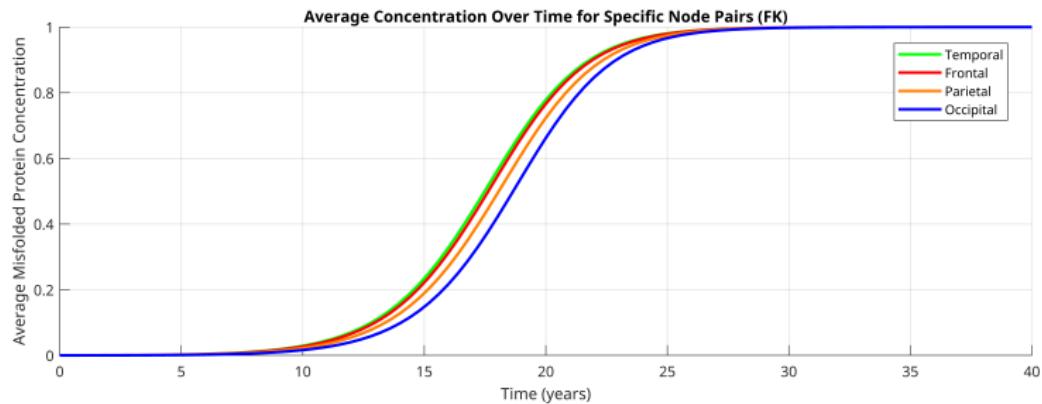
# Brain Network

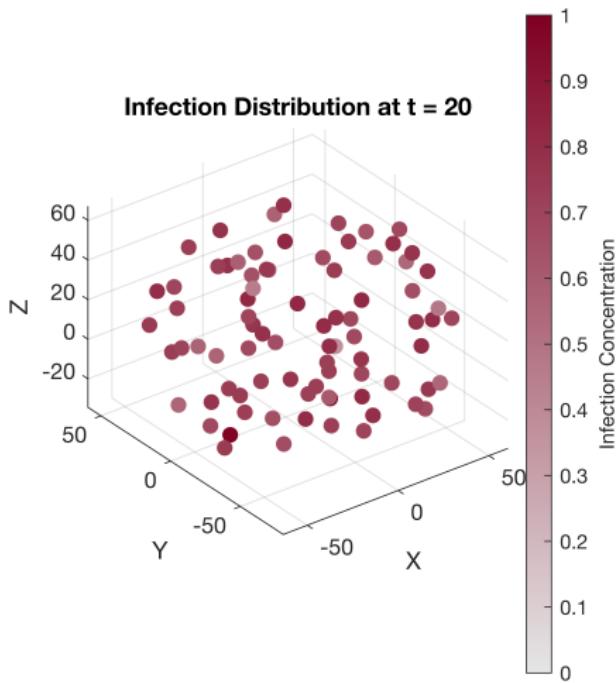
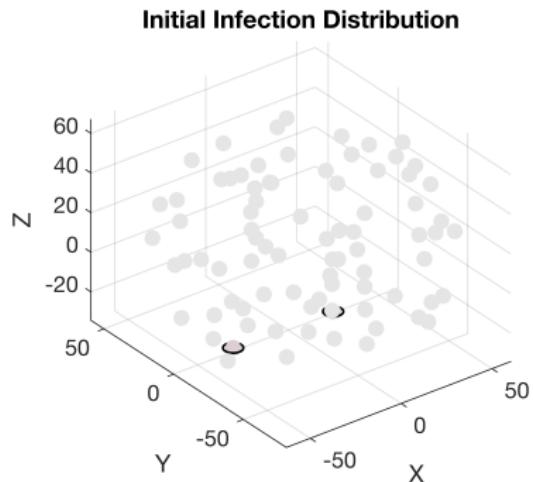


Legenda regioni cerebrali	
Regione Temporale	Green
Regione Frontale	Red
Regione Parietale	Orange
Regione Occipitale	Blue
Regione Entorinale	Yellow
Altre regioni	Grey

Gli archi mostrati rappresentano solo le connessioni il cui peso è superiore a 0.95.







# Modello di propagazione soggetta all'invecchiamento

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**Algorithm 1:** Modello di aging

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**Input:**  $A$ ,  $\rho = 0.2$ ,  $\Delta t = 0.4$ ,  $T = 40$  anni

**for**  $t = 0 : \Delta t : T$  **do**

$E \leftarrow \{(i,j) \mid A_{ij} > 0\};$

$M \leftarrow \lceil 0.8 |E| \rceil;$

$m \sim \text{UniformInt}(0, M);$

$S \leftarrow \text{random subset of } E \text{ of size } m;$

**foreach**  $(i,j) \in S$  **do**

$A_{ij} \leftarrow \rho A_{ij};$

$A_{ji} \leftarrow \rho A_{ji};$

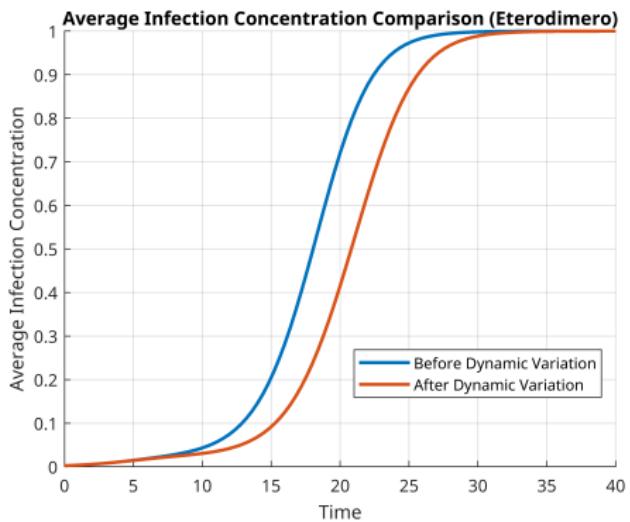
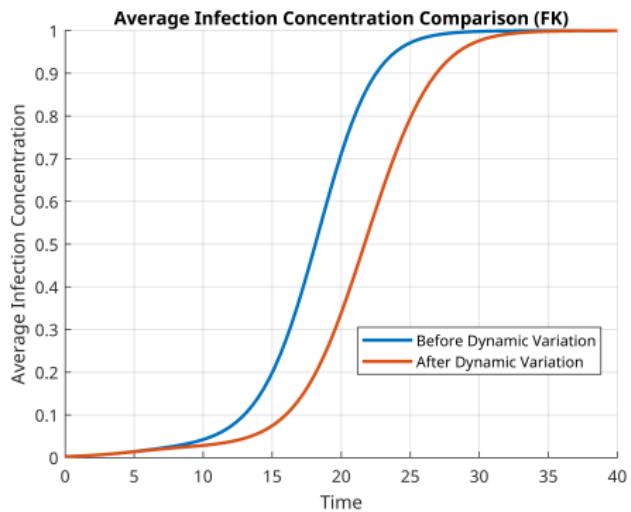
**end**

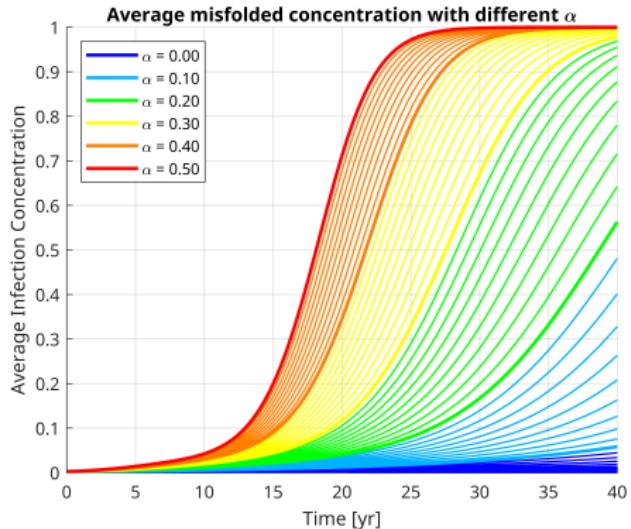
    Aggiorna  $L$  e applica Forward–Euler del modello;

**end**

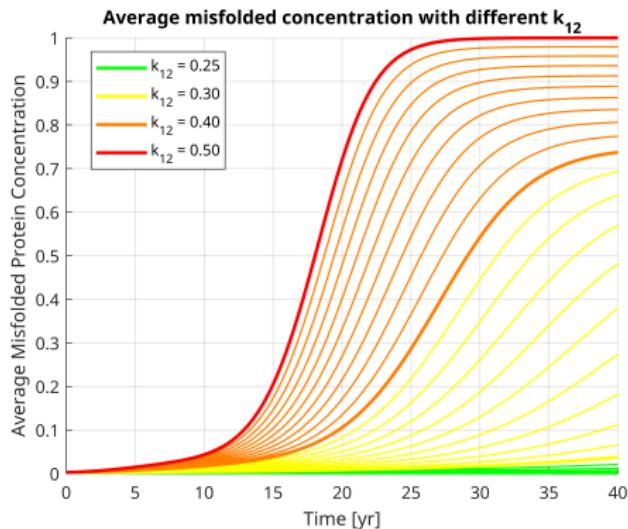


# Simulazione di propagazione soggetta all'invecchiamento





**Modello FK:** andamento della concentrazione media per diversi valori del parametro di crescita  $\alpha$ .



**Modello eterodimero:** andamento della concentrazione media per diversi valori del parametro di conversione  $k_{12}$ .



# Modello di cura (post- $t_{\text{switch}}$ )

## Algorithm 2: Modello di trattamento

**Input:**  $A$ ,  $\rho = 0.2$ ,  $\Delta t = 1$ ,  $T = 40$  anni,  $t_{\text{switch}}$ ,  $\theta = \{\alpha, k_{12}\}$

**for**  $t = t_{\text{switch}} : \Delta t : T$  **do**

$E \leftarrow \{(i, j) \mid A_{ij} > 0\};$

$\min M \leftarrow \lfloor 0.2 |E| \rfloor;$

$\max M \leftarrow \lceil 0.5 |E| \rceil;$

$m \sim \text{UniformInt}(\min M, \max M);$

$S \leftarrow \text{random subset of } E \text{ of size } m;$

**foreach**  $(i, j) \in S$  **do**

$A_{ij} \leftarrow \rho A_{ij};$

$A_{ji} \leftarrow \rho A_{ji};$

**end**

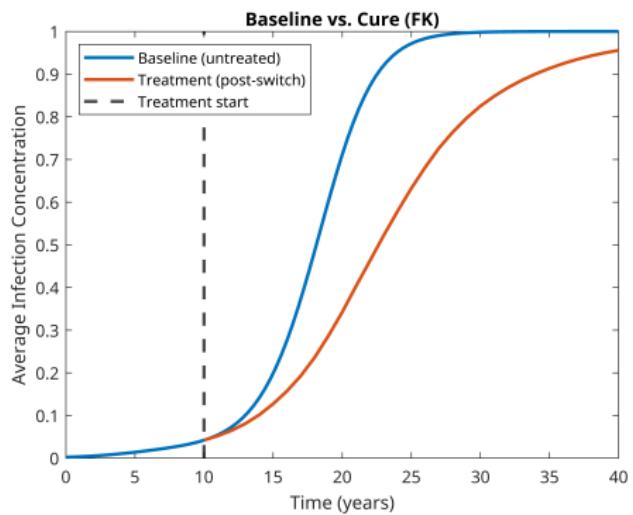
$\theta \leftarrow \theta \times \mathcal{U}(0.9, 1);$

Aggiorna  $L$  e applica Forward–Euler del modello;

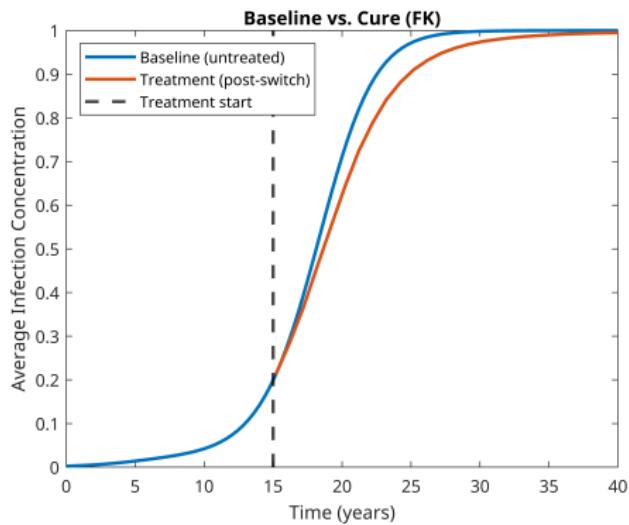
**end**



# Caso di cura (FK)



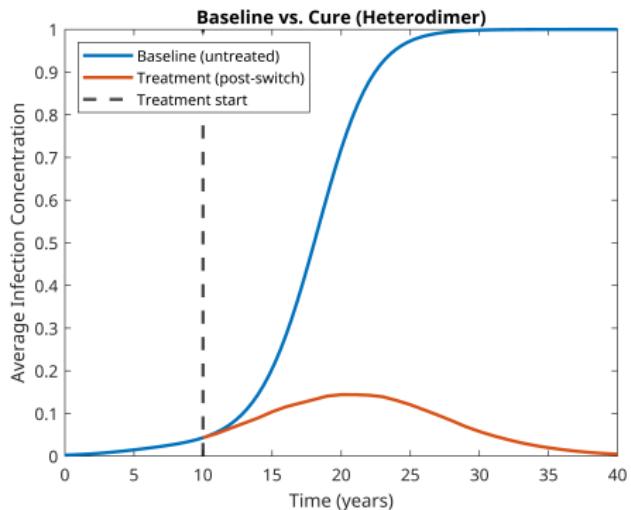
Inizio trattamento a  $t = 10$  anni.



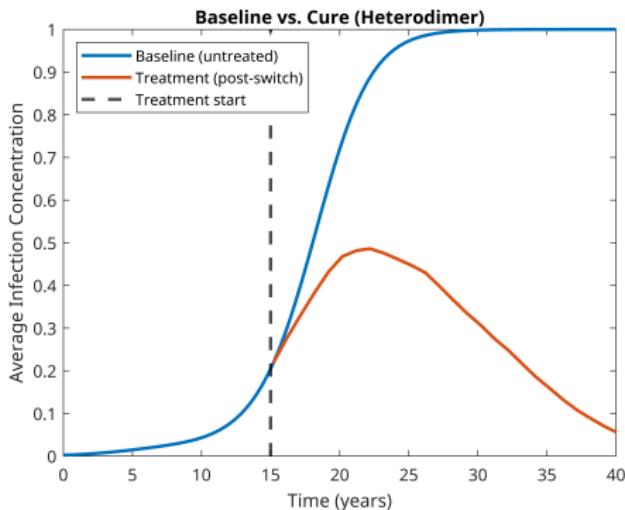
Inizio trattamento a  $t = 15$  anni.



## Caso di cura (Eterodimero)



Inizio trattamento a  $t = 10$  anni.



Inizio trattamento a  $t = 15$  anni.



