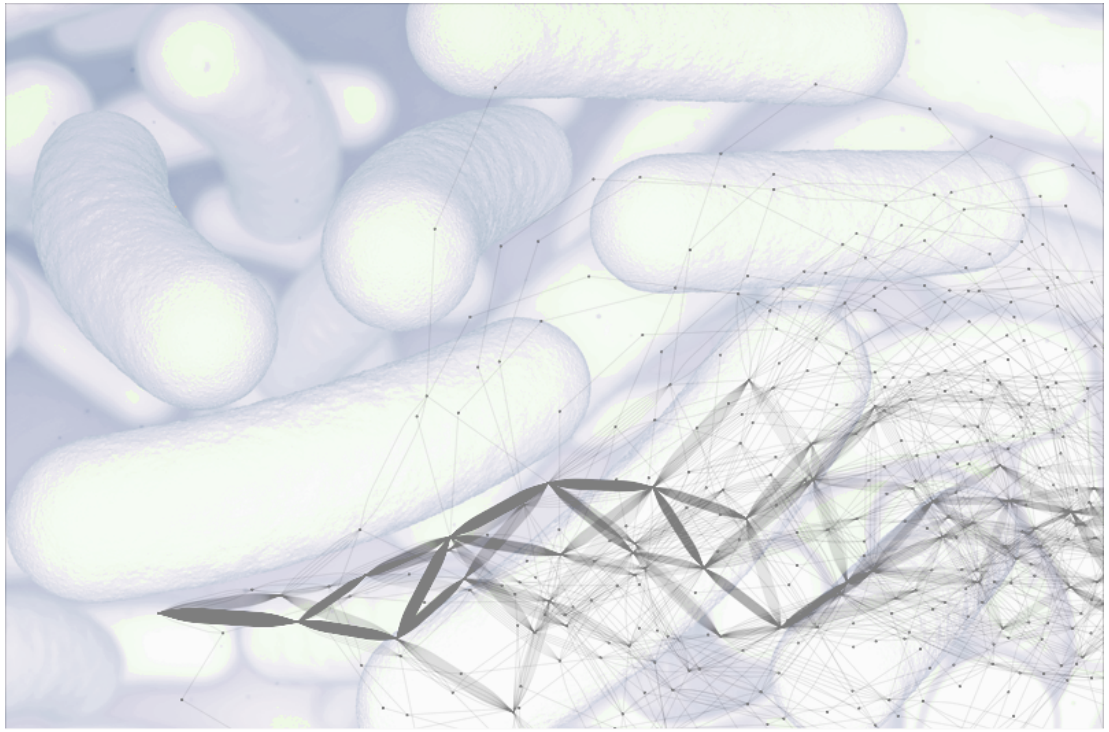
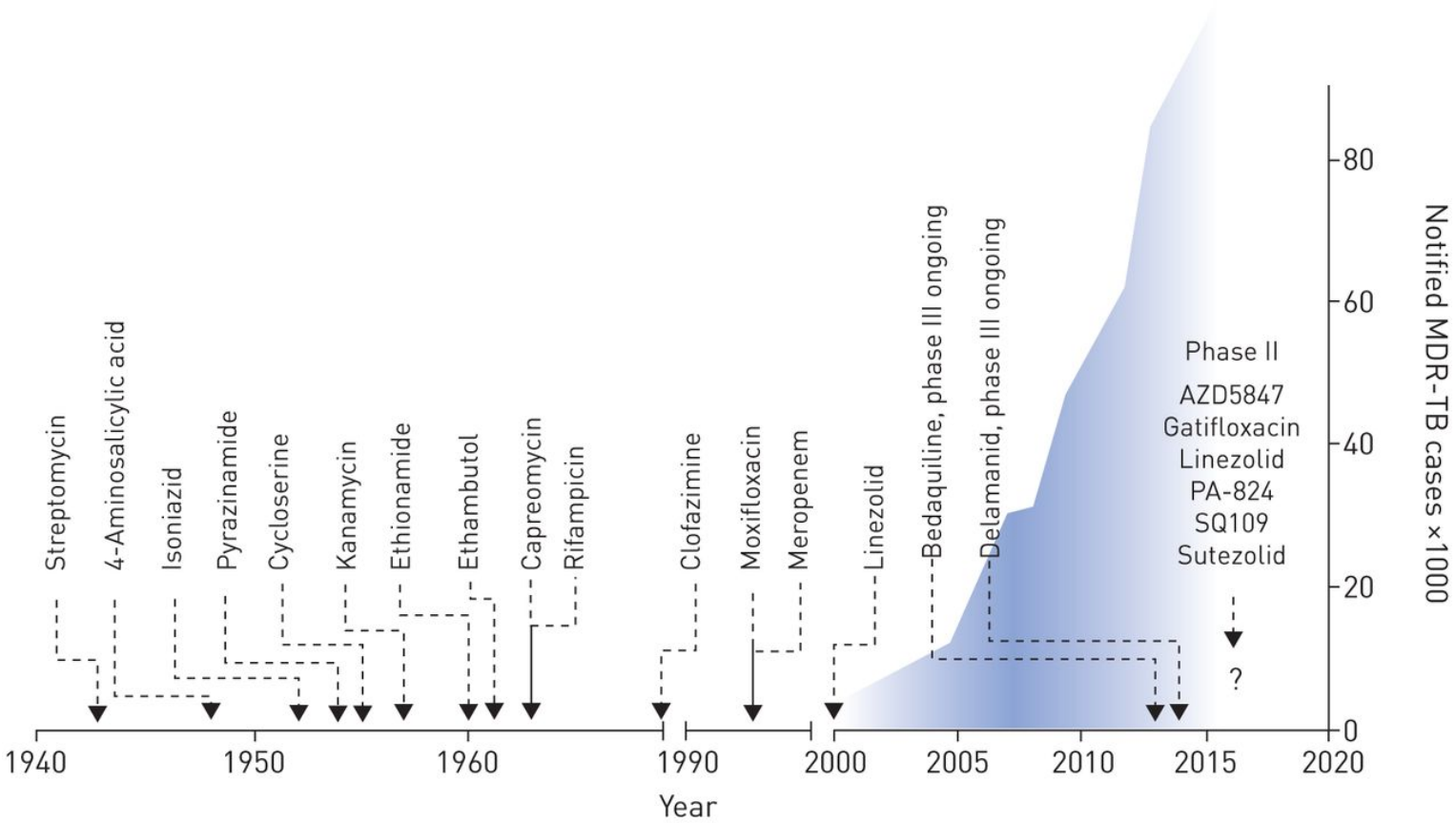
Bakterier utvikler antibiotikaresistens. Kan matematikk hjelpe?

Iain Johnston



Farlige bakterier utvikler resistens mot medisiner

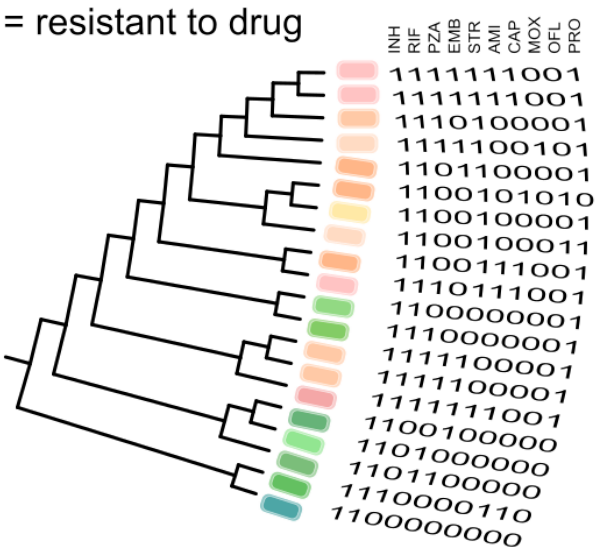


- Antimikrobiell resistens (AMR) / antibiotikaresistens (bakterier)

Figure source: European Respiratory Journal

Farlige bakterier utvikler resistens mot medisiner

0 = not resistant to drug
1 = resistant to drug



Datakilde: Casali et al. Nat Genet (2014)

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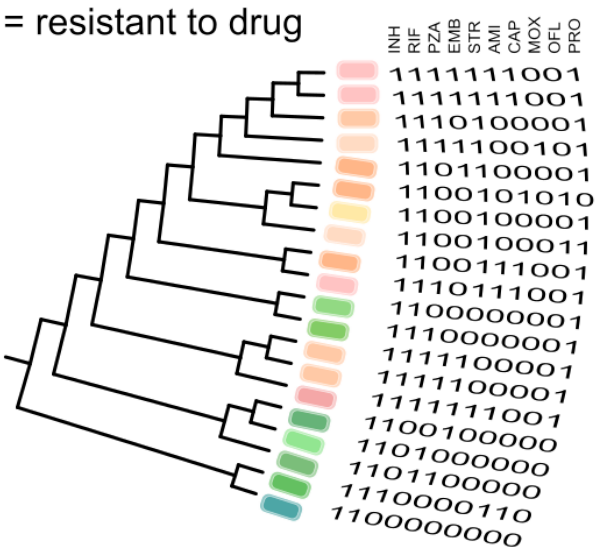

for example:

resistant only to INH (Isoniazid)
and RIF (Rifampin)

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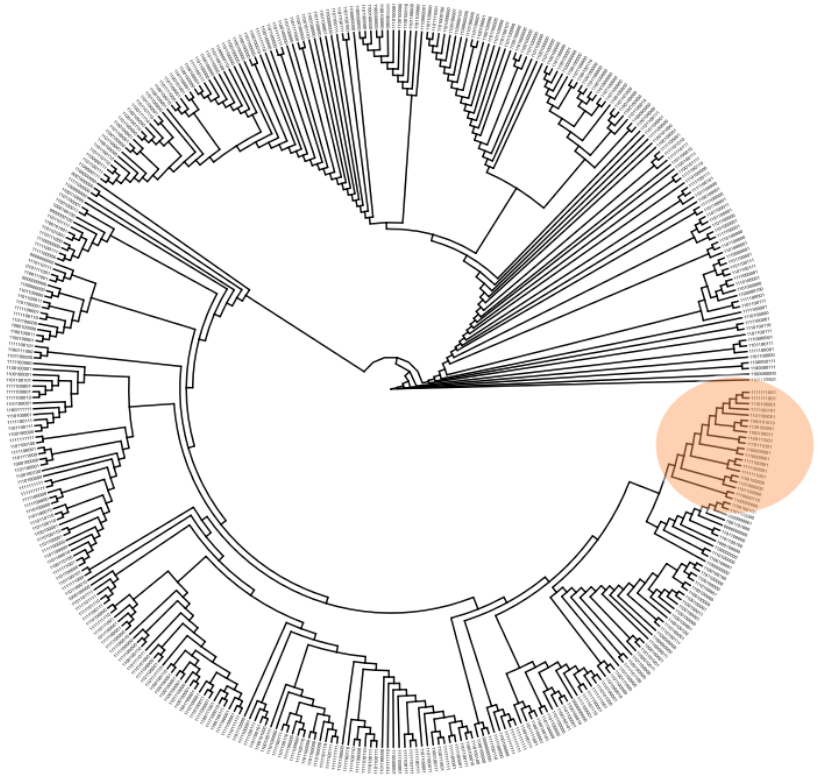

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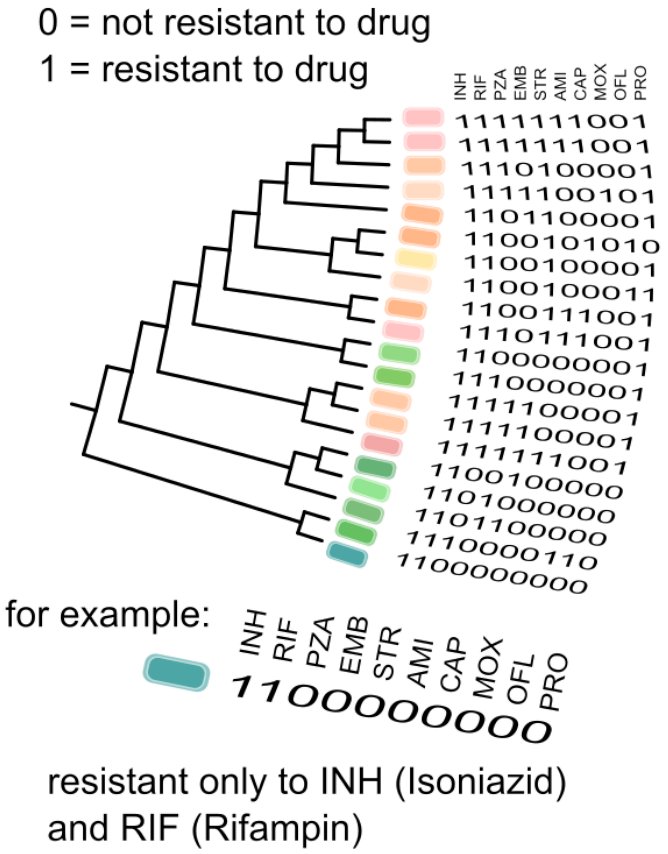
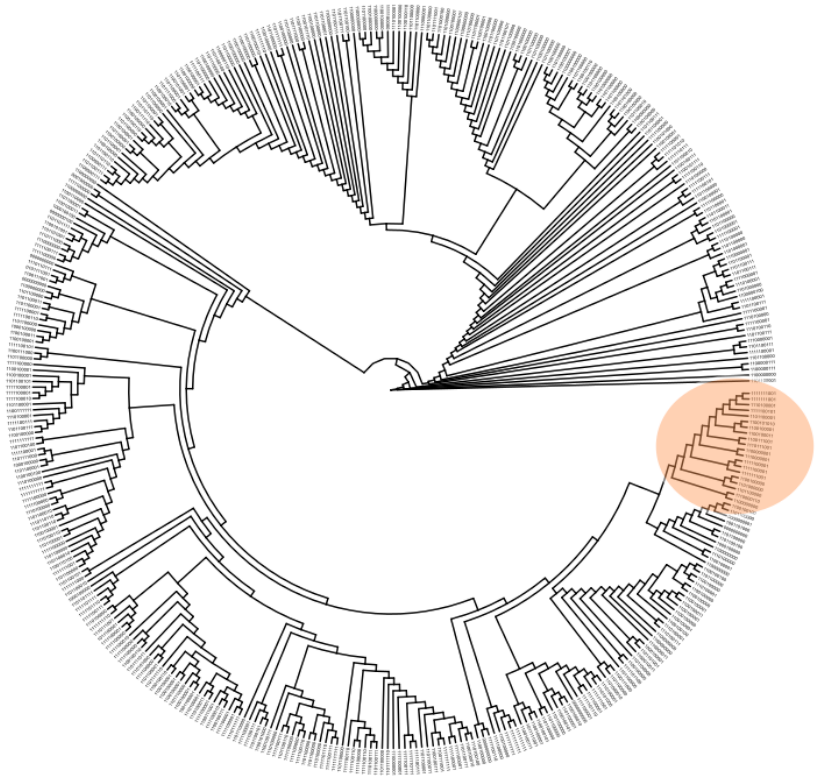
Farlige bakterier utvikler resistens mot medisiner

- Om vi observerer antibiotikaresistens i bakterier, kan vi lærer hvordan disse mønstrene har utviklet seg?





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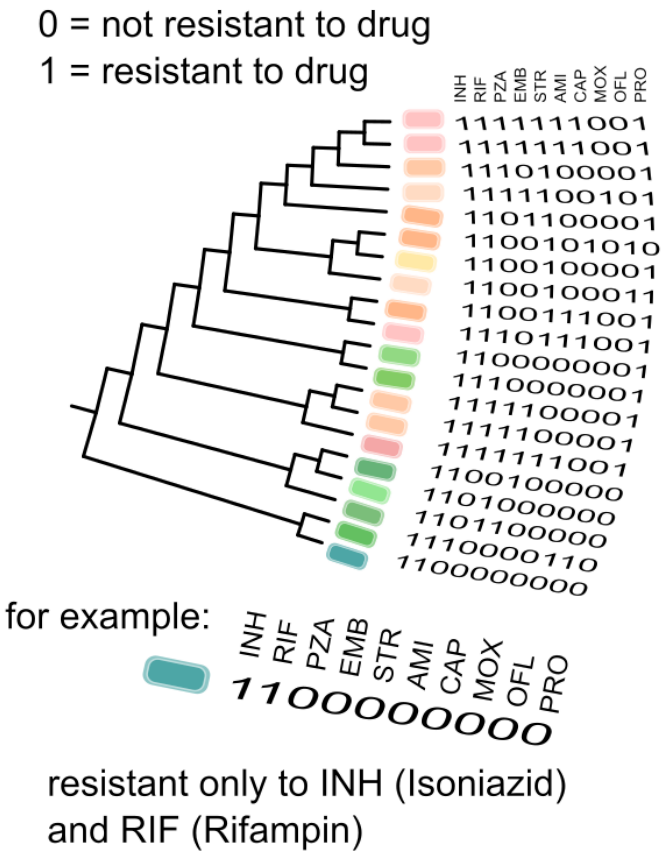

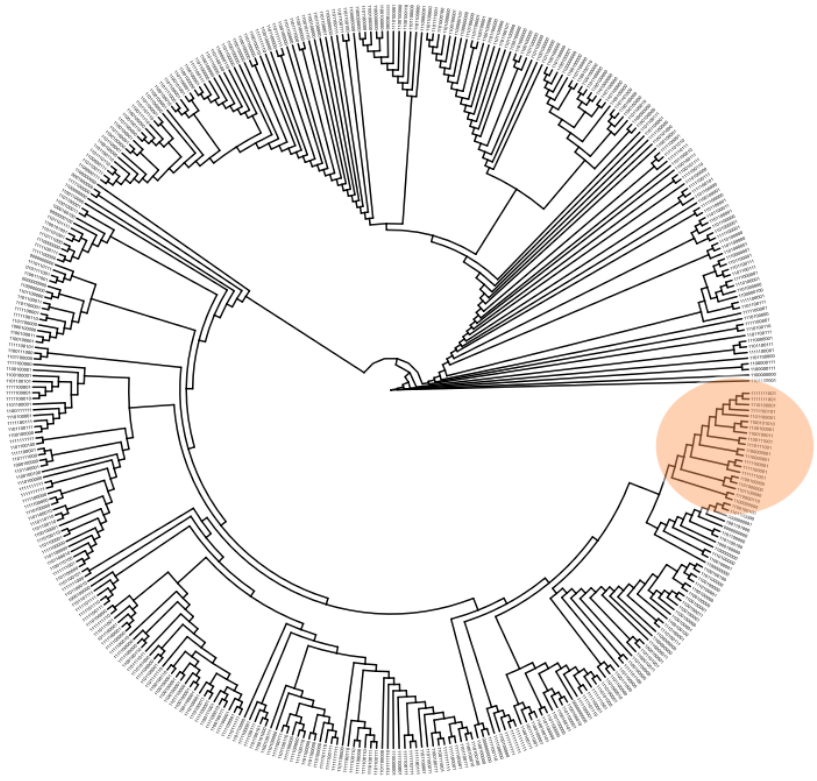

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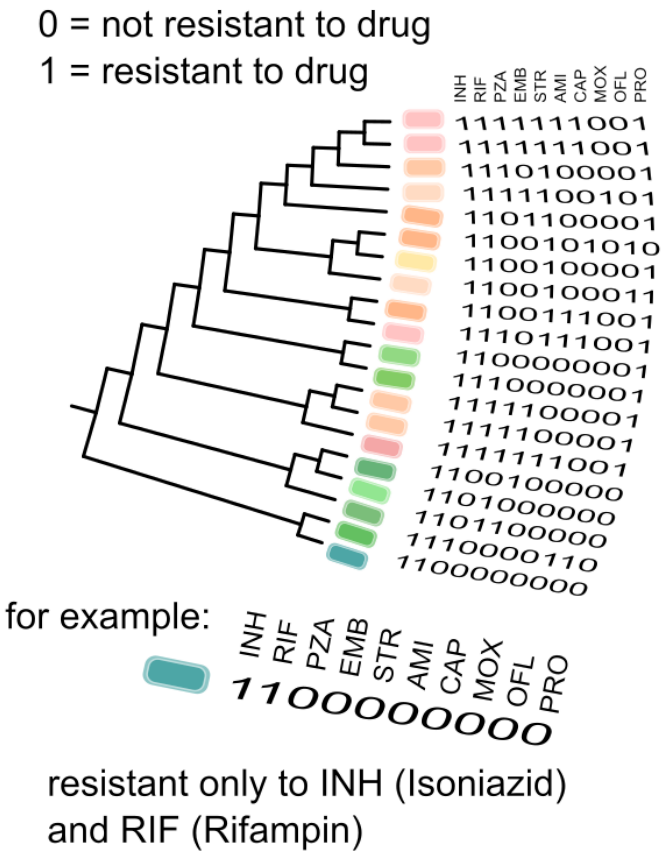
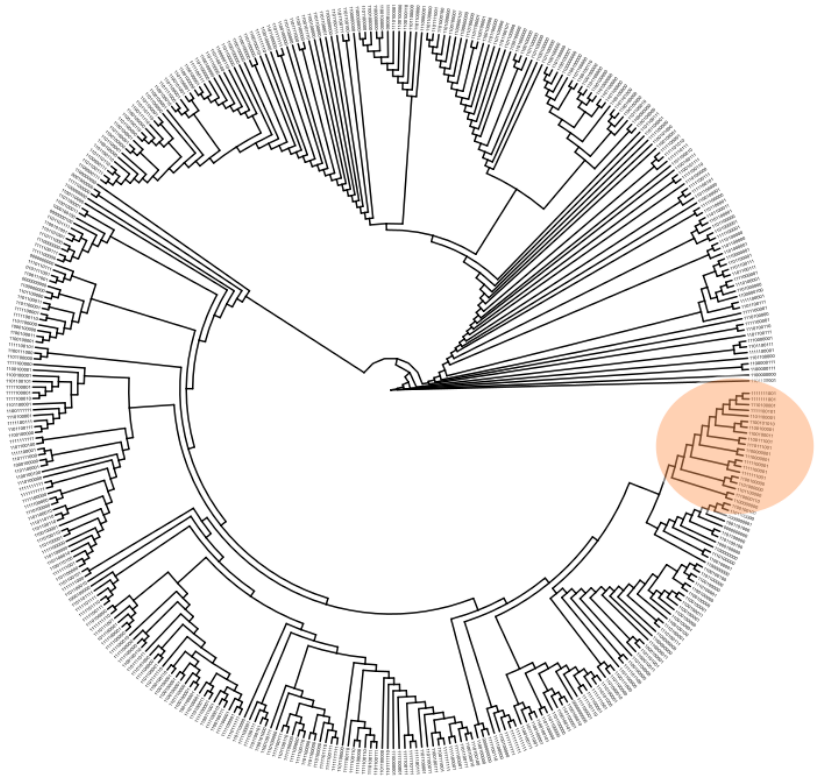
- **Hvordan kan matematikk beskrive og forutsi evolusjon?**





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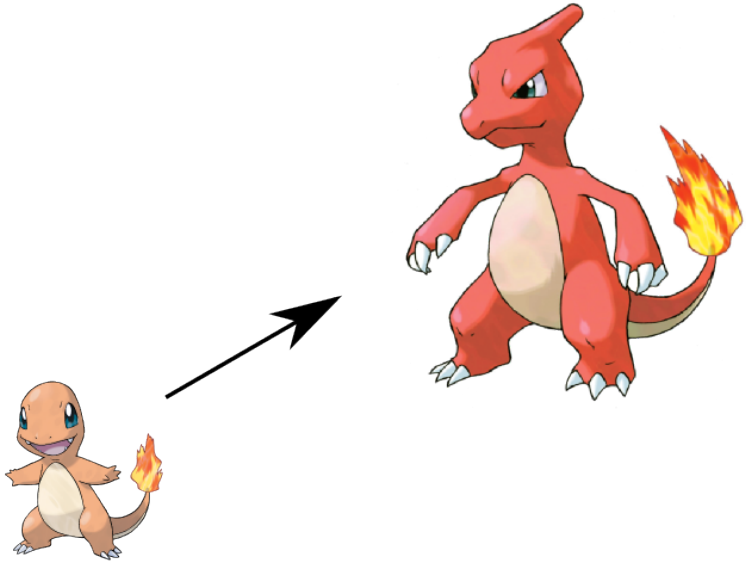
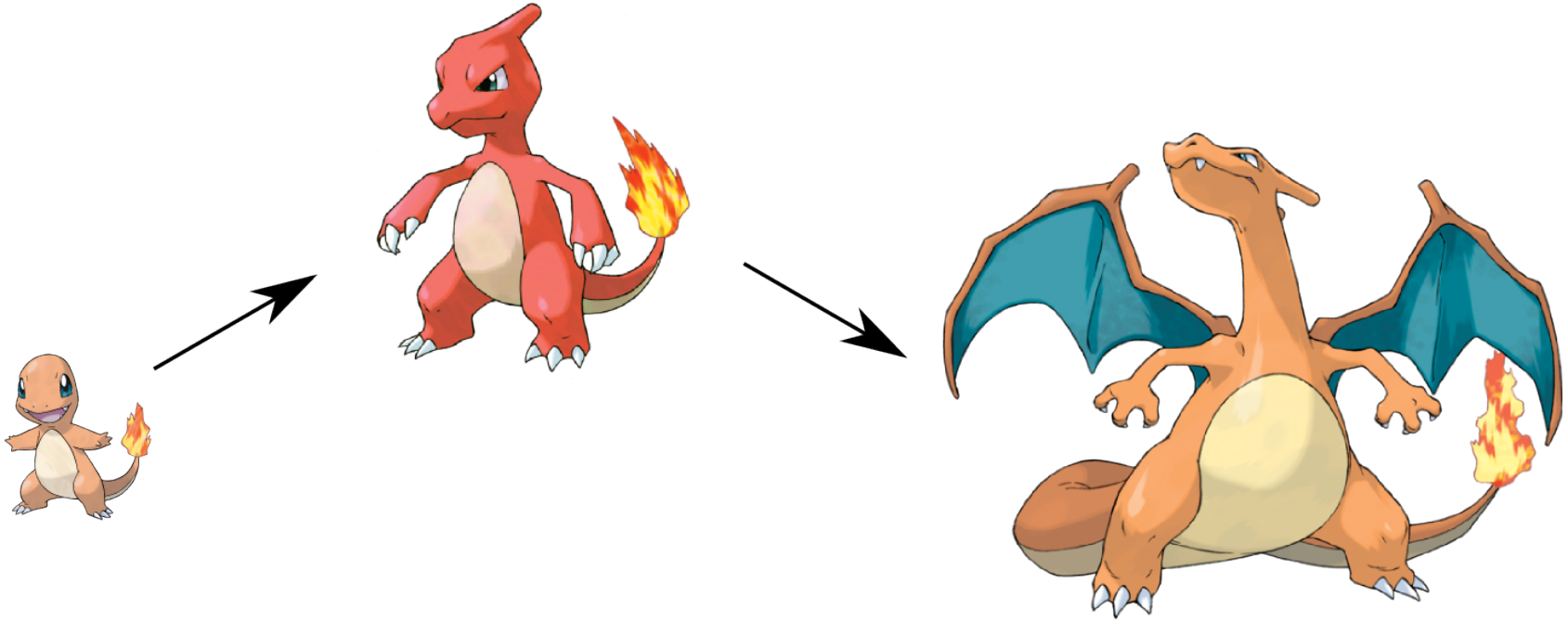
Kilde: Bulbapedia



Kilde: Bulbapedia

Evolusjonært rom: Et matematisk bilde av evolusjon



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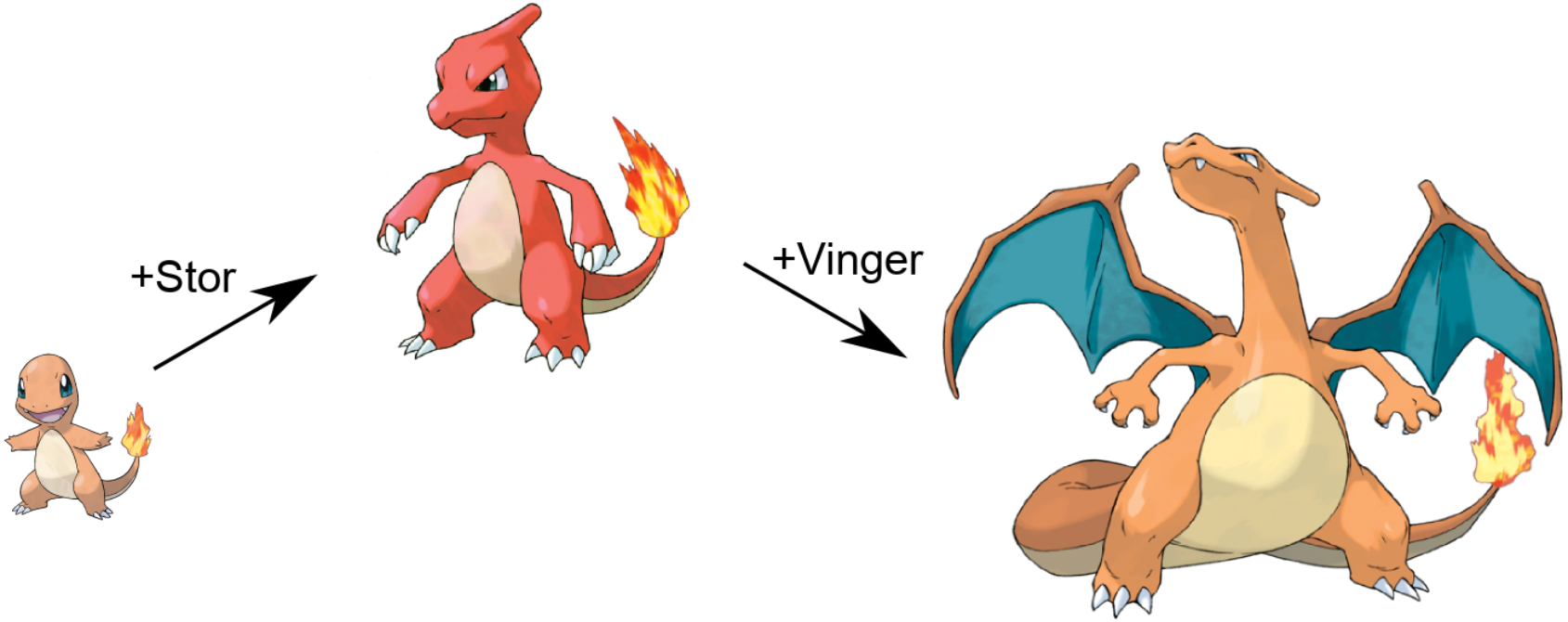

Kilde: Bulbapedia

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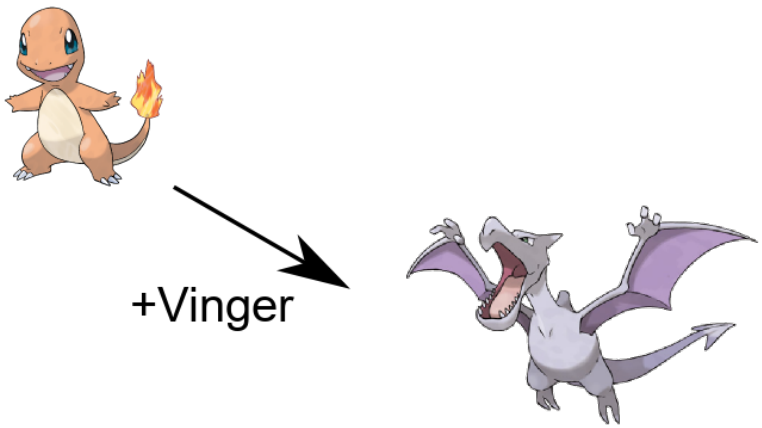

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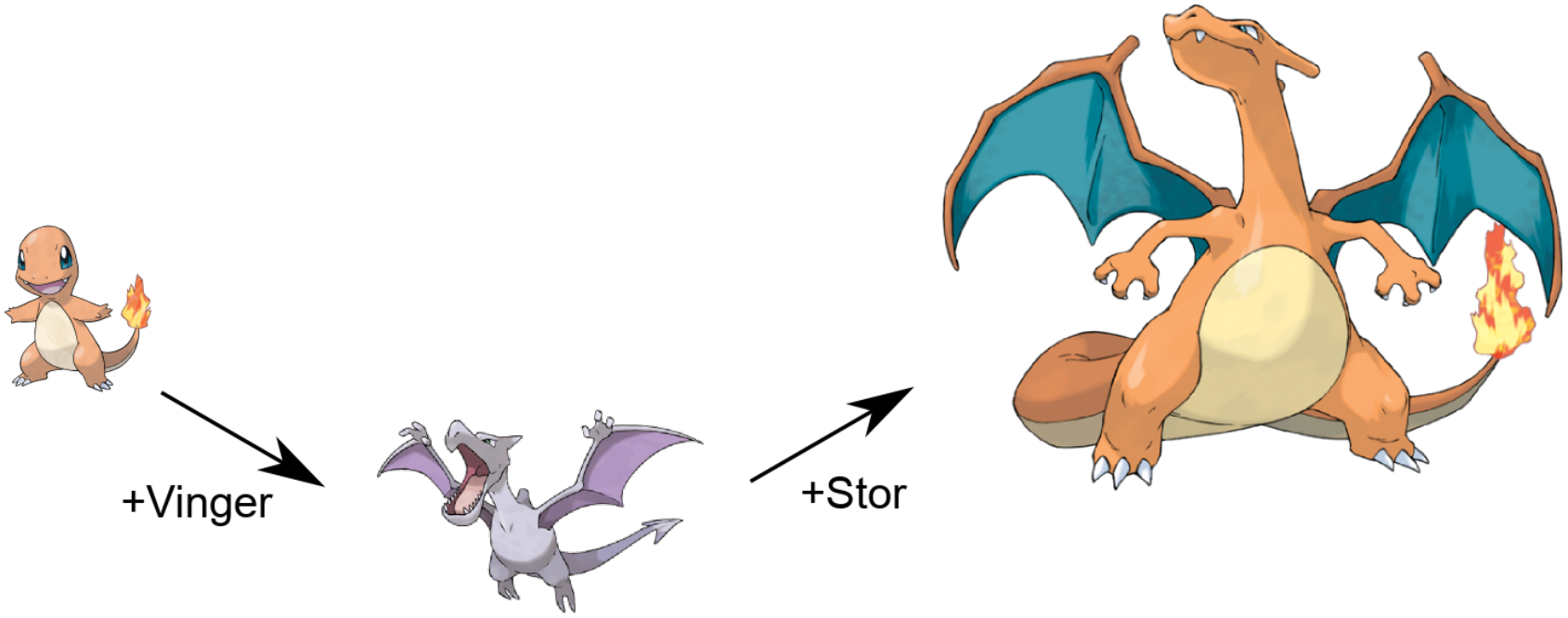
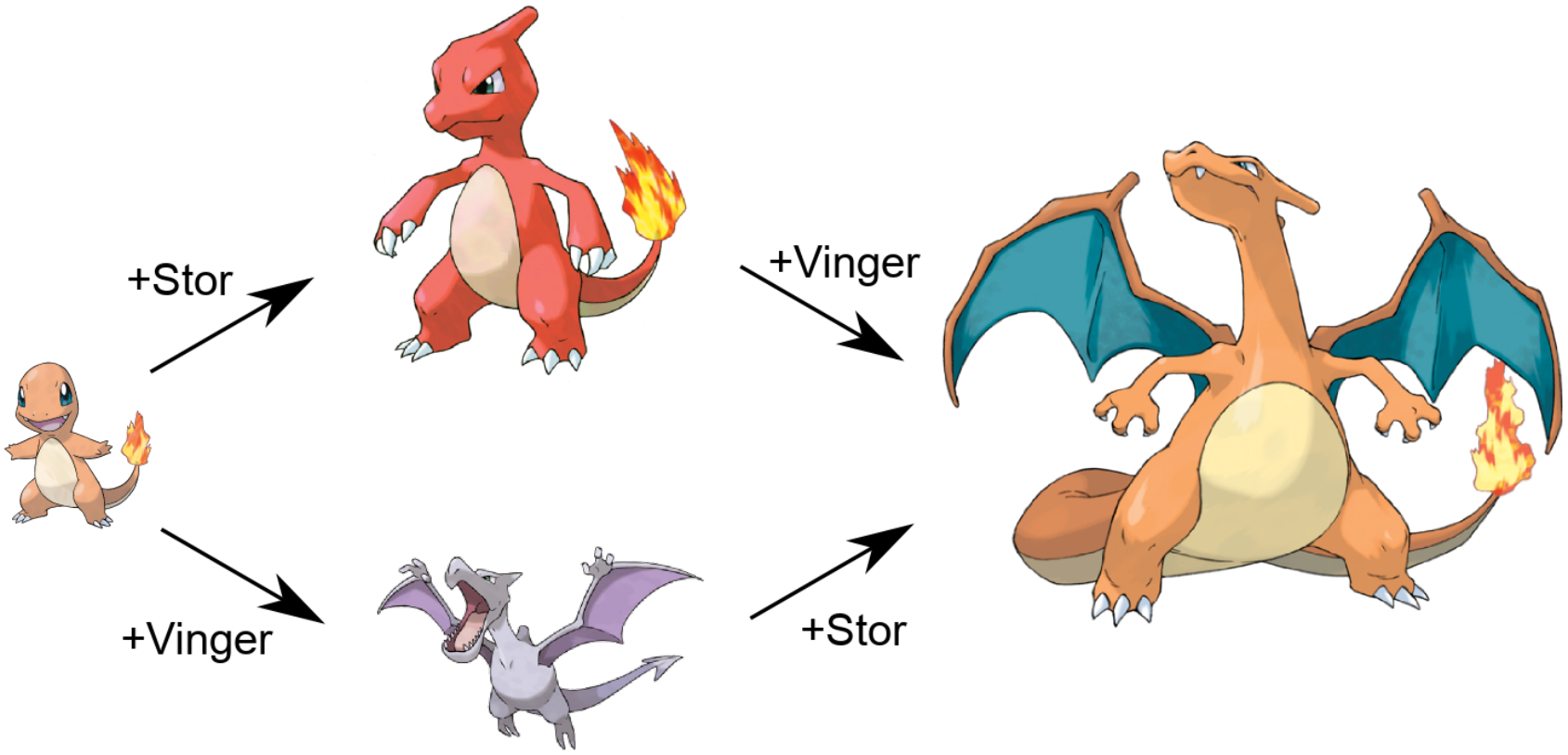


Kilde: Bulbapedia

Evolusjonært rom: Et matematisk bilde av evolusjon



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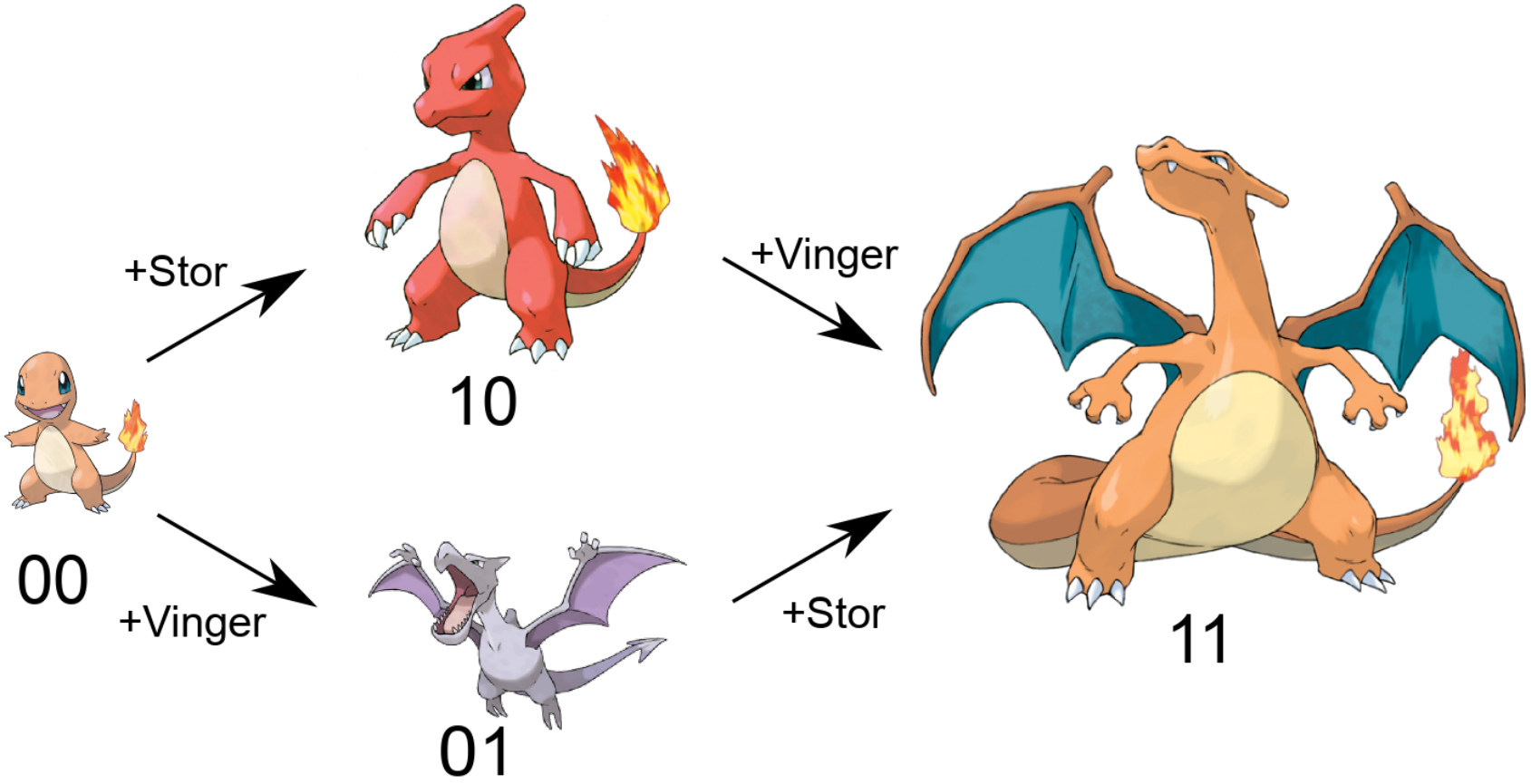
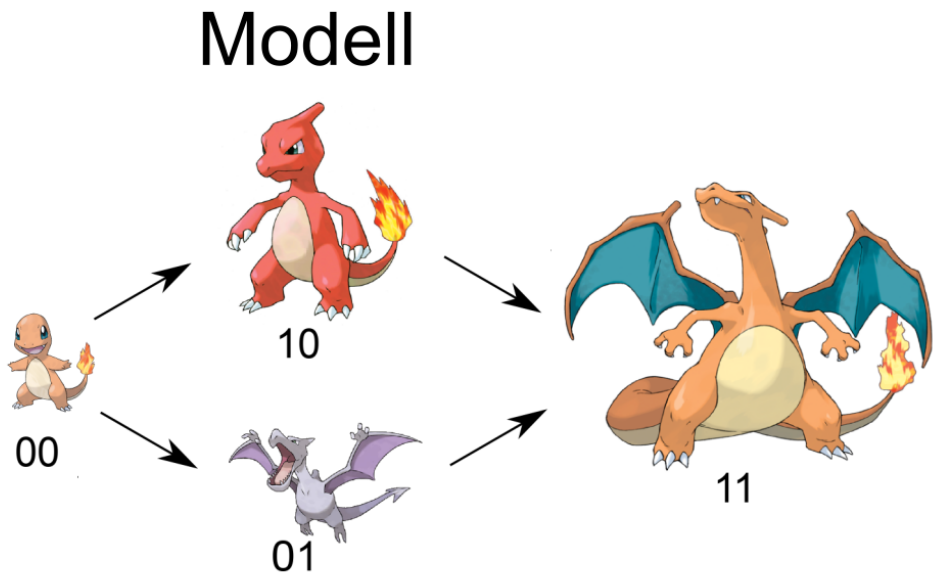


Kilde: Bulbapedia

Veier i evolusjonært rom

- Vi kan sammenligne modelsimuleringer med data for å se hvilke veier i rommet forklare de som vi ser



Data

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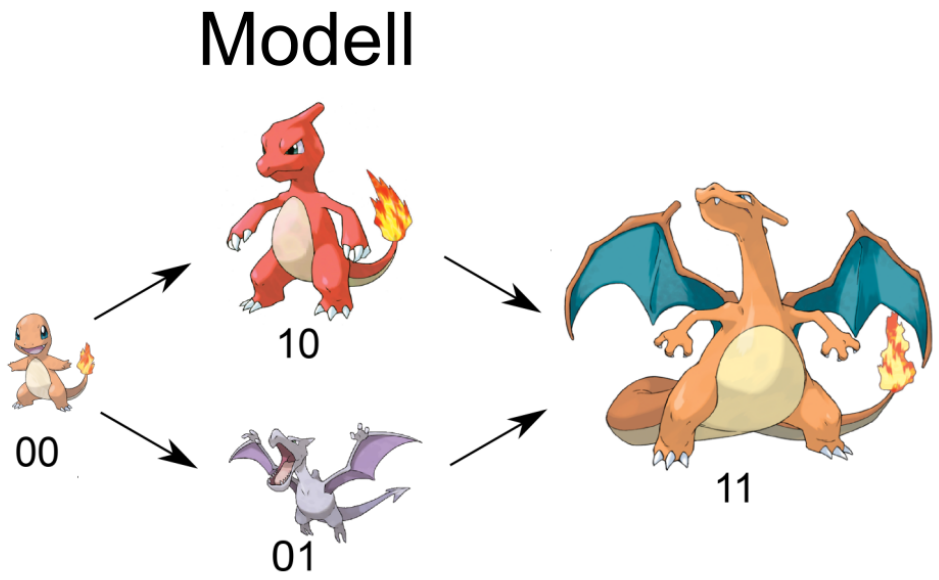

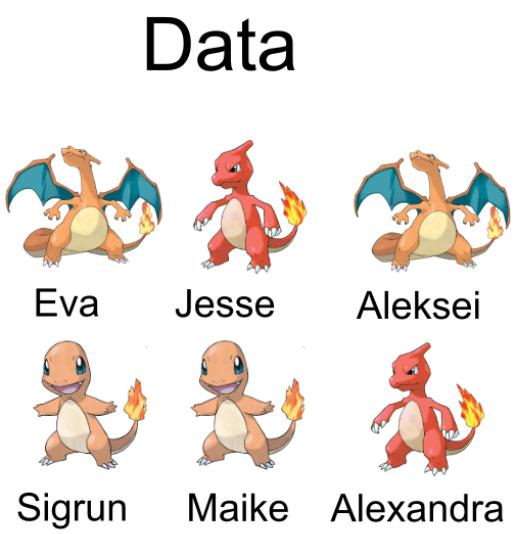

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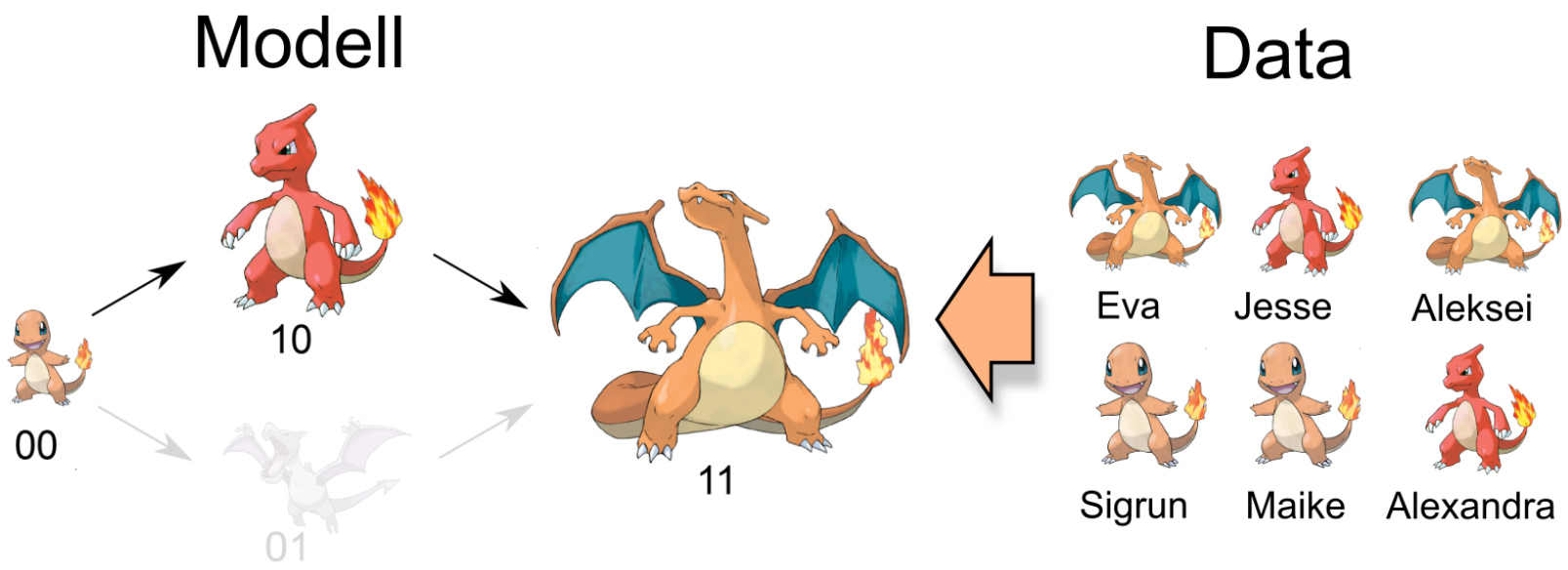

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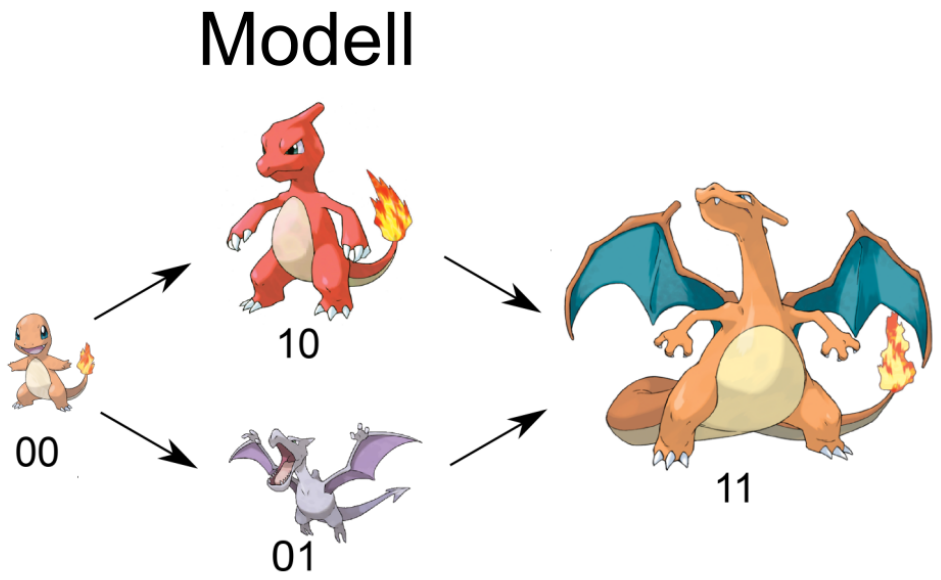

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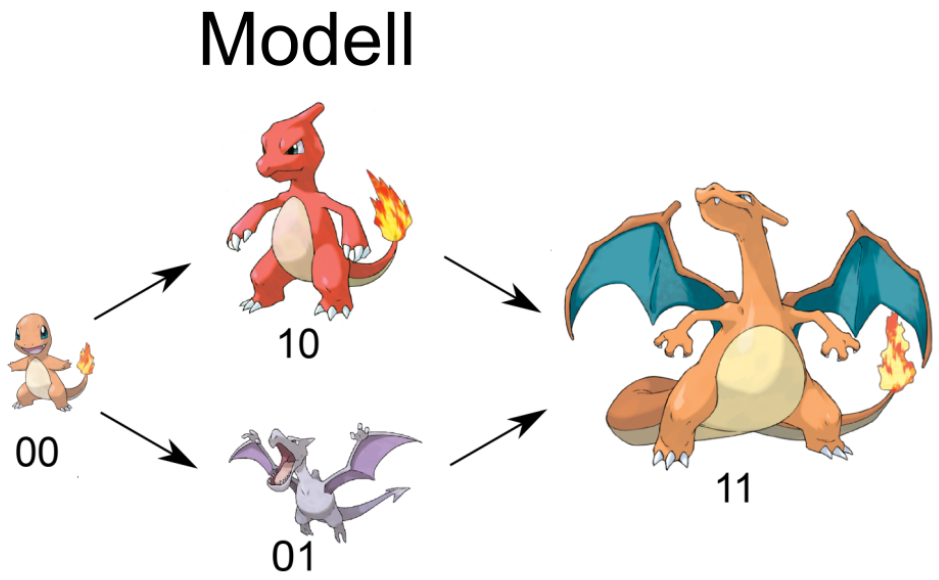

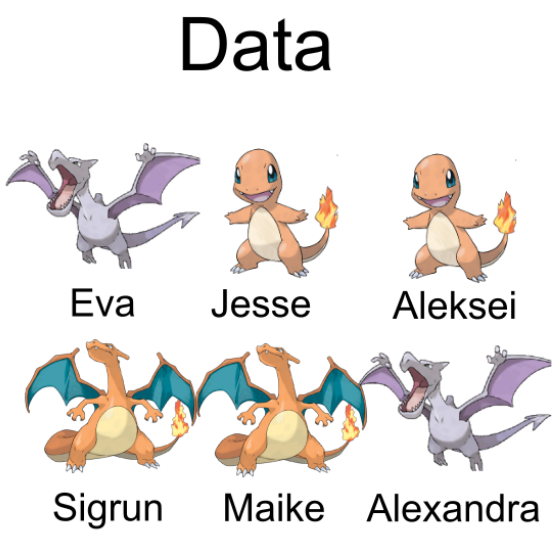

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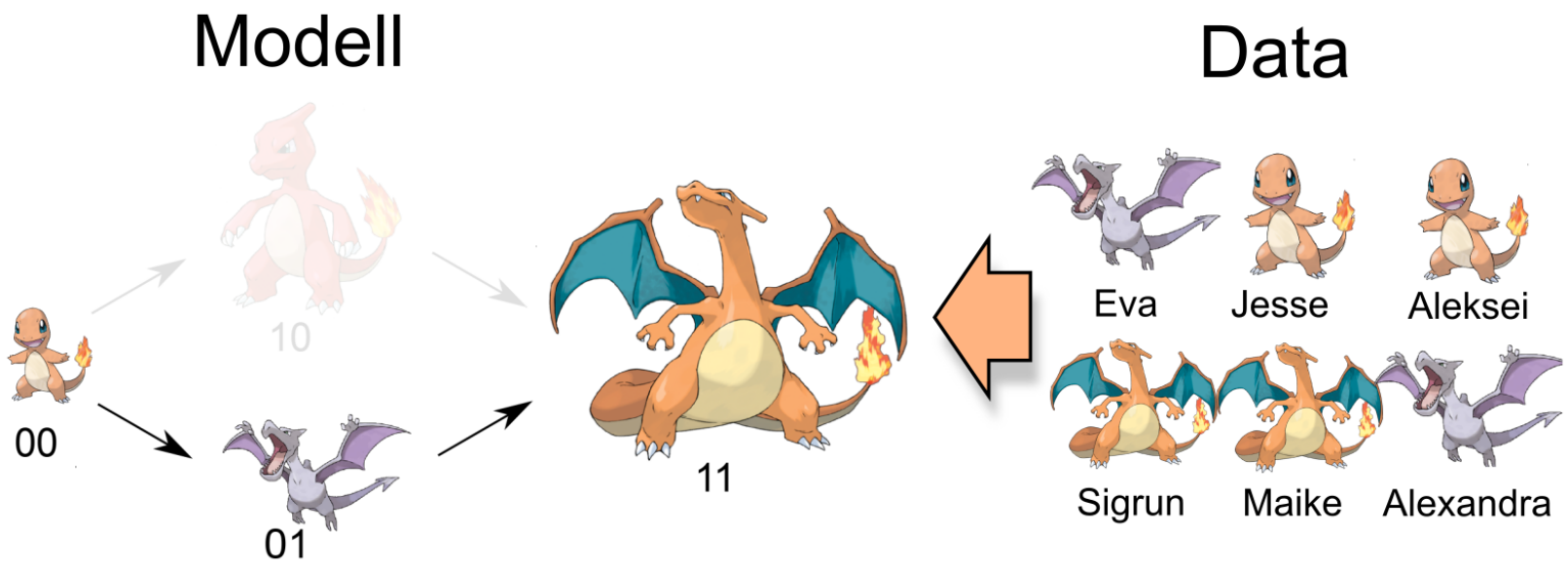

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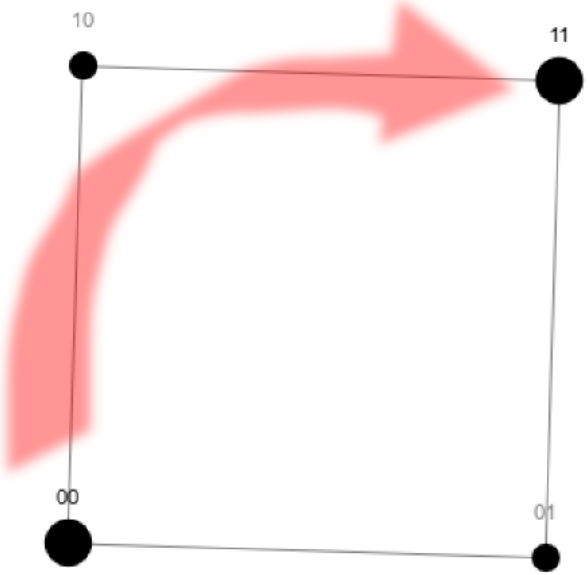
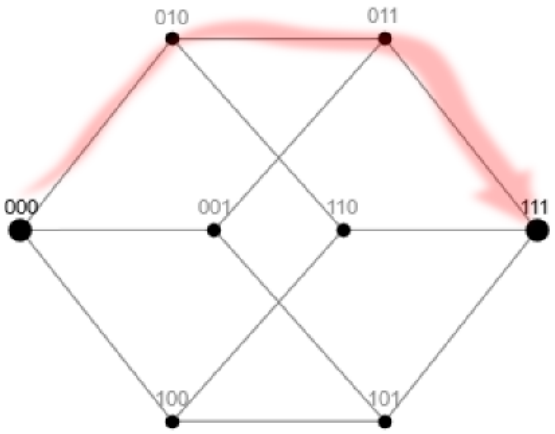
Maskinlæring (KI?) for å lære om evolusjon fra data

- Om vi kan gjøre slik med 2 egenskaper (4 punkter i evolusjonært rom), hvorfor ikke 3 (8 punkter; en kube)?





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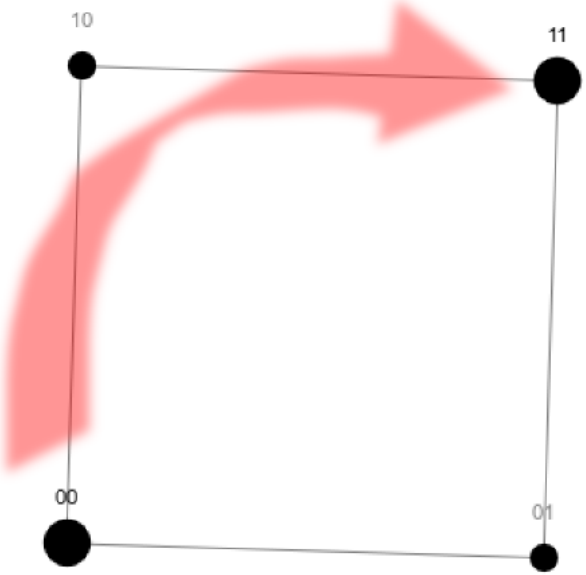
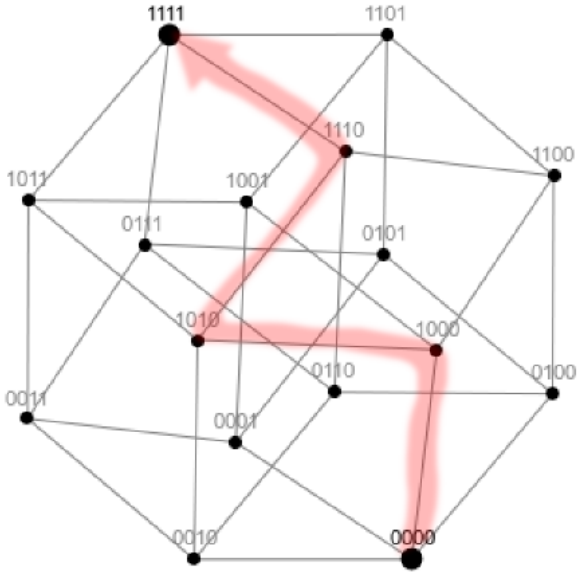
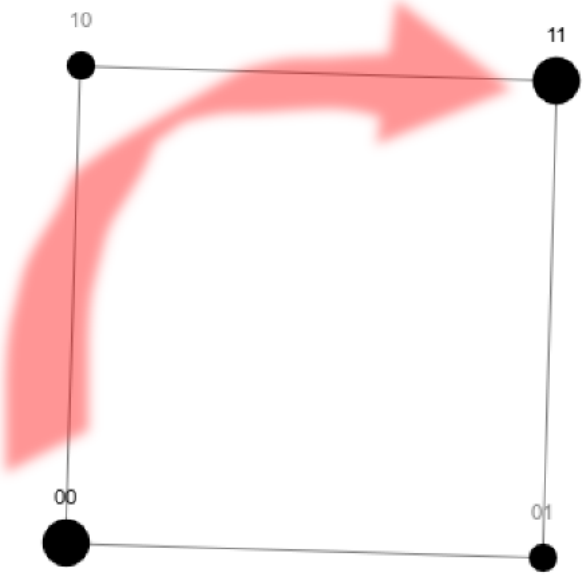
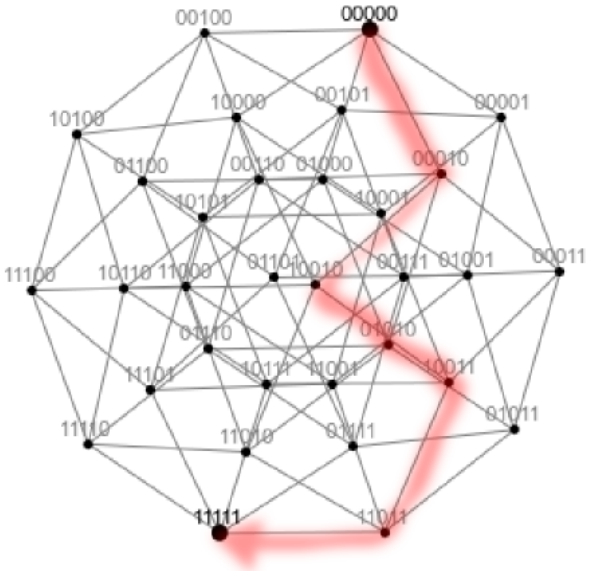


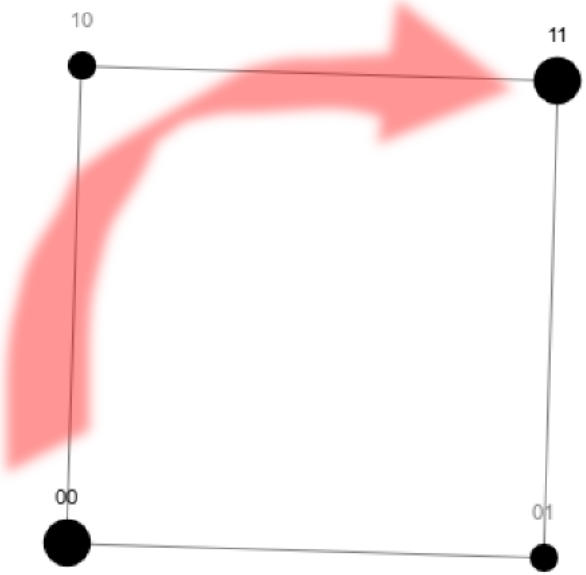


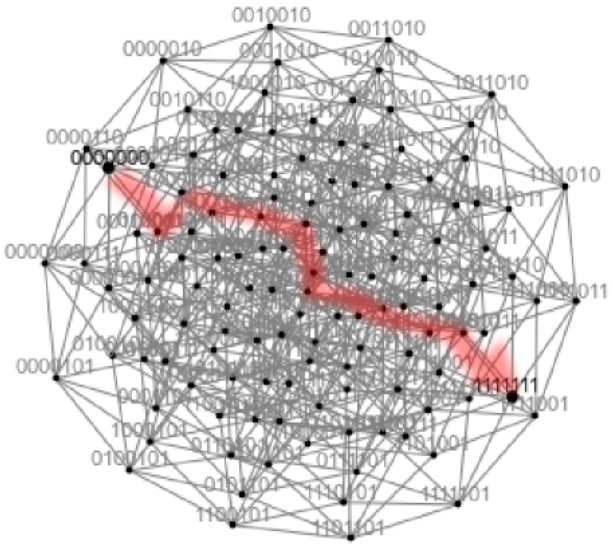
- Om vi kan gjøre slik med 2 egenskaper (4 punkter i evolusjonært rom), hvorfor ikke 5 (32 punkter; en 5-hyperkube)?





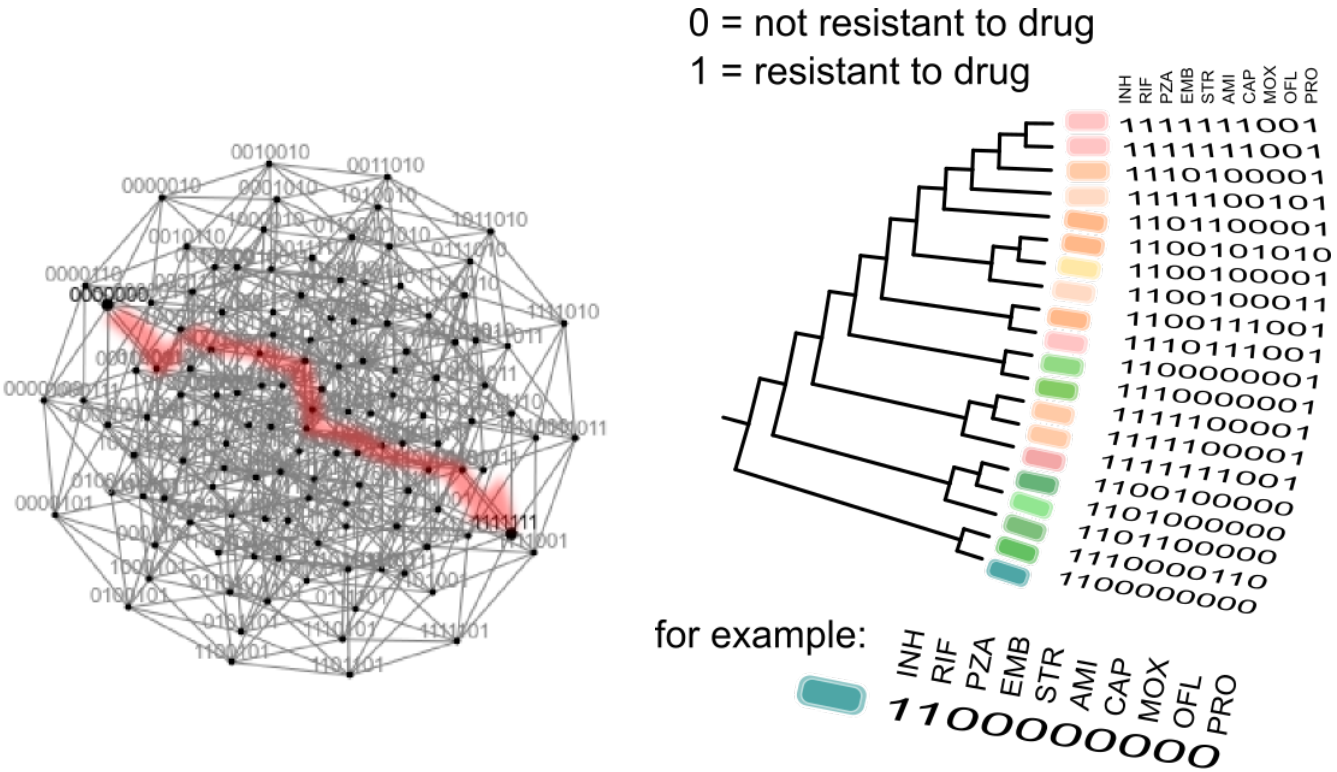
- Om vi kan gjøre slik med 2 egenskaper (4 punkter i evolusjonært rom), hvorfor ikke n (2^n punkter; en n-hyperkube)?



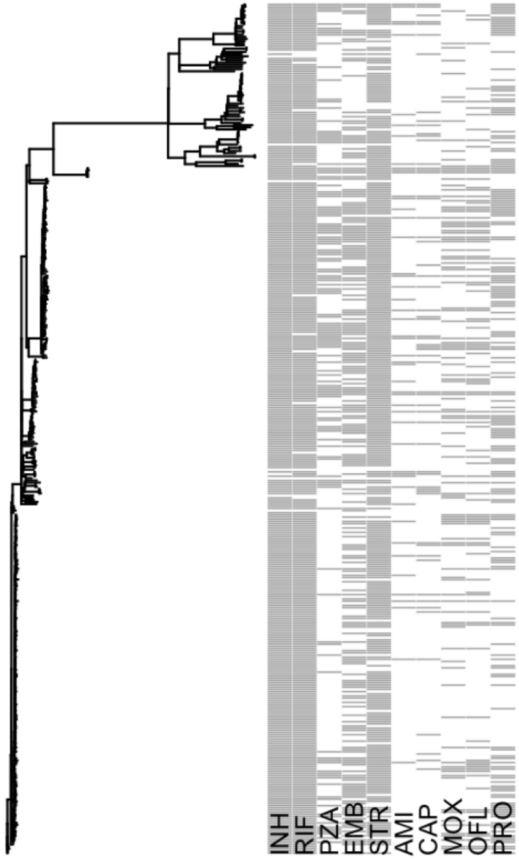


Maskinlæring (KI?) for å lære om resistensevolusjon fra data

- Om våre *n* egenskaper representerer resistens mot *n* legemidler...
- ... kan vi bruke data til å lære de evolusjonære veiene for antibiotikaresistens



Prediksjon av fremtidig resistensevolusjon i *Mycobacterium tuberculosis*



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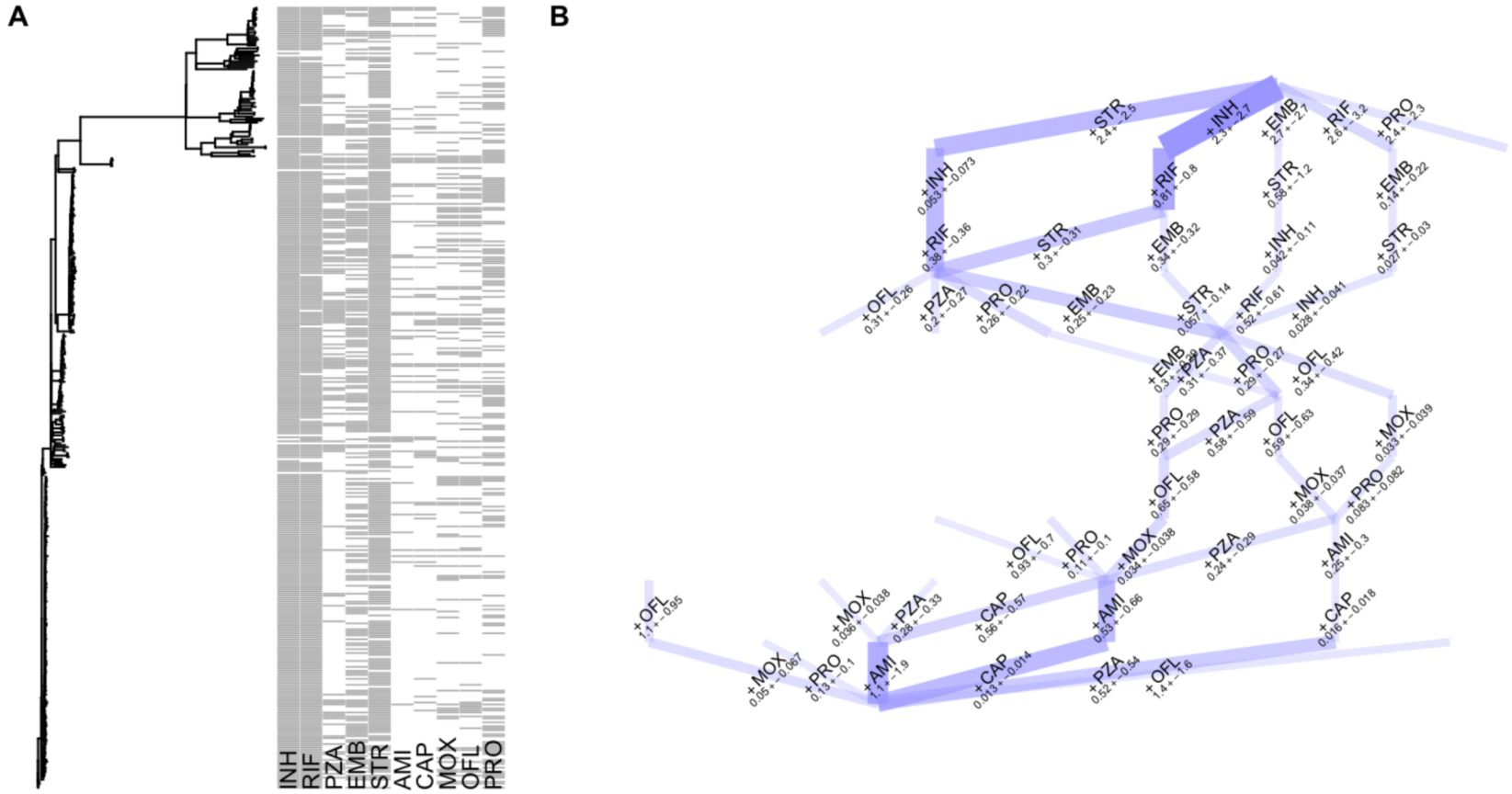

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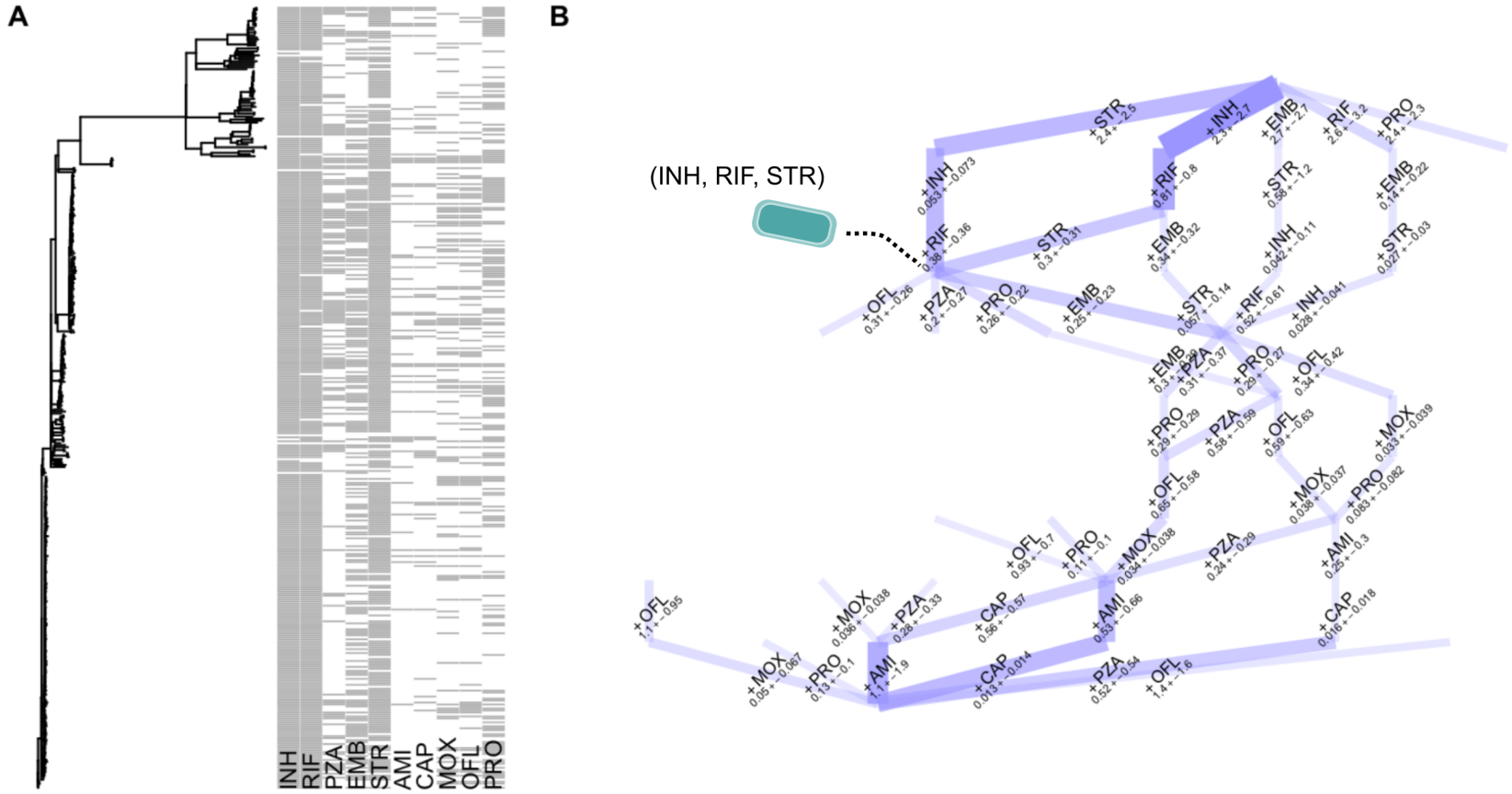

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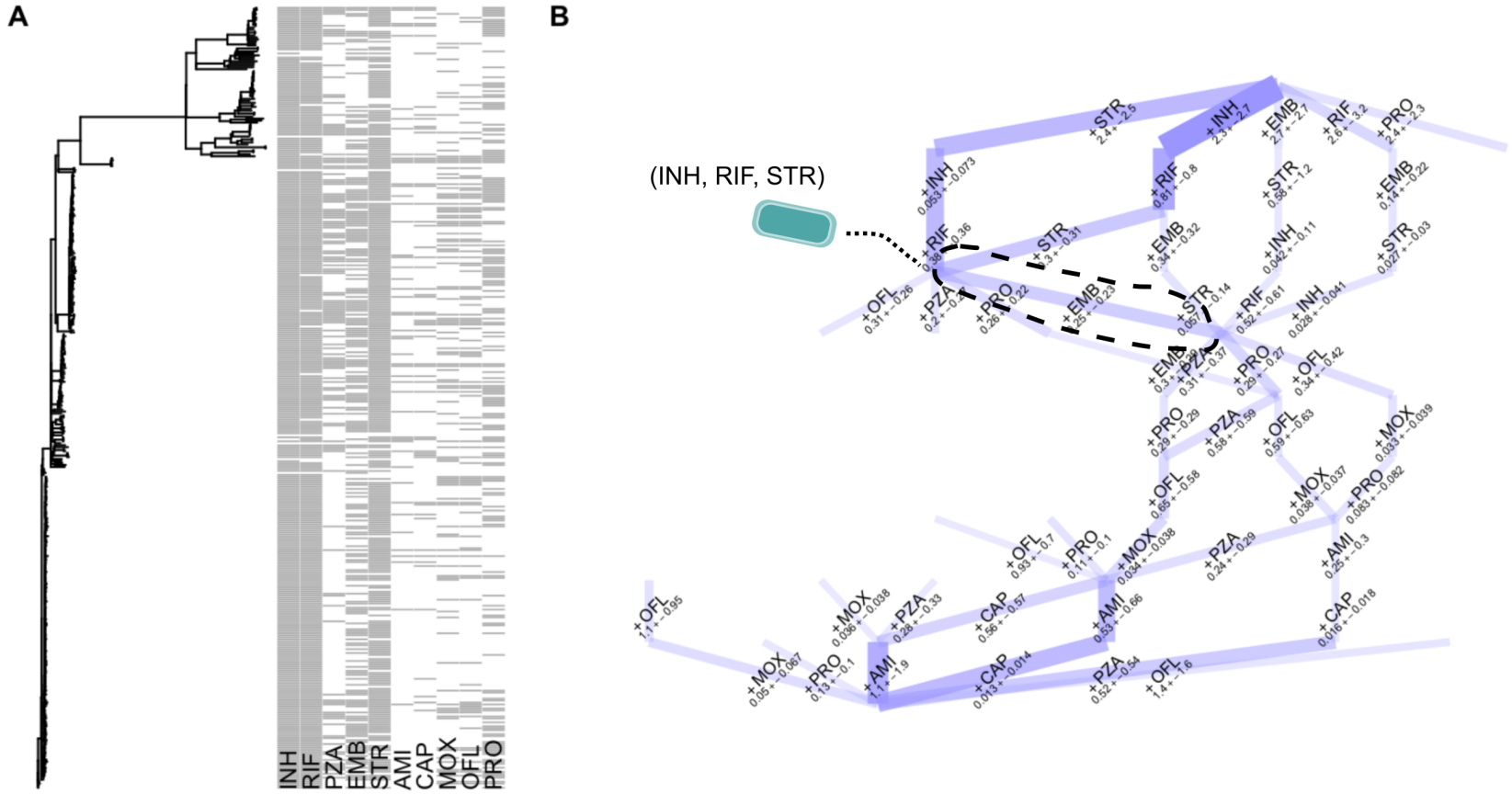

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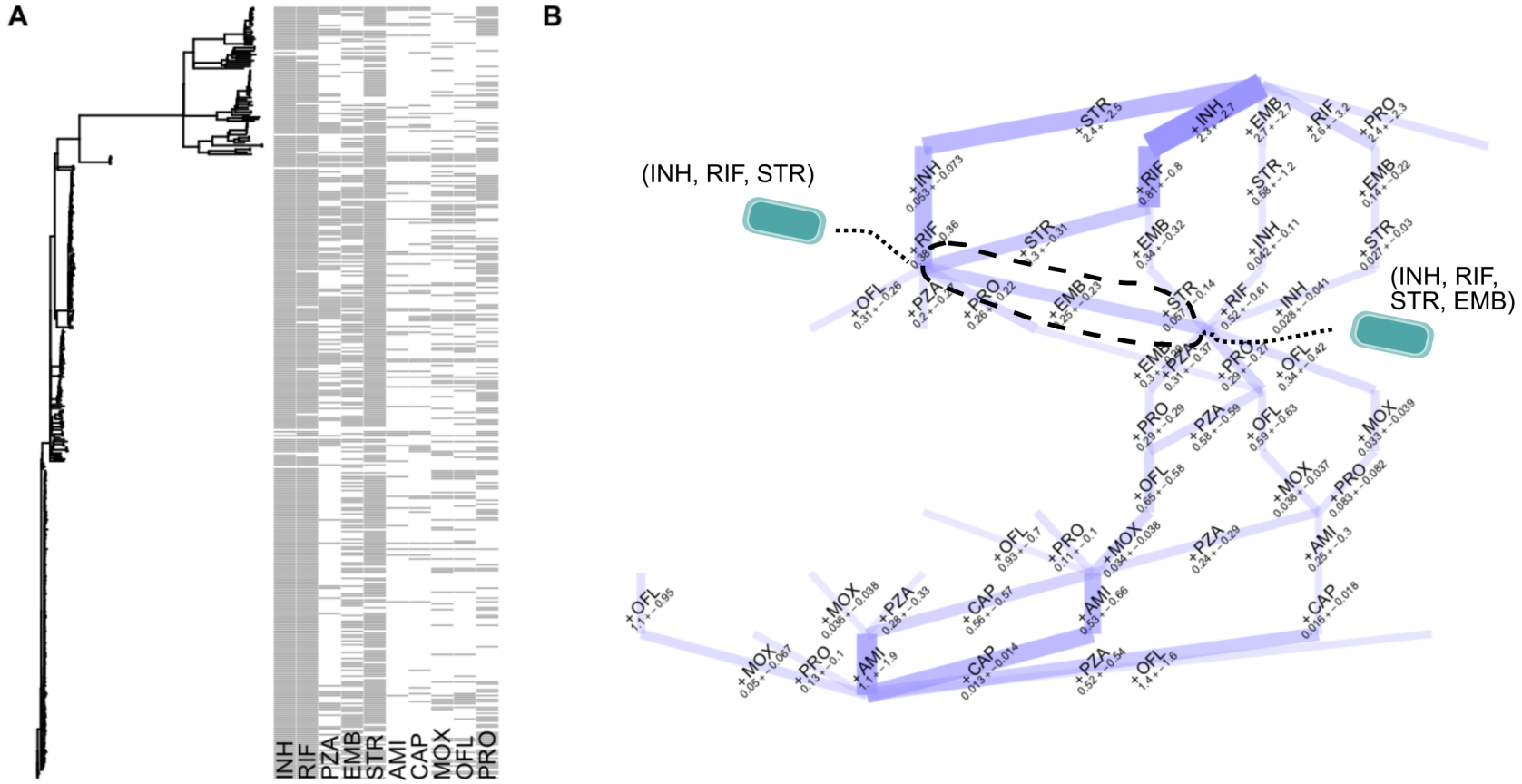

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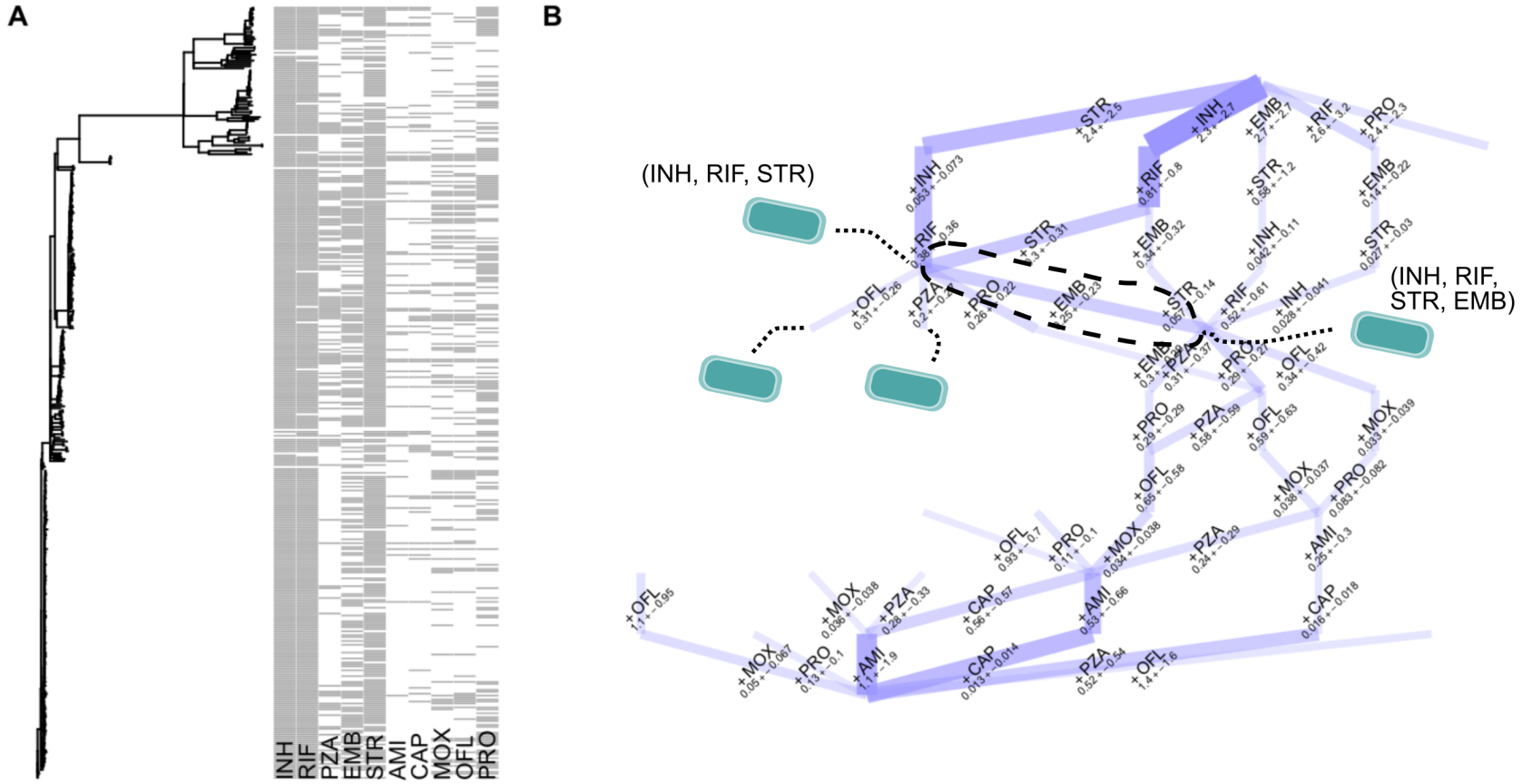

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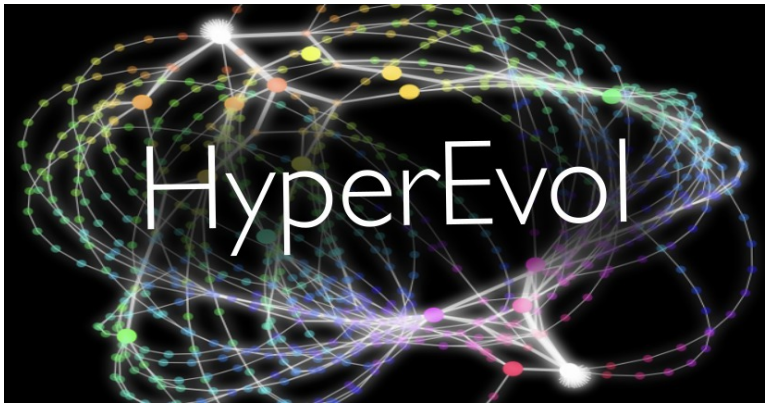
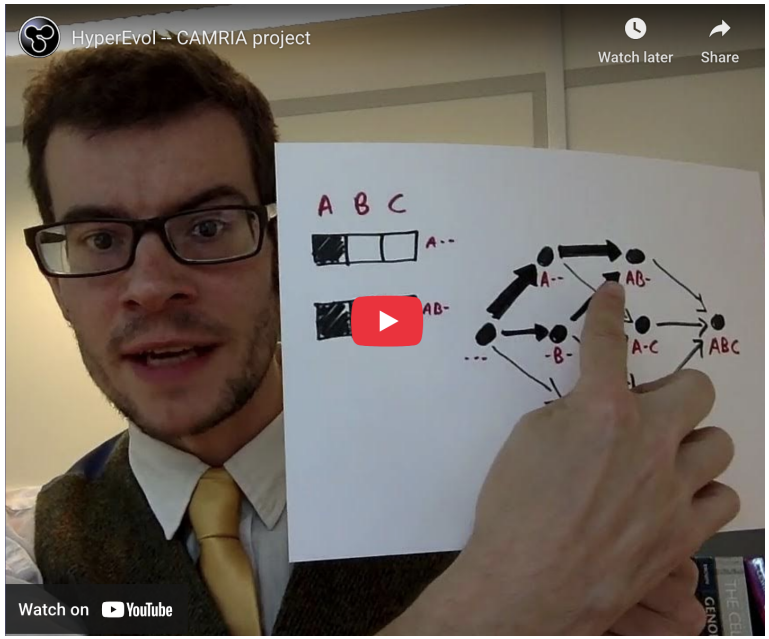
Combatting Anti-Microbial Resistance with Interdisciplinary Approaches





TROND MOHN STIFTELSE

https://camria.w.uib.no/hyperevol/