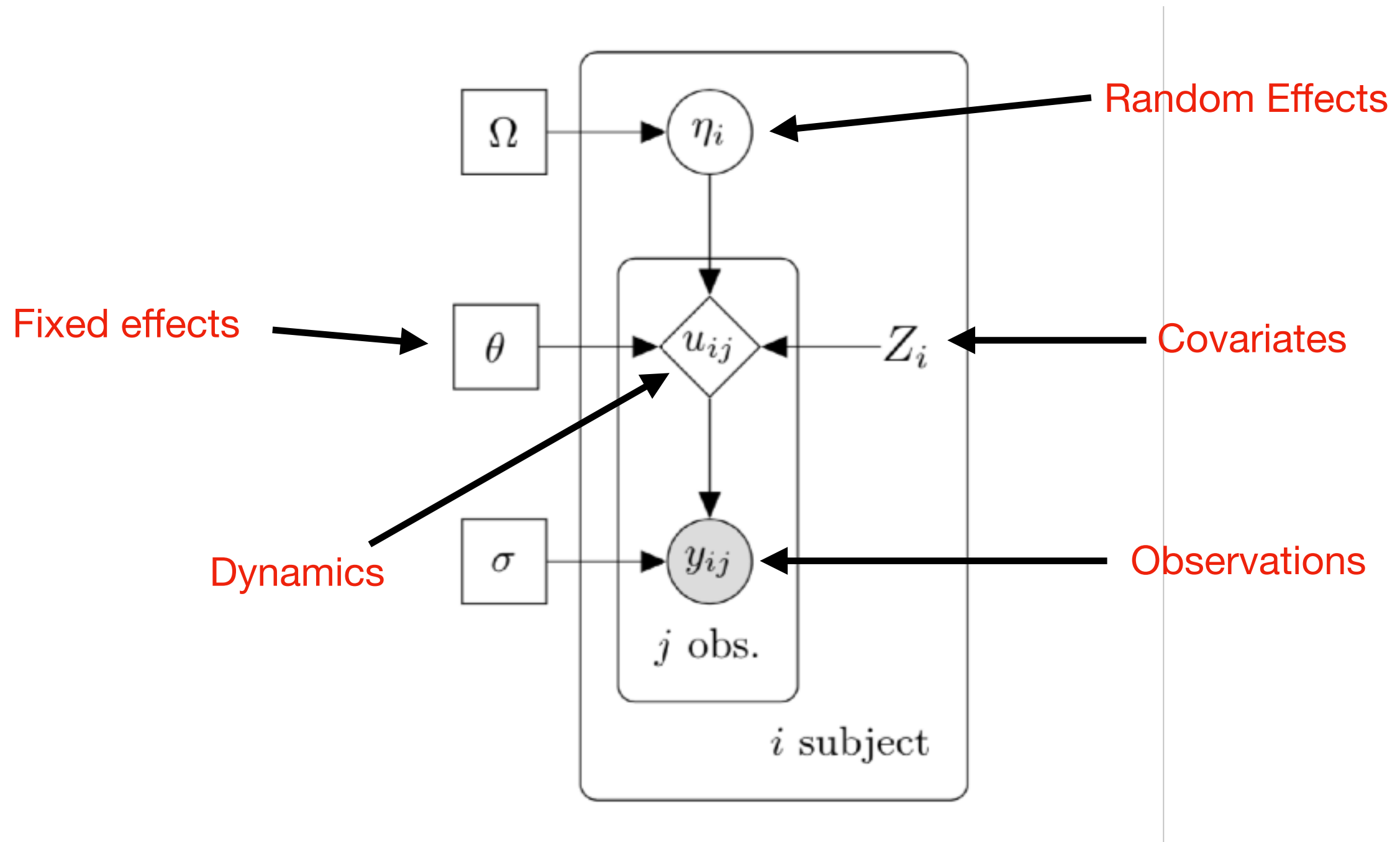# Non Linear Mixed Effects Models

# Defining NLME Models in Pumas

```julia
 1 nlme_model = @model begin
 2    @param begin
 3        θ ∈ VectorDomain(3,init=[3.24467E+01, 8.72879E-02, 1.49072E+00])
 4        Ω ∈ PSDDomain(init=Matrix{Float64}([ 1.93973E-02  1.20854E-02  5.69131E-02
 5                                             1.20854E-02  2.02375E-02 -6.47803E-03
 6                                             5.69131E-02 -6.47803E-03  4.34671E-01]))
 7        Σ ∈ PDiagDomain(init=[1.70385E-02, 8.28498E-02])
 8    end
 9
10    @random begin
11        η ~ MvNormal(Ω)
12    end
13
14    @pre begin
15        V  = θ[1] * exp(η[1])
16        Ke = θ[2] * exp(η[2])
17        Ka = θ[3] * exp(η[3])
18        CL = Ke * V
19    end
20
21    @vars begin
22        conc = Central / V
23    end
24
25    @dynamics begin
26        Gut'    = -Ka*Gut
27        Central' =  Ka*Gut - Ke*Central
28    end
29
30    @derived begin
31        dv ~ @. Normal(conc,sqrt(conc^2 *Σ.diag[1] + Σ.diag[end])+eps())
32    end
33 end
```