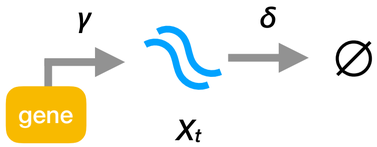
Poisson example

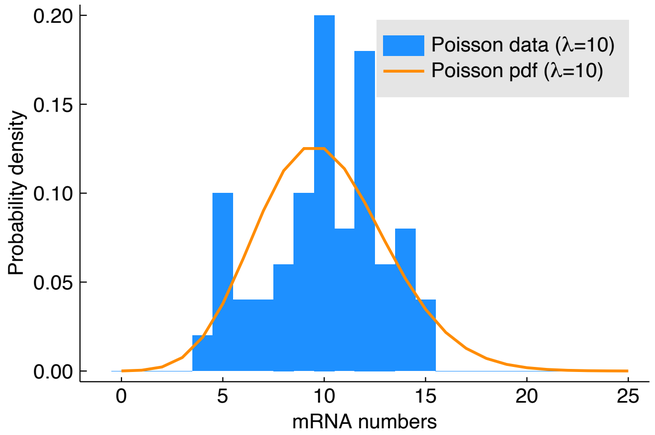


Constitutive gene expression

$$X_{\text{steady state}} \sim \text{Poi}(\frac{\gamma}{\delta}) = \text{Poi}(\lambda)$$

$$\text{with } \lambda = \frac{\gamma}{\delta}$$

Data (N=50)



Analytical result

Prior (conjugated)

$$\lambda \sim \Gamma(\alpha = 10, \beta = 1) \iff p(\lambda) = f_{\Gamma(10,1)}(\lambda)$$

Likelihood (exact)

$$p(D \mid \lambda) = \prod_{i=1}^{N} p(y_i \mid \lambda) = \prod_{i=1}^{N} f_{\text{Poi}(\lambda)}(y_i)$$

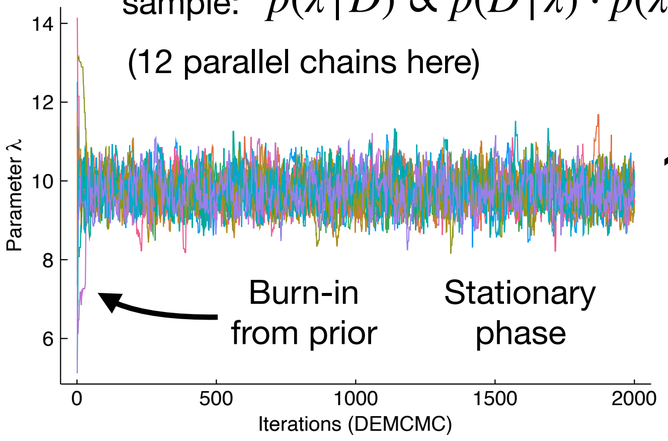
⇒ Posterior (analytical)

$$\lambda \mid D \sim \Gamma(10 + \sum_{i=1}^{N} y_i, N + 1) \iff p(\lambda \mid D) = f_{\Gamma}(\lambda)$$

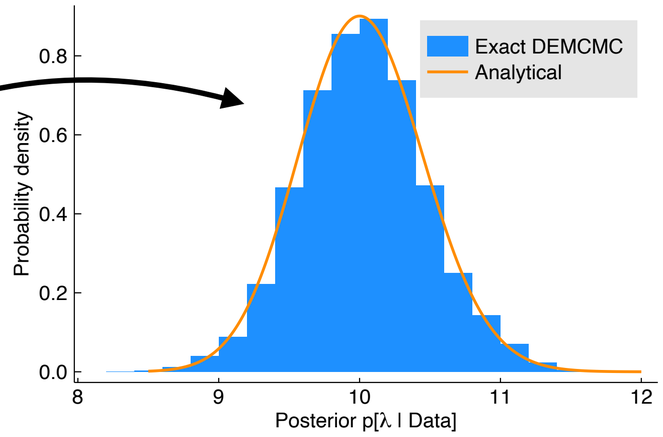
MCMC algorithms

sample: $p(\lambda \mid D) \propto p(D \mid \lambda) \cdot p(\lambda)$

(12 parallel chains here)



Posterior samples (as histogram)



Julia implementation

```julia
λtrue = 10
priors = (λ=(Gamma(λtrue, 1),),)

function loglike(λ, data)
    return sum(logpdf.(Poisson(λ), data))
end

model = DEModel(priors=priors, model=loglike)
de = DE(burnin=1000, priors=priors)

chains_exact = psample(model, de, 2000)
```

[example adapted from paper]