Today

- Finish McElreath Ch 8
- Training via HMC
  - Stan via McElreath's ulam
- Inference from samples

Things I haven’t covered yet!

- Design matrix
- Grammar of graphics/tidyverse
  - ggplot
  - dplyr
- Latex for equations
- Reproducible workflows
- AI tools

Main points McElreath Ch8

- Using HMC via Stan to fit models
- Now getting posterior samples from HMC
- Use ulam in rethinking to do HMC to follow examples
- Same syntax as sampost

Main points McElreath Ch8

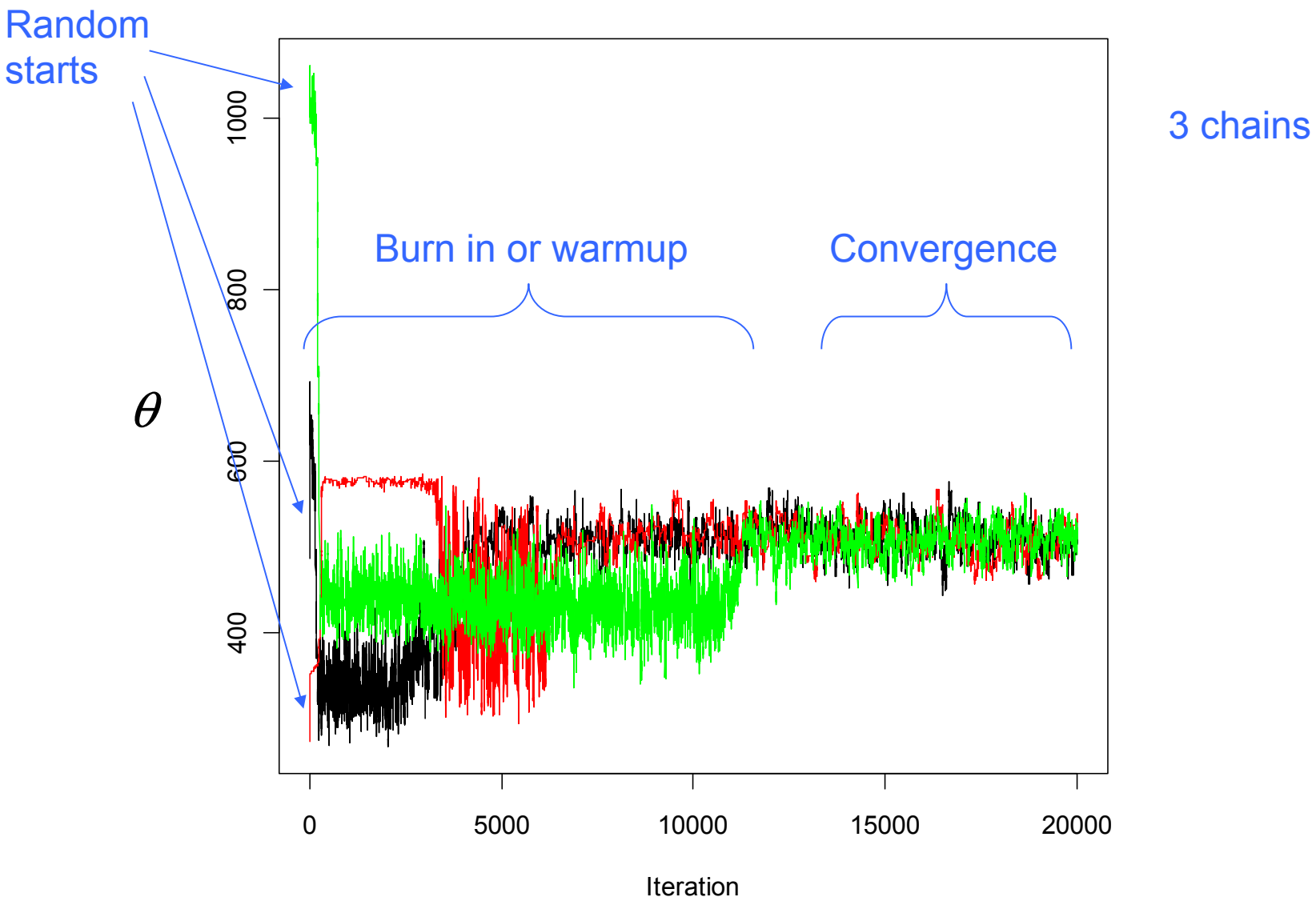
ulam or sampost

```
m1 <- ulam(
  alist(
    y ~ dnorm(mu, sigma),
    mu <- a + b * x,
    a ~ dnorm(0, 100),
    b ~ dnorm(0, 10),
    sigma ~ dcauchy(0, 2)
  ),
  data=d1)
```

Main points McElreath Ch8

- Good choice of priors (weakly informative) can be helpful to tame model fit
  - e.g. Half-Cauchy instead of uniform
- MCMC diagnostics to judge convergence of fit
  - rhat, n_eff
  - plot chain traces ("time series")
- Visualize posteriors
  - histograms, pairs plot

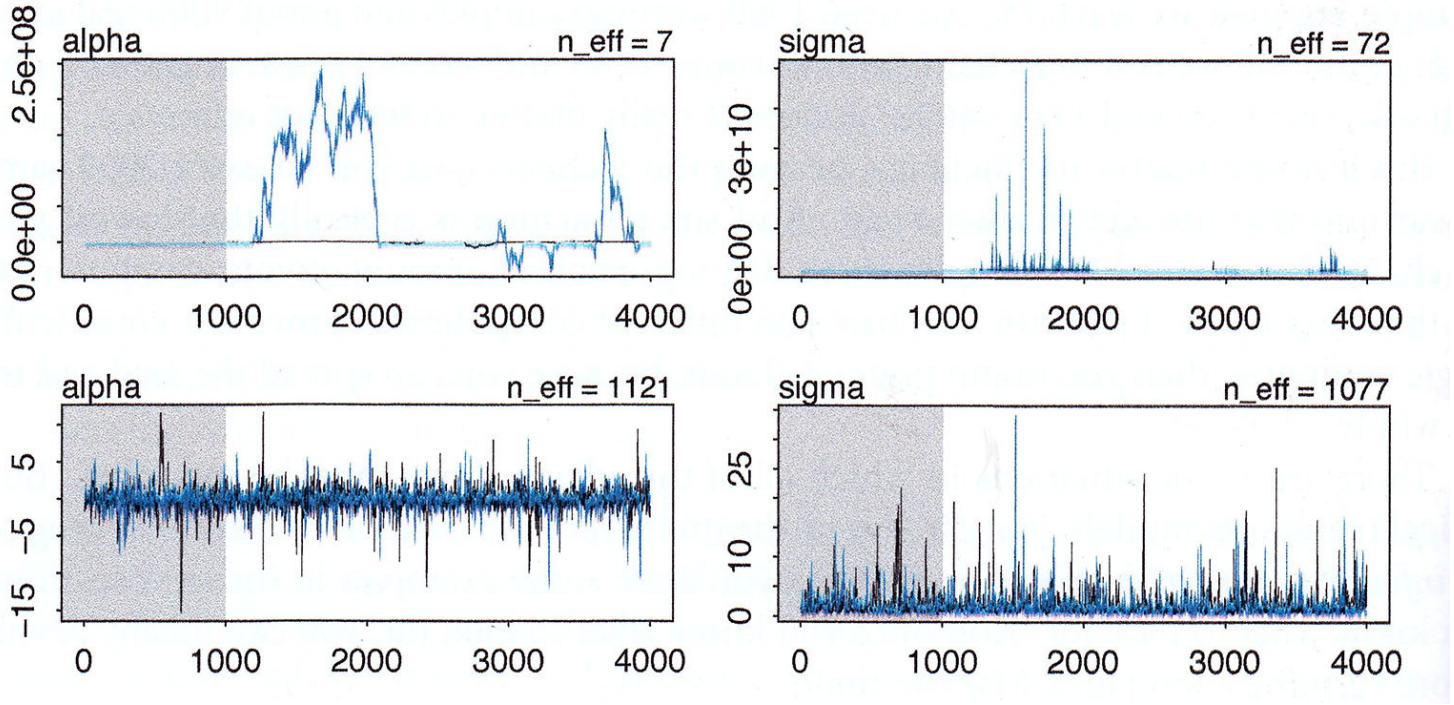
Chains


Random starts
3 chains
Burn in or warmup
Convergence
θ
1000
800
600
400
0
5000
10000
15000
20000
Iteration

Chains

Bad

Good



Fuzzy caterpillars are good!

Fig 8.5

Chains

Not converged Converged

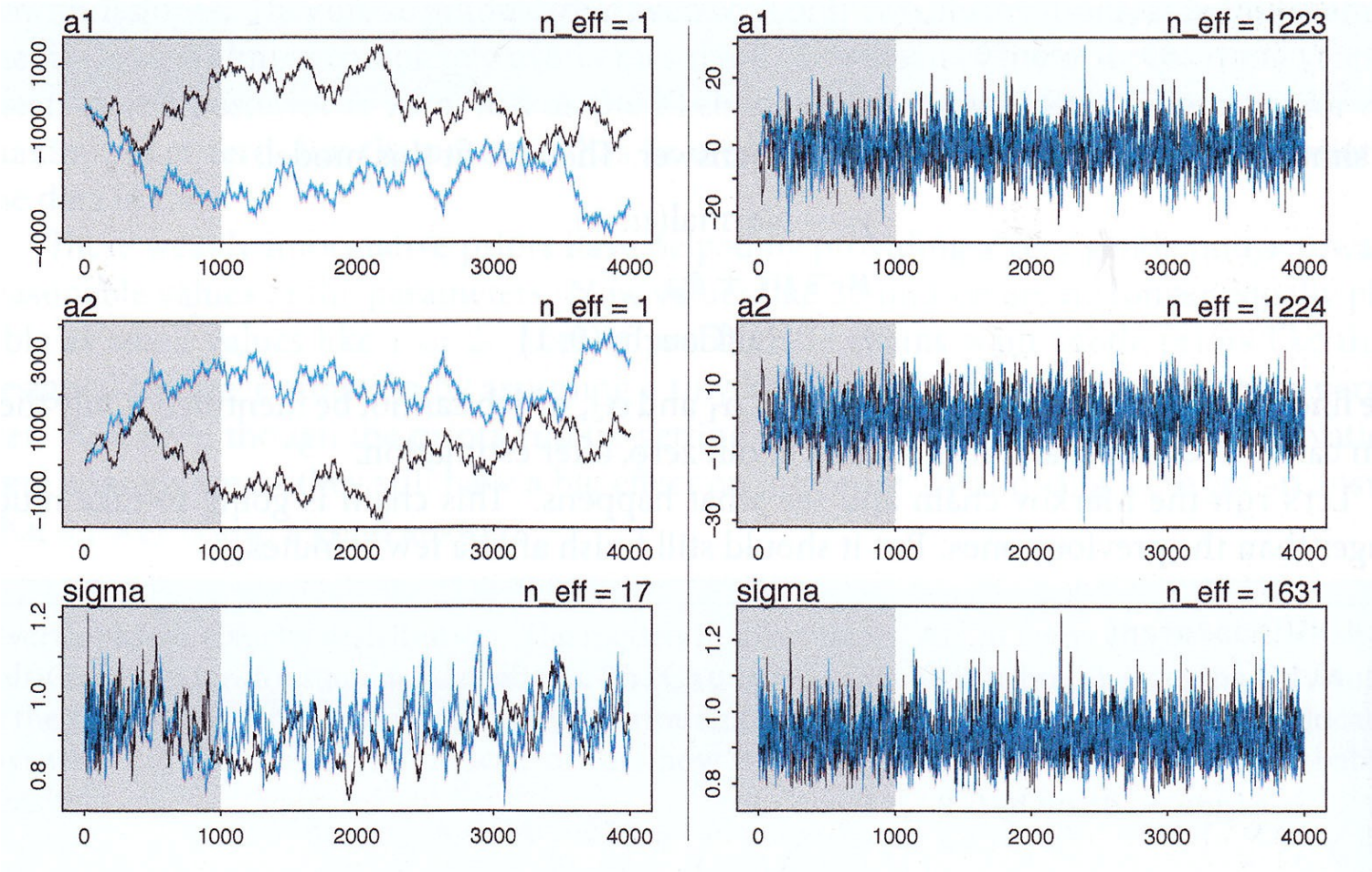


Fig 8.7

How to fix

- Better starting values
- Weakly informative priors
- Uncorrelated parameters (e.g. standardized)
- Less common: adjust MCMC algorithm parameters