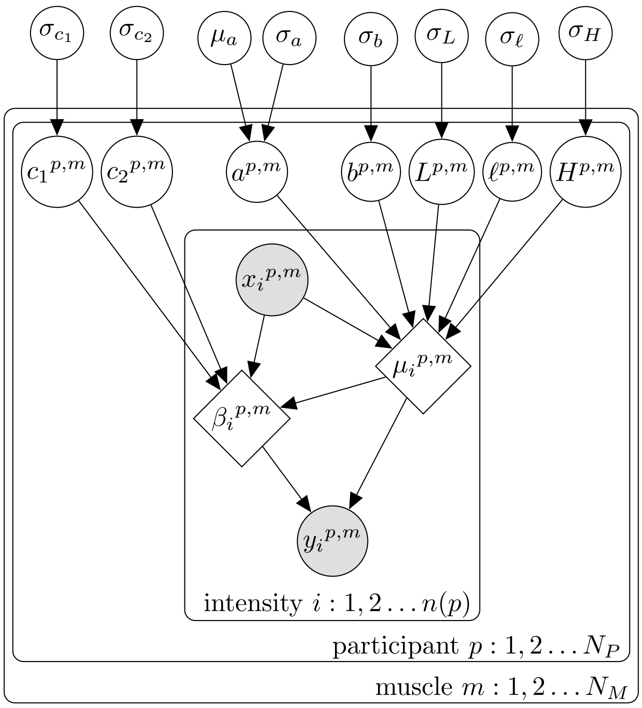
The first stage of hierarchy is the *participant-level* and specifies parametric model $P\left(y_i{}^p \mid x_i{}^p, \theta^p\right)$ for each of the N_P participants and models the MEP size $y_i{}^p$ as a function of stimulus intensity $x_i{}^p$ and participant-specific parameters θ^p. In the second stage, $\theta_1, \theta_2 \ldots \theta^P$ are assumed to be exchangeable and generated from a common distribution $P\left(\theta^p \mid \gamma\right)$ with hyper-parameters γ. In the third stage, the hyper-parameters γ are assumed to be unknown and assigned *weakly-informative* prior, also called hyperprior-density $P\left(\gamma\right)$.

$$y_i{}^p \mid x_i{}^p, \theta^p, \gamma \sim P\left(y_i{}^p \mid x_i{}^p, \theta^p, \gamma\right) \tag{4.2.1}$$

$$\theta^p \mid \gamma \sim P\left(\theta^p \mid \gamma\right) \tag{4.2.2}$$

$$\gamma \sim P\left(\gamma\right) \tag{4.2.3}$$

Figure 4.3.1 shows the graphical representation of the default hierarchical model implemented by hbmep for fitting recruitment-curves on TMS data [ref.] in [ref. to function comparison fig.].



I. Observation model

$y_i{}^{p,m} \sim \mathrm{Gamma}\left(\mu_i{}^{p,m} \cdot \beta_i{}^{p,m}, \beta_i{}^{p,m}\right)$

$\mu_i{}^{p,m} \leftarrow \mathcal{F}\left(x_i{}^{p,m} \mid a^{p,m}, \Omega^{p,m}\right)$

$\beta_i{}^{p,m} \leftarrow \dfrac{1}{c_1{}^{p,m}} + \dfrac{1}{c_2{}^{p,m} \cdot \mu_i{}^{p,m}}$

II. Participant-level parameters

$a^{p,m} \sim \mathrm{TruncatedNormal}\left(\mu_a, \sigma_a\right)$

$\theta^{p,m} \sim \mathrm{HalfNormal}\left(\sigma_\theta\right) \quad \forall \theta^{p,m} \in \Omega^{p,m}$

III. Population-level parameters

$\mu_a \sim \mathrm{TruncatedNormal}\left(50, 20\right)$

$\sigma_a \sim \mathrm{HalfNormal}\left(30\right)$

$\sigma_L \sim \mathrm{HalfNormal}\left(0.05\right)$

$\sigma_\theta \sim \mathrm{HalfNormal}\left(5\right) \quad \forall \sigma_\theta \in \Omega$

Here, $x_i^{p,1} = x_i^{p,2} = \ldots = x_i^{p,N_M} \quad \forall i$

$\Omega^p \leftarrow \{b^{p,m}, L^{p,m}, \ell^{p,m}, H^{p,m}, c_1{}^{p,m}, c_2{}^{p,m}\}$

$\Omega \leftarrow \{\sigma_b, \sigma_\ell, \sigma_H, \sigma_{c_1}, \sigma_{c_2}\}$