$$p(y;\eta) = b(y)\exp(\eta^T T(y) - a(\eta))$$

η : natural parameter (canonical parameter)

$T(y)$: sufficient statistic (usually $T(y) = y$)

$a(\eta)$: log partition function

$\exp(-a(\eta))$: usually normalization constant

$$\sum p(y;\eta) = 1 \quad \text{or} \quad \int p(y;\eta) = 1$$

$T, a, b ; \eta \rightarrow$ defines the family of distribution

<Gaussian distribution>

$$\begin{aligned}
p(y;\mu) &= \frac{1}{\sqrt{2\pi}} \exp\left(-\frac{1}{2}(y-\mu)^2\right) \\
&= \frac{1}{\sqrt{2\pi}} \exp\left\{-\frac{1}{2}(y^2 - 2\mu y + \mu^2)\right\} \\
&= \frac{1}{\sqrt{2\pi}} \exp\left\{-\frac{1}{2}y^2 + \mu y - \frac{1}{2}\mu^2\right\} \\
&= \frac{1}{\sqrt{2\pi}} \exp\left(-\frac{1}{2}y^2\right) \times \exp\left(\mu y - \frac{1}{2}\mu^2\right)
\end{aligned}$$

$\rightsquigarrow$

$T(y) = y$

$a(\eta) = \frac{1}{2}\mu^2$

$b(y) = \frac{1}{\sqrt{2\pi}} \exp\left(-\frac{1}{2}y^2\right)$

$\eta = \mu$

$a(\eta) = \frac{1}{2}\eta^2$