# LogGamma prior

## Parametrization

The Gamma distribution has density

$$\pi(\tau) = \frac{b^a}{\Gamma(a)} \tau^{a-1} \exp(-b\ \tau) \quad (1)$$

for $\tau > 0$ where:

$a > 0$ is the shape parameter, and

$b > 0$ is the inverse-scale parameter.

The mean of $\tau$ is $a/b$ and the variance is $a/b^2$, and we denote this distribution $\text{Gamma}(a, b)$. The variable $\theta$ has[1] a *logGamma*$(a, b)$ distribution, if $\theta = \log(\tau)$ and $\tau$ is $\text{Gamma}(a, b)$ distributed.

## Specification

The LogGamma prior for the hyperparameters is specified inside the `f()` function as following using the old-style,

```
f(<whatever>,prior=loggamma, param=c(<a>,<b>))
```

or better, the new style

```
f(<whatever>, hyper = list(<theta>) = list(prior="loggamma", param=c(<a>,<b>)))
```

In the case where there is one hyperparameter for that particular f-model. In the case where we want to specify the prior for the hyperparameter of an observation model, for example the Gaussian, the the prior spesification will appear inside the control.family()-argument; see the following example for illustration.

## Example

In the following example we estimate the parameters in a simulated example with gaussian responses and assign the hyperparameter (the precision parameter), a logGamma prior with parameters $a = 0.1$ and $b = 0.1$

```
n=100
z=rnorm(n)
y=rnorm(n,z,1)

data=list(y=y,z=z)
formula=y~1+z
result=inla(formula,family="gaussian",data=data,
       control.family=list(hyper = list(prec = list(prior="loggamma",param=c(0.1,0.1)))))
```

## Notes

None

[1]We *define* it in this way; if variable $X$ has distribution $D$ then $\log(X)$ has distribution *logD*. This is oposite to the implicite convention leading to the definition of the logNormal distribution, which we believe is confusing.