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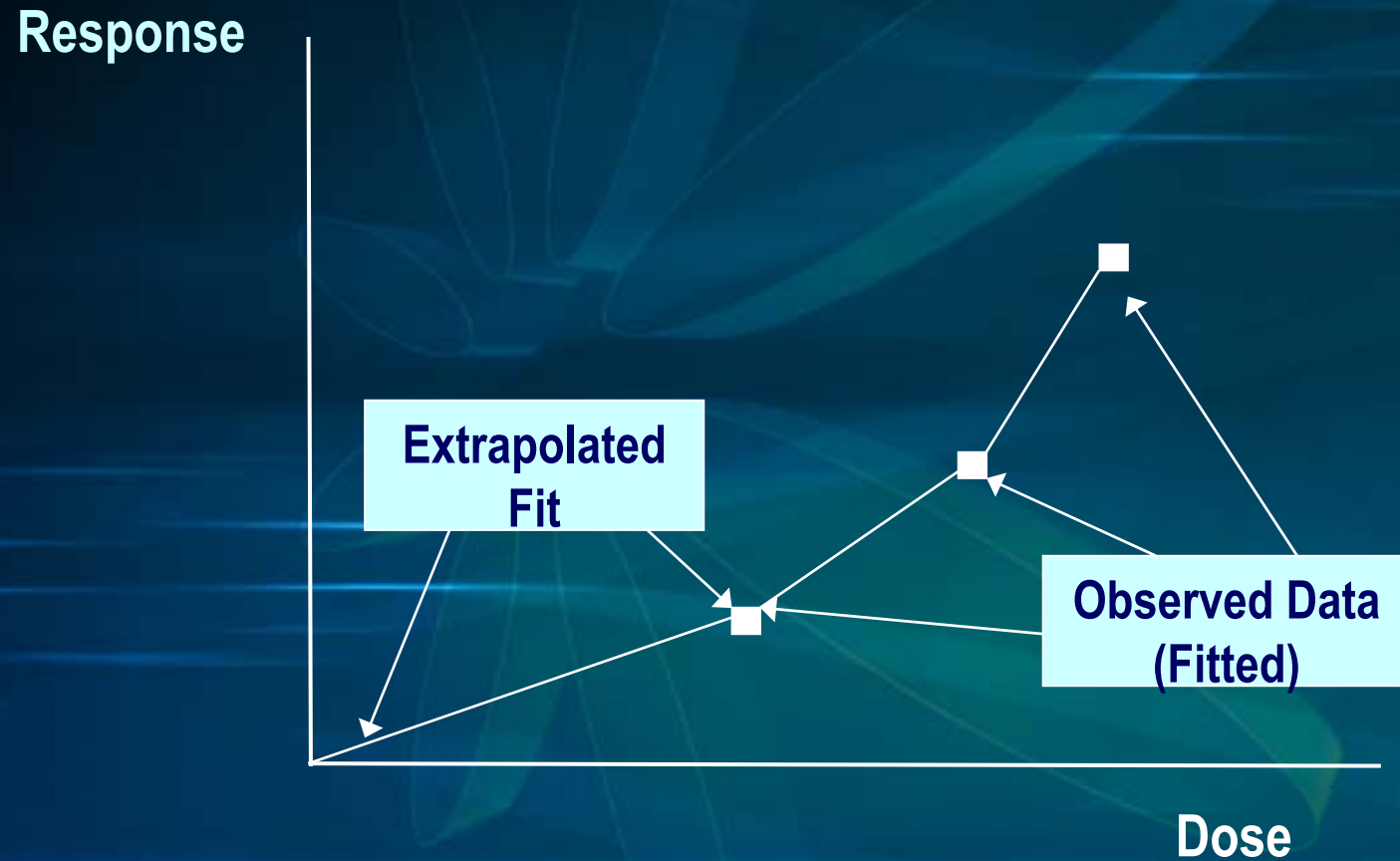
**Quantitative risk assessment  
could be defined as a  
method suitable to give a  
quantitative characterization  
of risks across a range of  
doses**

**The preferred approaches are  
dose-response models that  
characterize risk as a  
probability over a range of  
environmental exposure  
levels**

**These risk probabilities allow estimates of the risk reduction under different decision options.**

**They provide the risk information needed for benefit-cost analyses of different decision options.**

# Diagrammatic representation of the use of mathematical models to fit observed data and extrapolation to low dose

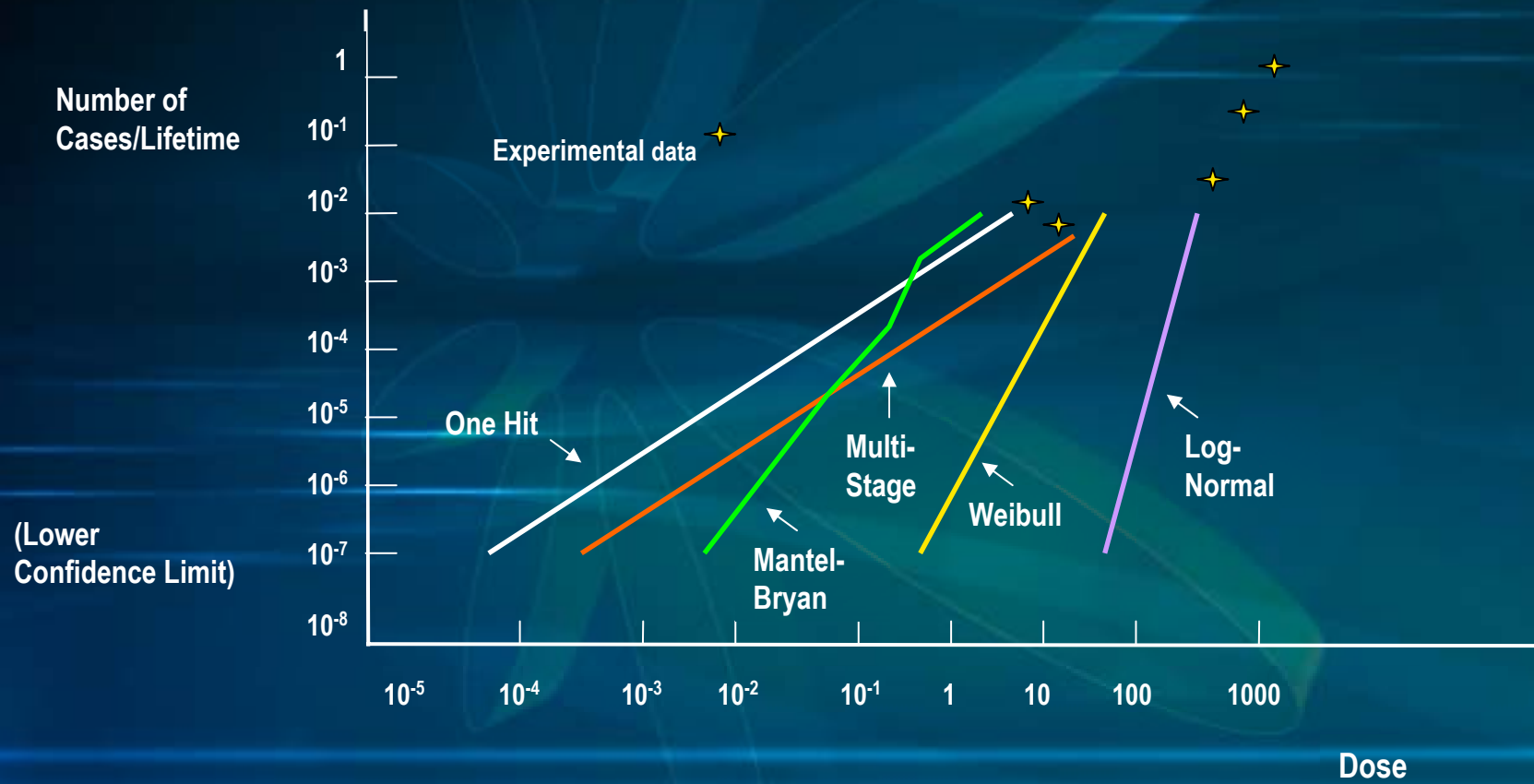


# List of models used for carcinogen risk assessment

Category	Model	Underlying Biology
Stochastic or mechanistic, and/or linearised	One-hit Multi-hit Multi-stage Linearised multi-stage	Single "hit" or several random hits can initiate the irreversible process leading to cancer
Tolerance distribution	Weibull Logit Probit (Mantel-Bryan)	A population contains a distribution of individuals of different susceptibility
Time-to-tumour	Log-normal distribution Weibull distribution Hartley-Sielken Armitage-Doll Multi-stage (adapted)	Presence or absence of a tumour in an animal by a fixed time
Biologically motivated	Moolgavkar-Venzon-Knudson	Based on knowledge of tissue growth and cell kinetics



# Estimation of cancer risk by different mathematical models from a single set of experimental data calculated for Ethylenethiourea (redrawn from Cothurn, 1986)

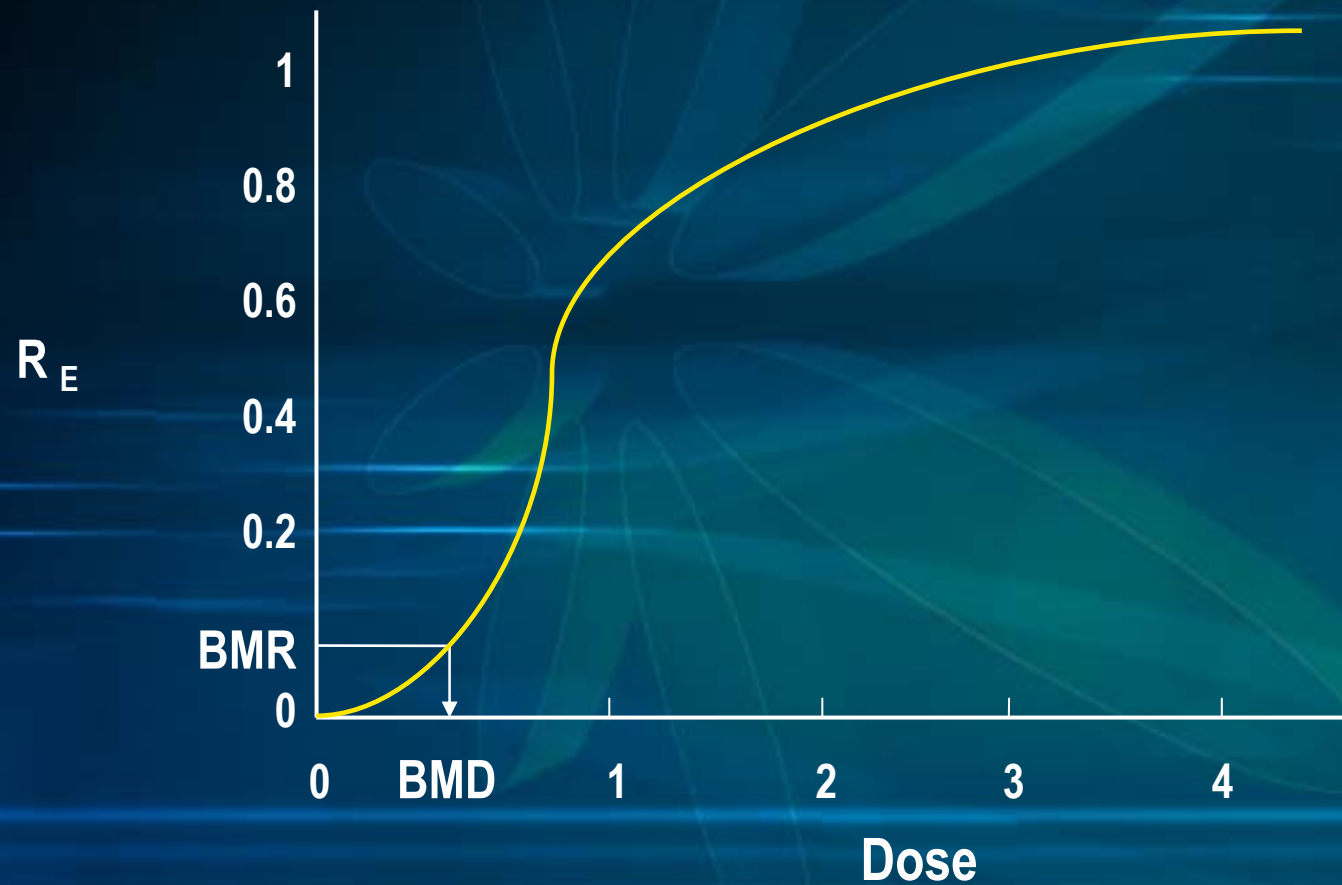


# Benchmark Dose (BMD)

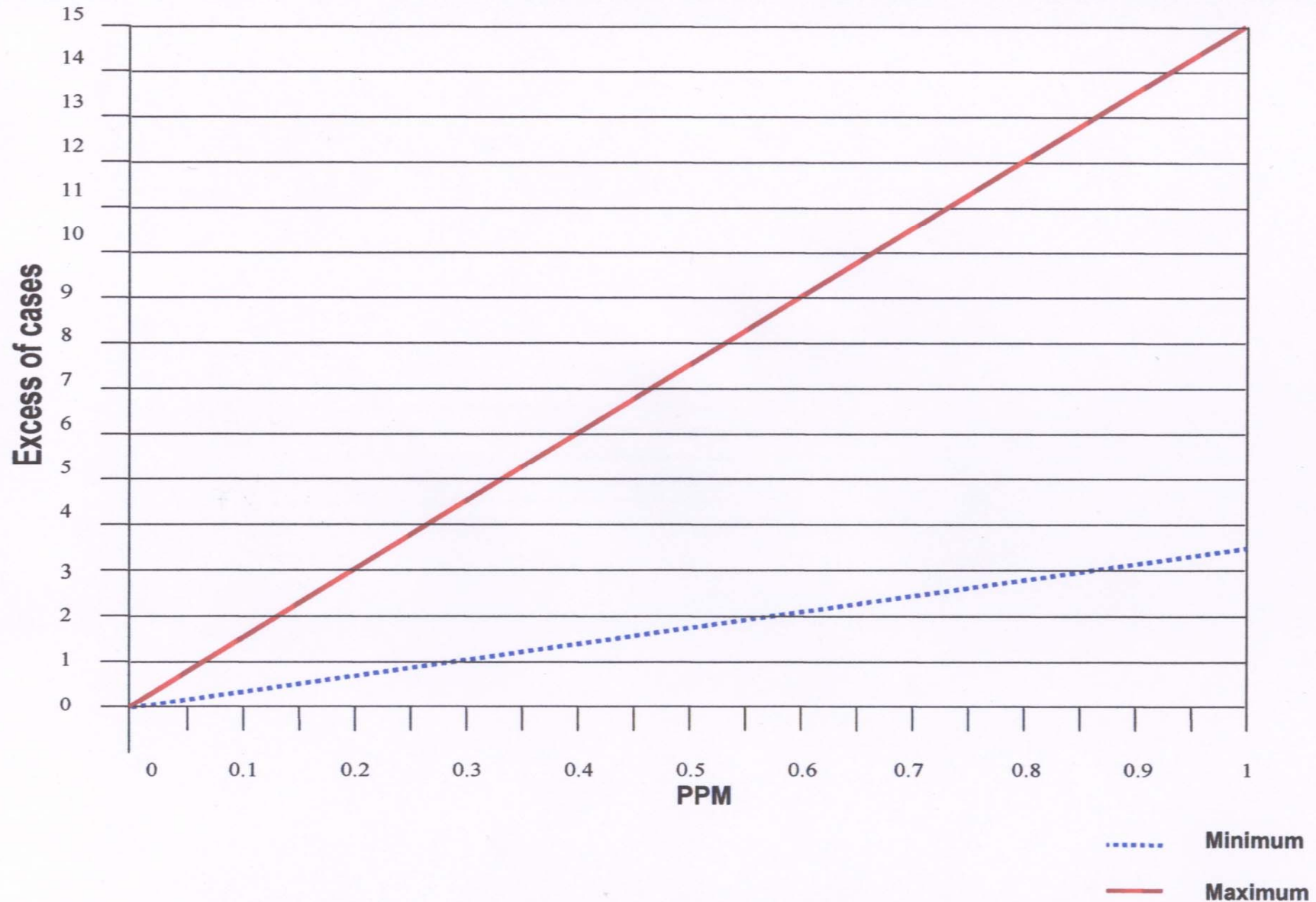
**Mathematical model fitted to the experimental data within the observable range to estimate a dose corresponding to a defined level of effect, to arrive at a level of acceptable exposure to the hazard.**



# Construction of estimated BMD (at BMR = 0.10) by inverting the estimated extra risk function $R_E$



# Excess of leukaemia cases (min/max) for 1000 exposed people for 40 years



		Exposure per year (ppm)						
		0.1	0.2	0.5	1	2	5	10
<b>Excess of leukaemia cases</b>	<b>Minimum</b>	0	0	0	0	0	0	2.21
	<b>Maximum</b>	7.13	7.13	7.13	7.13	8.37	17.01	17.37

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