# Article information:

Markovian approaches to modeling intracellular reaction processes with molecular memory | PNAS
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# Article summary:

1. Intracellular reaction processes may be nonmarkovian due to molecular memory, which creates nonexponential waiting-time distributions.

2. A systematic approach, including the stationary generalized chemical-master equation (sgCME), the stationary generalized Fokker–Planck equation, and the generalized linear-noise approximation, has been developed to model nonmarkovian reaction kinetics in a general reaction network with arbitrary intrinsic waiting-time distributions.

3. Molecular memory can have significant effects on gene-expression regulation, inducing bimodality, fine-tuning expression noise, and inducing switch. These formulations can have broad applications and may help us discover new biological knowledge underlying memory effects.

# Article rating:

Appears well balanced: The article presents the information in a reliable and balanced way, without biases and prejudices. The claims made in the article are well supported and, where applicable, all sides of the argument are given opportunity to present their point of view. The article appears trustworthy and reliable.

# Article analysis:

本文是一篇关于细胞内反应过程建模的研究论文，主要介绍了一种新的方法来处理具有分子记忆的非马尔可夫反应动力学。文章指出，传统上，对于细胞内生化过程的建模都基于马尔可夫假设，即反应物的随机运动不受先前状态的影响，只受当前状态的影响。然而，在实际情况中，当反应物与环境相互作用时，分子记忆肯定存在，并且其效果不能被忽略。因此，作者提出了一种新的公式——稳态广义化学主方程（sgCME），将非马尔可夫问题转化为马尔可夫问题，并保持稳态概率行为不变。此外，作者还开发了广义福克-普朗克方程和广义线性噪声逼近等公式来快速评估波动。这些公式可以有广泛的应用，并可能帮助我们发现分子记忆效应下新的生物学知识。

从内容上看，本文并没有明显偏见或宣传内容。但是，在某些方面可能存在片面报道或缺失考虑点。例如，在介绍马尔可夫假设时，并没有提到其局限性和适用范围；在讨论分子记忆时，并没有涉及到其可能对细胞功能产生负面影响或风险；在探讨新方法时，并没有与其他已有方法进行比较和验证等。

总之，本文是一篇科学研究论文，提供了一种新方法来处理具有分子记忆的非马尔可夫反应动力学问题。虽然可能存在某些片面报道或缺失考虑点，但整体上并没有明显偏见或宣传内容。

# Topics for further research:

* Limitations of Markov assumption
* Applicability of Markov assumption
* Negative effects or risks of molecular memory
* Comparison and validation with existing methods
* Generalized Fokker-Planck equation
* Generalized linear noise approximation

# Report location:

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