The mathematics of the immune system

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List of Topics.

No.	Date	Title of the topic and short description	Speaker
1		**Minimal antibody repertoire and reliability of the self-non-self discrimination**: to study the paper [9] as well as some parts of [5] (in particular Theorem 1).	
2		**A matching problem in immunology**: to study [6] as well as Section II.C in [10].	
3		**Models of kinetic proofreading:** to study [3] + [2] (this talk could be divided into two talks if the number of participants is large).	
4		**Receptor clustering:** to study [7] (if the number of participants is large we can study also the follow up papers)	
5		**Optimal strategies in immunology:** to study [8]	
6		**Maturation of antibody affinity:** to study [4]	
7		**Immunological memory:** to study [13] (depending on the number of students we can add also [1] as another talk)	
8		**Chemical networks in immunology (generalization of kinetic proofreading):** to study [11]	

Literature

[1] R. J. De Boer, A. S. Perelson , I. G. Kevrekidis. Immune network behavior—I. From stationary states to limit cycle oscillations. *Bulletin of mathematical biology*, 55.4 (1993).

[2] E. Franco , and J. J. L. Velázquez. A stochastic version of the Hopfield-Ninio kinetic proofreading model. To appear *SIAM Journal on Applied Mathematics* (2025).

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[4] T. B. Kepler, A. S. Perelson, (1993). Somatic hypermutation in B cells: an optimal control treatment. *Journal of theoretical biology*, 164(1).

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[6] J. K. Percus, O.E. Percus and A.S. Perelson Predicting the size of the T-cell receptor and antibody combining region from consideration of efficient self-nonself discrimination. *Proceedings of the National Academy of Sciences* 90.5 (1993).

[7] A. S. Perlson and Delish C. Receptor clustering on a cell surface I. *Mathl. Biosci* 53.1 (1981).

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[10] A. S. Perelson and G. Weisbuch . Immunology for physicists. *Reviews of modern physics* 69.4 (1997).

[11] A. D. Rendall, E. D. Sontag. Multiple steady states and the form of response functions to antigen in a model for the initiation of T-cell activation. Royal Society Open Science, 4.11 (2017).

[12] J. V. Uspensky. Introduction to mathematical probability. (1937).

[13] G. Weisbuch, R. J. De Boer, and A. S. Perelson. "Localized memories in idiotypic networks." *Journal of theoretical biology* 146.4 (1990).