Selection and characterization of bioreceptors to develop nanoparticle-based lateral-flow immunoassays under COVID-19 pandemic

Enric Calucho [1,†]

Liming Hu [1,†], Celia Fuentes-Chust [1], Claudio Parolo [1,2], Andrea Idili [1], Ruslan Álvarez-Diduk [1], Lourdes Rivas [1], Arben Merkoçi [1,3]

[1] Catalan Institute of Nanoscience and Nanotechnology (ICN2), Avinguda de Serragalliners S/N, 08193 - Bellaterra (Barcelona), Spain
[2] ISGlobal, Barcelona Institute for Global Health, Carrer del Rosselló 132, 08036 - Barcelona, Spain
[3] Institució Catalana de Recerca i Estudis Avançats (ICREA), Passeig de Lluís Companys 23, 08010 - Barcelona, Spain
† These auhors contributed equally

arben.merkoci@icn2.cat

The ongoing COVID-19 pandemic has shown the importance of developing reliable yet easy-to-use, cheap, fast, and portable diagnostic devices to support mass-testing. [1-3] As suggested by World Health Organization (WHO), in order to meet such a high demand of testing, countries have been relying on Lateral Flow Assays (LFAs), due to their inherent features, *e.g.* fast, low-cost, user-friendly.
The selection of a suitable bioreceptor is not an automatic step in the development of LFA. Detailed information on binding affinity and association kinetics is not always found in commercial antibodies, thus creating a scenario in which new antibodies have to be tested in a trial and error fashion. With the motivation to develop a LFA to detect SARS-CoV-2 nucleoprotein, we implemented a two-step methodology to screen antibodies for their suitability as bioreceptors in LFA, consisting in: (1) enzyme-linked immunosorbent assays (ELISA), to quickly check antibody binding performance; and (2) half-stick format LFA, to check their compatibility with the conditions encountered in a LFA (*i.e.*, under a constant flow in a nitrocellulose membrane). Up to 80 antibody couples have been tested, of which only 4 were deemed suitable to be used on the final half-stick LFA format. The entire selection process required over 10 months and ~25,000 €. Herein we raise the issue as to whether antibody producers should implement more extensive characterization of their products, which in turn would definitely help the research community in their purchases.

References

[1] Wells, C.R., J.P. Townsend, A. Pandey, S.M. Moghadas, G. Krieger, B. Singer, R.H. McDonald, M.C. Fitzpatrick, A.P. Galvani, Optimal COVID-19 quarantine and testing strategies, Nat. Commun. 2021, 12, 1–9.
[2] Guglielmi, G., Fast Coronavirus Tests Are Coming, Nature. 2020, 585, 496.
[3] Larremore, D.B., B. Wilder, E. Lester, S. Shehata, J.M. Burke, J.A. Hay, M. Tambe, M.J. Mina, R. Parker, Test sensitivity is secondary to frequency and turnaround time for COVID-19 surveillance, MedRxiv. 2020.