**Table S1. HA protein sequences of H1N1 influenza vaccines for strains recommended by the WHO from 2011 to 2020**

|  |  |  |  |
| --- | --- | --- | --- |
| Strain | Subtype | Protein | GISAID Accession |
| A/California/7/2009 | H1N1 | HA | EPI1593569 |
| A/Christchurch/16/2010 | H1N1 | HA | EPI280344 |
| A/Michigan/45/2015 | H1N1 | HA | EPI1349891 |
| A/Brisbane/02/2018 | H1N1 | HA | EPI1312566 |
| A/Guangdong-Maonan/SWL1536/2019 | H1N1 | HA | EPI1542573 |
| A/Victoria/2570/2019 | H1N1 | HA | EPI1801565 |
| A/Wisconsin/588/2019 | H1N1 | HA | EPI1661758 |
| A/Hawaii/70/2019 | H1N1 | HA | EPI1617983 |

**Table S2. Average particle size, PDI and encapsulation efficiency of H1c-mRNA-LNPs**

|  |  |  |  |
| --- | --- | --- | --- |
| **Record** | **Average particle size** | **PDI** | **encapsulation efficiency** |
| 1 | 76.56 | 0.049 | 94.5% |
| 2 | 77.46 | 0.040 | 94.2% |
| 3 | 77.24 | 0.045 | 95.7% |
| Average | 77.09 | 0.045 | 94.8% |

**Figure S1.** Cross-reactive neutralizing antibody response of H1c-mRNA-LNPs in mice. Each BALB/c female mouse received intramuscular immunization with 2 µg (n = 9), 10 µg (n = 9), or 20 µg (n = 9) of H1c-mRNA-LNPs, followed by a booster at the same dose on day 21. Mice received 15 µg of the H1N1 split vaccine (n = 9) or PBS (n = 9) as control. Serum was harvested on days 21 and 42 after the initial immunization. Neutralizing antibodies were measured by microneutralization assay. Two-way ANOVA was used to compare the differences. ns, not significant; \*, *P <* 0.05; \*\*, *P <* 0.01; \*\*\*, *P <* 0.001; \*\*\*\*, *P <* 0.0001; ns, not significant. MN, microneutralization; ANOVA, analysis of variance; PBS, phosphate-buffered saline