

Case Study: Moderna, Inc.

mRNA Vaccines and Therapeutics

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Biotechnology Internship



Moderna, Inc.: mRNA Biotech Case Study

Company Overview

- **Founded:** 2010 in Cambridge, Massachusetts (originally “ModeRNA Therapeutics”). Moderna was co- founded by RNA biologists including Derrick Rossi and is now led by CEO Stéphane Bancel (appointed 2011).
- **Mission:** Specializes in RNA-based therapeutics, primarily messenger RNA (mRNA) vaccines and treatments. Its name “Moderna” derives from “modified RNA” reflecting this focus.
- **Scale:** Publicly traded (Nasdaq: MRNA) biotech with ~5,800 employees (2024). By 2024 it has advanced 44 drug/vaccine candidates (37 in clinical trials) across infectious diseases, rare diseases, and cancer.

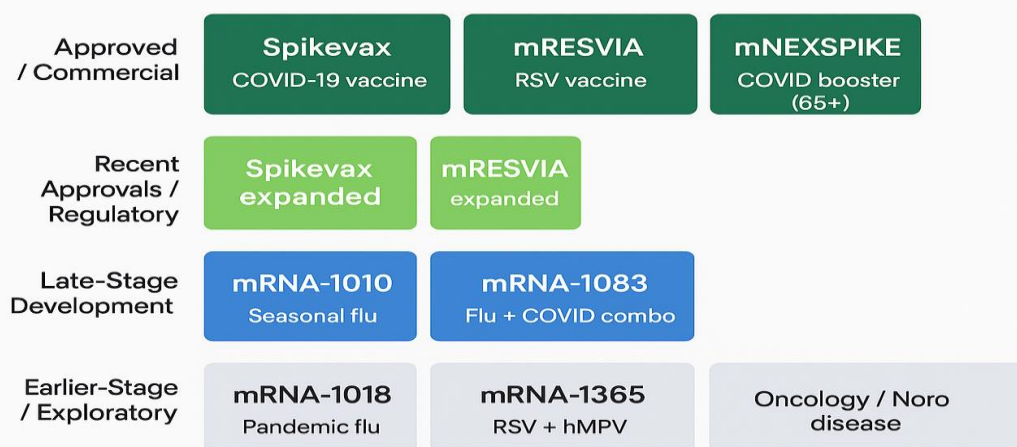
Technology and Innovation

- **mRNA Platform:** Moderna’s core innovation is using synthetic mRNA to instruct cells to produce therapeutic proteins. This approach allows rapid design of vaccines by encoding the genetic blueprint of antigens. The COVID-19 pandemic “proved that mRNA was the fastest route to developing highly effective vaccines”.
- **Speed & Flexibility:** Moderna demonstrated unprecedented speed: for example, its first human mRNA vaccine trial (an influenza candidate) occurred in 2015. mRNA technology’s modularity lets Moderna pivot quickly between targets (COVID, RSV, flu, etc.).
- **Support & Funding:** Moderna secured hundreds of millions in government funding (e.g., DARPA, Operation Warp Speed) to accelerate R&D. For COVID-19, it received nearly \$1 billion from U.S. programs, enabling rapid late-stage trials and deployment.

Key Products and Pipeline

- **Spikevax (COVID-19 Vaccine):** Moderna's first approved product, an mRNA vaccine against SARS- CoV- 2. Full FDA approval (as "Spikevax") was granted in early 2022; billions of doses have been administered globally. Spikevax generated most of Moderna's early revenue.
- **mRESVIA (RSV Vaccine):** The company's second approved product (respiratory syncytial virus vaccine for older adults). FDA approval was obtained in 2024. This expanded Moderna's commercial portfolio beyond COVID-19.
- **mNEXSPIKE (New COVID Booster):** Moderna's third product, a 2025-approved variant COVID booster for older/high-risk individuals (65+) and children (6m–11y). This targets waning immunity and viral variants.
- **Pipeline Candidates:** Moderna lists about 44 mRNA vaccine/therapy candidates. These span **infectious diseases** (influenza, cytomegalovirus, Zika, HIV, chikungunya, Nipah, etc.), **cancer vaccines** (e.g. personalized mRNA-4157 for melanoma), and **rare diseases**. The breadth illustrates its platform approach.

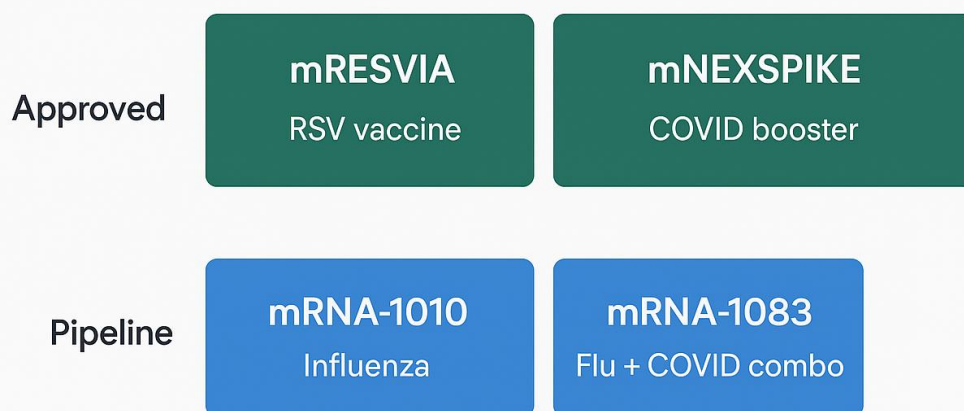
Moderna's 2025 Prioritised R&D Pipeline



Respiratory Vaccines Portfolio

- **COVID-19 Vaccines:** In addition to adult boosters, Moderna has secured authorization for children. Its pediatric Spikevax (for ages 6–11, high-risk) was recently approved[4]. By Fall 2023, Moderna's U.S. market share of COVID-19 vaccines reached ~48% (up from 37% in 2022).
- **mRESVIA (RSV):** Approved for seniors (60+) in 2023, and expanded in 2025 to high-risk adults 18–59[4]. The CDC's Advisory Committee on Immunization Practices (ACIP) has recommended it for these groups, reflecting its public health role.
- **Influenza and Combo Vaccines:** Moderna reported positive Phase-3 results for mRNA-1010 (quadrivalent flu vaccine) demonstrating ~26.6% higher efficacy than standard flu shots[3]. Its flu/COVID combo candidate (mRNA-1083) is in late-stage development. These candidates illustrate efforts to repurpose mRNA tech into routine respiratory vaccines[3].

Moderna's Respiratory Vaccine Pipeline



Market Impact

- **Pandemic Success:** Moderna's mRNA vaccines were central to the COVID-19 response. It delivered hundreds of millions of doses worldwide, demonstrating the real-world power of mRNA. The UK and other governments even partnered to build new mRNA R&D/manufacturing hubs (e.g. Harwell, UK) because of Moderna's success.
- **Revenue Peak:** Sales surged in 2021–2022. Moderna reported roughly **\$19.3 billion** in COVID-19 vaccine revenue for 2022, boosting its market capitalization to ~\$185 billion at the pandemic peak.
- **Market Share:** In the U.S. retail vaccine market, Moderna's Spikevax achieved about **48%** share in Fall 2023. This was a big gain from 37% in 2022, roughly a 30% relative increase in share over one year.
- **Revenue Decline:** As COVID became endemic, demand fell sharply. By 2024 revenue plunged to around **\$3.2 billion**. (This is about an **83%** decline from \$19.3B in 2022). Moderna's market capitalization similarly fell ~90% to ~\$10 billion by late 2025. These changes reflect the transient nature of pandemic-driven sales.

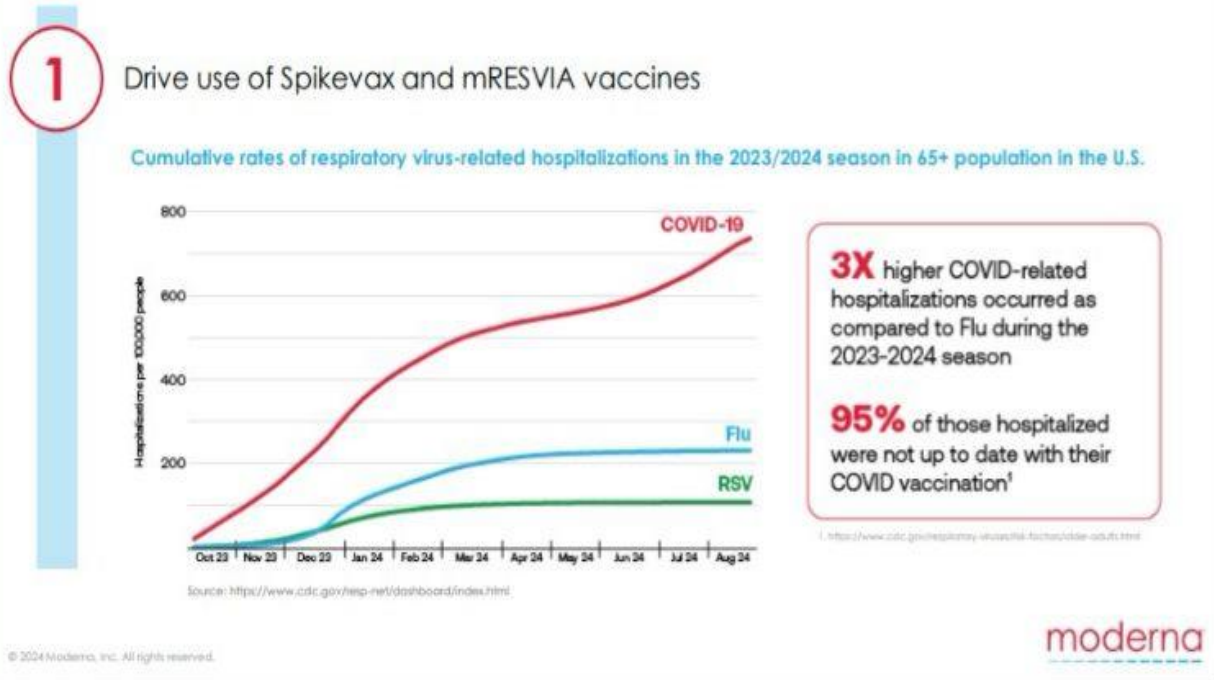
Challenges and Competition

- **Falling Demand:** The swift drop in COVID-vaccine uptake led to massive revenue declines. Moderna has had to slash manufacturing and staffing to align with lower demand, testing its ability to pivot to other products.
- **Government Support:** Originally propelled by Operation Warp Speed, Moderna has faced reduced government buying. In 2025, U.S. HHS canceled a **\$766 million** contract for bird-flu vaccine preparedness, indicating policy shifts. (Notably, this occurred under an HHS Secretary known for COVID-vaccine skepticism.)
- **Intellectual Property Battles:** Moderna's mRNA patents are being challenged. For example, in 2025 the U.S. Patent Trial and Appeal Board invalidated key claims of two Moderna COVID-19 vaccine patents following litigation with Pfizer/BioNTech[6]. Ongoing patent disputes introduce risk and uncertainty.
- **Competition:** Other biotech firms (notably Pfizer/BioNTech) also have mRNA vaccines, and new entrants (GSK, CureVac, Sanofi, etc.) are developing mRNA platforms. Success in saturated vaccine markets (influenza, RSV) is not guaranteed.

- **Technical Hurdles:** mRNA drugs require complex manufacturing (lipid nanoparticles, cold-chain). Scaling production efficiently has been challenging; Moderna is addressing this (see below) but it remains a technical barrier.

Financial Performance & Strategy

- **Recent Results:** By 2024 Moderna's annual revenue was about **\$3.24 billion**, reflecting the mid-pandemic demand collapse. In Q2 2025, quarterly revenue was **\$142 million** (down 41% YoY) with net product sales \$114M[7]. The company reported a **net loss of \$0.8 billion** for Q2 2025[8].
- **Cost Reduction:** Moderna has aggressively cut costs to improve sustainability. It slashed operating expenses by about 35% in Q2 2025 vs. Q2 2024[8]. Management aims to halve annual operating expenses (from ~\$11.1B in 2023 to ~\$4.7–5.0B by 2027) to reach breakeven by 2028[9].
- **Cash Reserves:** Despite losses, Moderna maintained a strong cash position (~\$7–8B in reserves in 2025[7]), giving it runway to continue R&D and pivot strategies.



Future Outlook and Initiatives

- **New Approvals:** Moderna is expanding its label. As of 2025, it has won FDA approvals for mNEXSPIKE (COVID-19 booster for 65+/high-risk 12–64) and Spikevax for children (6m–11y)[4]. Such expansions should bolster sales in niche segments.
- **Pipeline Progress:** The company is advancing its late-stage programs. For instance, mRNA-1010 (flu vaccine) met its primary endpoint with higher efficacy[3]. It aims to submit these for approval soon. Positive trial results for new vaccines could drive future growth.
- **Cancer Vaccines:** Moderna partners with Merck on mRNA-4157 (a personalized cancer vaccine). This candidate gained FDA “breakthrough” status in 2023. If successful, this could open the lucrative oncology market.
- **Manufacturing & Tech:** To improve production, Moderna acquired OriCiro Genomics in 2023 (creating “Moderna Enzymatics”). OriCiro’s enzyme-based mRNA synthesis can shorten manufacturing times and reduce costs. Moderna also collaborates on advanced tech – for example, partnering with IBM on AI and quantum computing to accelerate R&D.
- **Global Health Partnerships:** Moderna is investing in broader mRNA access. It joined with CEPI (Coalition for Epidemic Preparedness Innovations) to develop outbreak-response vaccines. Its *mRNA Access Program* provides researchers worldwide with mRNA tools for neglected diseases. These initiatives aim to leverage its platform for global health beyond COVID-19.

Conclusion

Moderna has dramatically demonstrated the power of mRNA biotechnology. Its platform enabled one of the world’s fastest vaccine developments, saving countless lives in the COVID-19 pandemic. However, this case also shows the volatility of biotech markets: without pandemic demand, revenues plunged by over 80% and the company faces stiff competition and patent uncertainties. Moderna’s future hinges on diversifying its mRNA applications – from flu and RSV vaccines to cancer immunotherapies – while executing a leaner operational strategy. Its story highlights how cutting-edge biotech can deliver rapid breakthroughs but must continually innovate and adapt to sustain long-term impact.