Journal 3: Pfizer and BioNTech Vaccine Announcement

BMES Cell Team

Fall 2020

Outline

- Background
    - Clinical Trials
    - Vaccine Candidate Overview
- Article Background
    - Press Release
    - Pfizer Protocol
    - News Article
- Discussion Questions
    - Breakout Rooms

https://giphy.com/gifs/nestaway-animation-coronavirus-corona-KzcZehxjzsH8Ix110Nhttps://tekdeeps.com/cool-india-ready-to-trial-covid-19-vaccine-to-humans-in-august/

Background: Clinical Trials

https://giphy.com/gifs/fergie-xT9IgwO5n8TslpaMSc

Clinical Trial Phases

Phase 1

- 20 – 80 subjects
- Focus: safety

Phase 2

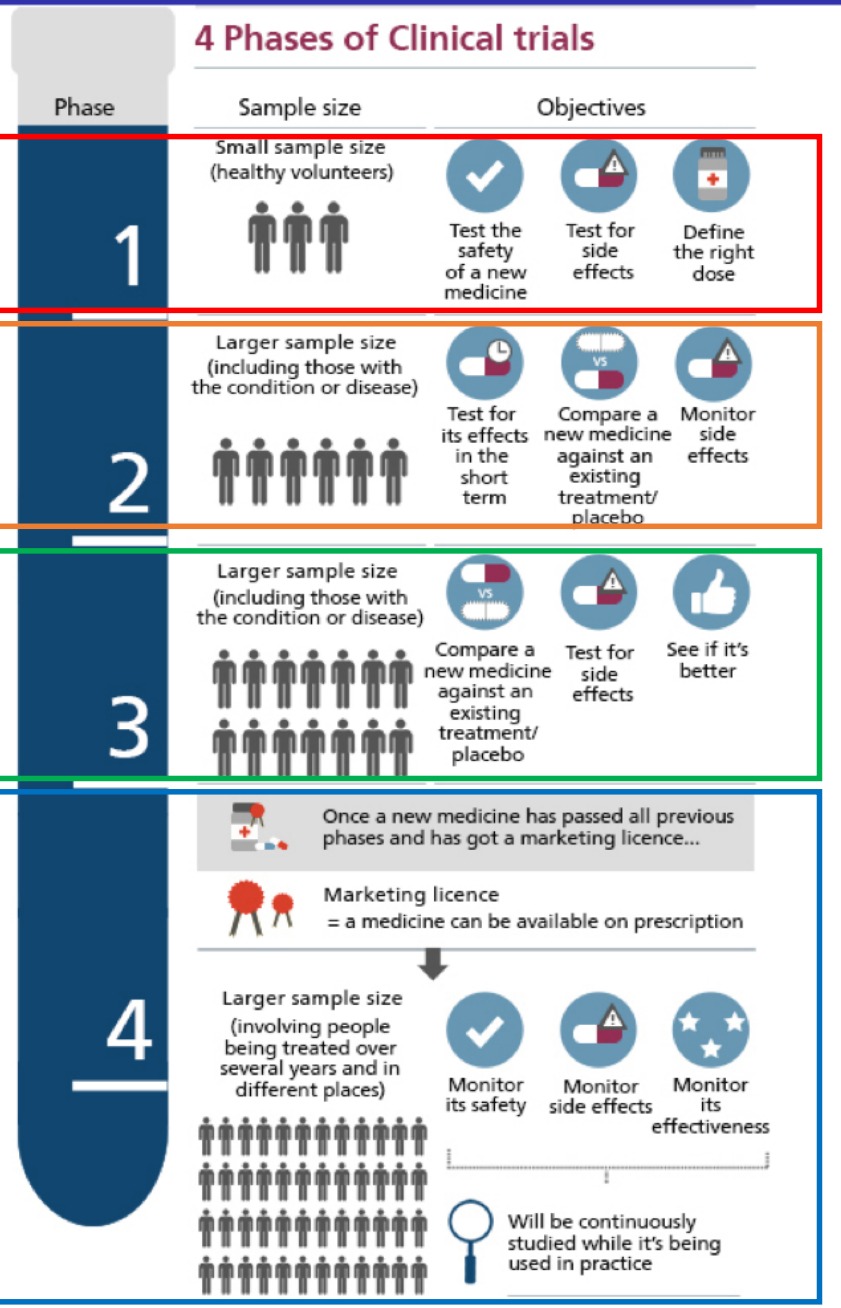
- 100 – 1000 subjects
- Focus: efficacy

Phase 3

- 1000 – 10,000 subjects
- Focus: utility

Phase 4 (On the Market)

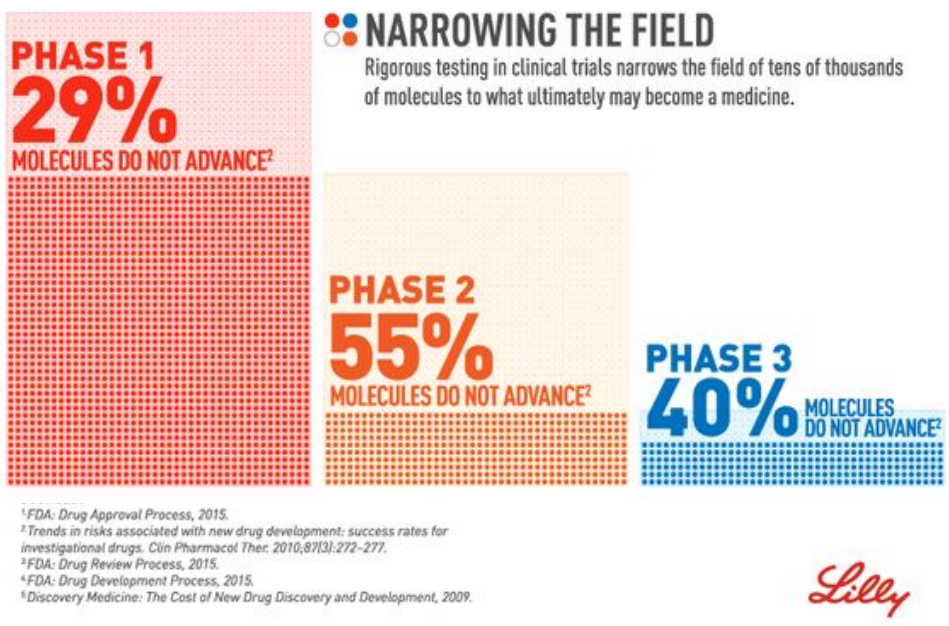
- Variable # of subjects
- Longer studies
- Focus: safety



https://www.fda.gov/media/82381/download https://www.uhs.nhs.uk/ClinicalResearchinSouthampton/Public-and-patients/What-is-clinical-research.aspx

Clinical Trial Success

- Phase 1 success: justifies product administration to target population
- Phase 2 success: justifies product's use in patient treatment
- Phase 3 success: justifies product administration to a larger population over a longer period of time
- Overall, ≈13.8% of tested drugs make it through clinical trials
- Vaccines for infectious disease tend to have relatively high FDA approval ratings (≈33.4%)



Probability of Success[2] by Clinical Trial Phase and Therapeutic Area

	P1 to P2	P2 to P3	P3 to Approval	Overall
Oncology	57.6	32.7	35.5	3.4
Metabolic/Endocrinology	76.2	59.7	51.6	19.6
Cardiovascular	73.3	65.7	62.2	25.5
Central Nervous System	73.2	51.9	51.1	15.0
Autoimmune/Inflammation	69.8	45.7	63.7	15.1
Genitourinary	68.7	57.1	66.5	21.6
Infectious Disease	70.1	58.3	75.3	25.2
Ophthalmology	87.1	60.7	74.9	32.6
Vaccines (Infectious Disease)	76.8	58.2	85.4	33.4
Overall	66.4	48.6	59.0	13.8
Overall (Excluding Oncology)	73.0	55.7	63.6	20.9

Source: Chi Heem Wong, Kien Wei Siah, Andrew W Lo. "Estimation of clinical trial success rates and related parameters." *Biostatistics* 20(2): April 2019, Pages 273-286. Published online: 31 January 2018. DOI: 10.1093/biostatistics/kxx069

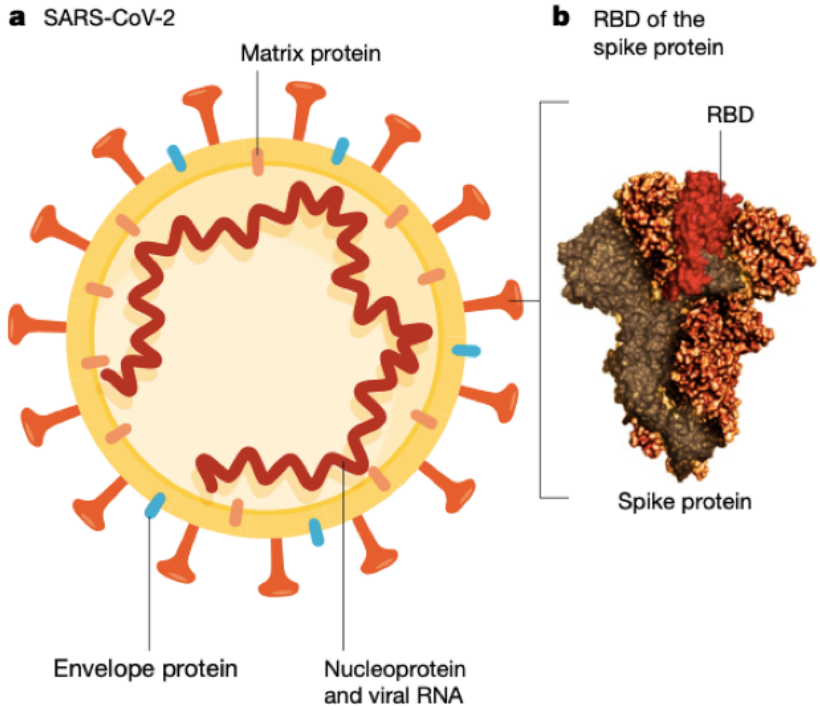
https://www.centerwatch.com/articles/12702-new-mit-study-puts-clinical-research-success-rate-at-14-percenthttps://academic.oup.com/biostatistics/article/20/2/273/4817524

Background: Vaccine Candidate Overview

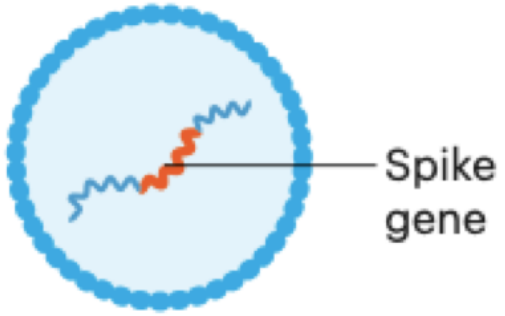
UCLA BIOMEDICAL ENGINEERING SOCIETY @

Overview of BNT162-b2

- collaboration between Pfizer & BioNTech
  - BioNTech = mRNA vaccine platform, vaccine manufacturing
  - Pfizer = global vaccine R&D, regulation, and distribution
- mRNA based vaccine
  - Contains genetic info for antigen
  - BNT162-b1 = RBD
  - BNT162-b2 = spike protein



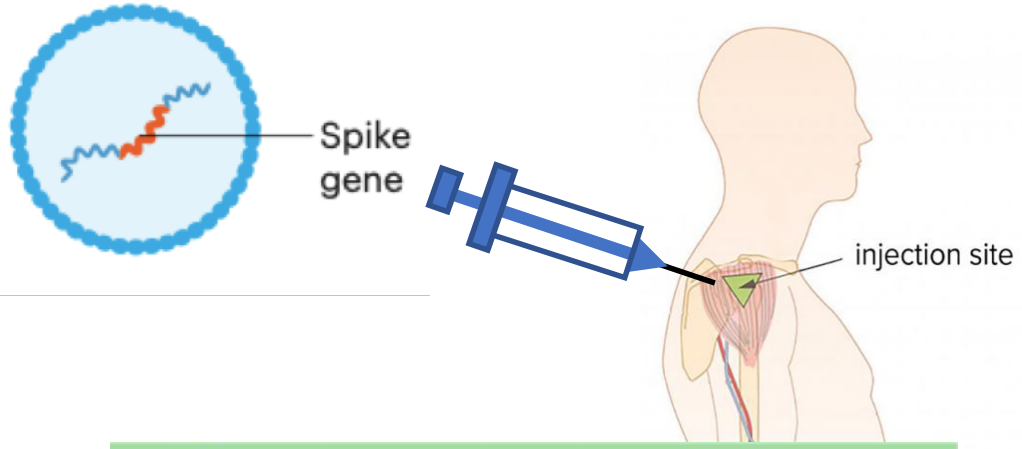
RNA vaccines consist of RNA encoding the spike protein and are typically packaged in LNPs

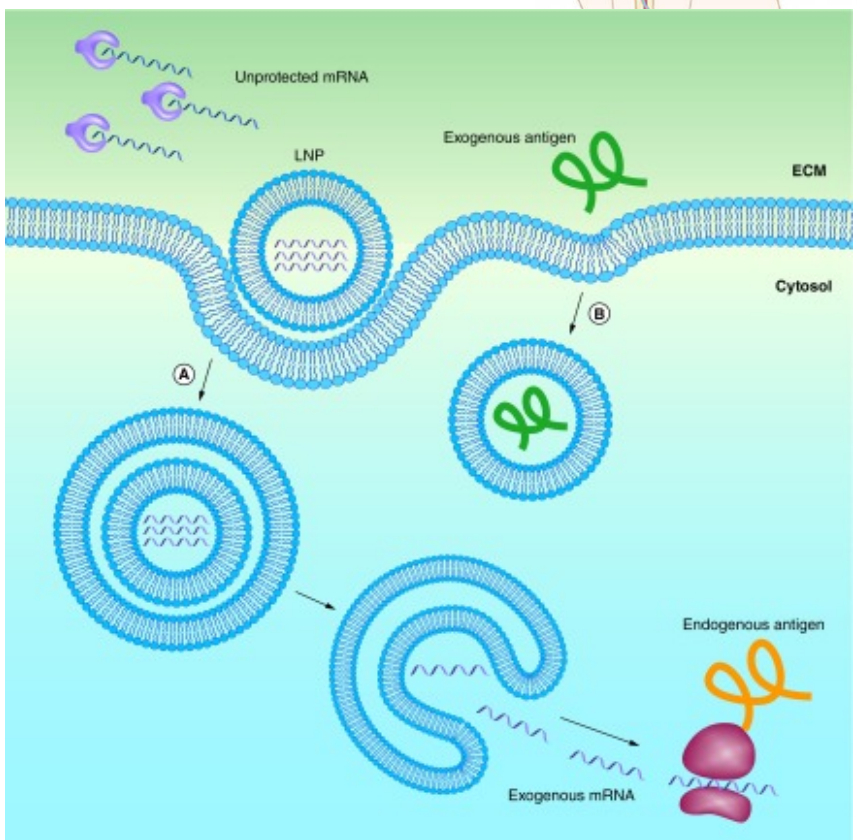


https://pubmed.ncbi.nlm.nih.gov/27075952/

Vaccine Delivery

- Dosage:
  - Immunogenic: 1 ug – 5 ug
  - Administered: 10, 20, 30 ug
- Intramuscular Injection
  - High bioavailability
  - High immunogenicity
- Lipid nanoparticle encapsulation
  - Enhances intracellular delivery
  - Protects against enzymatic degradation of mRNA





https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5439223/

Pfizer/BioNTech vs. Moderna

	Pfizer/BioNTech	Moderna
Information Released	Final Efficacy Analysis November 18	First Interim Analysis November 16
Efficacy Rate	95% ($p < 0.0001$)	94.5% ($p < 0.0001$)
Storage Conditions	- 70 ℃ (Long Term)	- 20 ℃ (Long Term) 2 ℃ – 8 ℃ (Short Term)
Projected Doses	50 million in 2020 1.2 billion by the end of 2021	20 million in 2020 (US only) 500 million - 1 billion by the end of 2021
Side Effects	Fatigue (3.8%), Headache (2%)	Fatigue (9.7%), Muscle Pain (8.9%), Headache (4.5%)
Participants	43,538 (global) 94 confirmed COVID cases	30,000+ (in US) 95 confirmed COVID cases

https://investors.modernatx.com/news-releases/news-release-details/moderna-announces-longer-shelf-life-its-covid-19-vaccine

Fun Fact

Journal 3: Pfizer and BioNTech Vaccine Candidate

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Document 1: The Press Release

- Biotechnology companies communicate clinical trial results through press releases
- Company representatives write press releases for **investors**
    - Typically include positive outlook on the company's reported findings and quotes from C-suite members
- Distributed by press release companies like Business Wire and News Wire

Pfizer

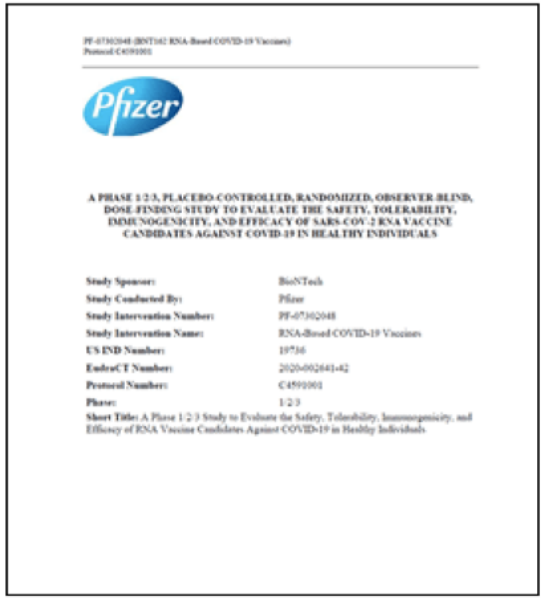
ALBERT BOURLA, DVM, PH.D.
Chairman and Chief Executive Officer,

BIONTECH

Ugur Sahin
Chief Executive Officer

Document 2: The Protocol

- Biotechnology companies demonstrate their study methods, designs, benchmarks for success, and schedule through a study protocol
- Company representatives write protocols for **regulatory agencies** and **review boards**
    - Consider subject protection and safety
    - Detailed objectives and endpoints
    - Once the Sponsor's protocol is approved, the study can begin



PF-07302048 (BNT162 RNA-Based COVID-19 Vaccines)
Protocol C4591001

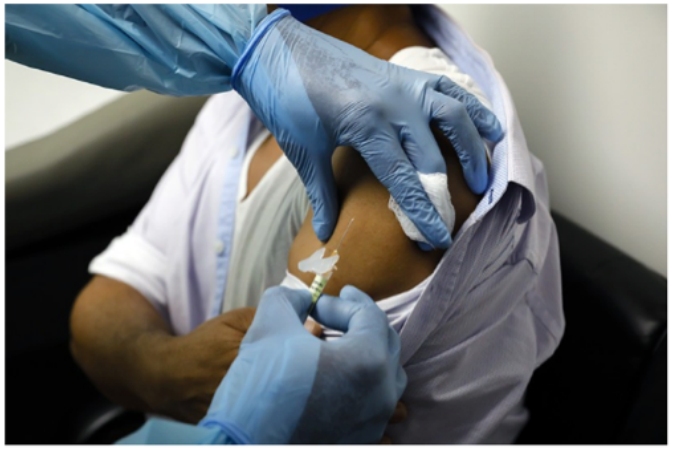
Pfizer

A PHASE 1/2/3, PLACEBO-CONTROLLED, RANDOMIZED, OBSERVER-BLIND, DOSE-FINDING STUDY TO EVALUATE THE SAFETY, TOLERABILITY, IMMUNOGENICITY, AND EFFICACY OF SARS-COV-2 RNA VACCINE CANDIDATES AGAINST COVID-19 IN HEALTHY INDIVIDUALS

Study Sponsor:	BioNTech
Study Conducted By:	Pfizer
Study Intervention Number:	PF-07302048
Study Intervention Name:	RNA-Based COVID-19 Vaccines
US IND Number:	19736
EudraCT Number:	2020-002641-42
Protocol Number:	C4591001
Phase:	1/2/3

Short Title: A Phase 1/2/3 Study to Evaluate the Safety, Tolerability, Immunogenicity, and Efficacy of RNA Vaccine Candidates Against COVID-19 in Healthy Individuals

Document 3: The News Article



Credit: Eva Marie Uzcategui/Bloomberg via Getty

- Author: Ewen Callaway
  - Senior Reporter at *Nature*
    - *Nature* journalist since 2010
  - UCSC, University of Washington
- Explains the significance of scientific findings to a **general audience**
  - Weaves together interviews with experts in the field
  - Communicates complex scientific information in language that the audience can understand

Discussion Questions

- Document 1 discusses the diversity of study participants in Pfizer/BioNTech's trial. Why is diversity important in a Phase III clinical trial? What facets of diversity does Pfizer address in Documents 1 and 2? Why is this important for a COVID-19 vaccine?
- Document 3 raises several questions about Pfizer/BioNTech's vaccine. How could study designers modify their protocol or add experiments to address these concerns?
- Refer to the "Pfizer/BioNTech vs. Moderna" slide and Document 1. When looking at the current data, what is promising about these two vaccine candidates? What are some areas of concern?

https://uvic470ecology.weebly.com/uploads/1/2/4/4/12445281/470_howtoleaddiscussion.pdf