

Tools for Pandemic Preparedness:

Charting and Mapping Vaccine Development Capacities

Innovation & Technology Policy Lab | Global Health

Malcolm Nowlin | Public Policy & Chemistry
 Nora Ghanem | Public Policy & Global Health
 Niveen Hennein | Public Policy & Global Health
 Julia Tuttle | Global Health & Cultural Anthropology

Farrukh Jadoon | Computer Science
 Christina Langmack | Public Policy & Global Health
 Kushal Kadakhia | Public Policy & Global Health
 Courtney Scoufis | Public Policy & Global Health



Project Summary

With the significant international consequences of recent outbreaks, the ITP Lab conducted extensive stakeholder interviews and macro-level health policy analysis to expose gaps in pandemic preparedness and develop legal frameworks for future threats.

Emerging Danger

- Scientists and public health experts have identified several key pathogens that have caused or are likely to cause severe outbreaks and have few or no medical interventions available

| Nipah Virus | Lassa Fever | Zika Virus |
|---|--|--|
| <ul style="list-style-type: none"> Emerging zoonosis causing disease in both human and animal hosts Recent outbreaks in Malaysia (1998) and India (2004) No vaccine is currently available | <ul style="list-style-type: none"> Endemic in several West African countries Mostly transmitted to humans through rodents but person to person transmission is also common No vaccine currently available | <ul style="list-style-type: none"> Cases reported in 30+ countries Possible link to microcephaly \$3.5+ billion in estimated losses No vaccine is currently available for future outbreaks |

| Middle East Respiratory Syndrome (MERS) | Severe Acute Respiratory Syndrome (SARS) | Ebola Virus |
|---|---|--|
| <ul style="list-style-type: none"> 1000+ cases reported in 24 countries \$2+ billion in losses during 2015 South Korea outbreak No vaccine is currently available for future outbreaks | <ul style="list-style-type: none"> 8000+ cases reported in 37 countries 700+ deaths prior to containment \$40+ billion in losses worldwide No vaccine is currently available for future outbreaks | <ul style="list-style-type: none"> 28,000+ cases reported in 10 countries 10,000+ deaths prior to containment \$30+ billion in losses worldwide No vaccine is currently available for future outbreaks |

| Marburg Virus | Rift Valley Fever | Crimean Congo Hemorrhagic Fever |
|---|---|---|
| <ul style="list-style-type: none"> High fatality rate for those infected Clinically similar to Ebola virus Transmitted to humans through fruit bat No vaccine currently available | <ul style="list-style-type: none"> Outbreaks reported throughout sub-Saharan and North Africa Cases have also spread to the Middle East and Asia No licensed vaccine for human use | <ul style="list-style-type: none"> Endemic in countries throughout Africa, Asia, the Balkans, and the Middle East High fatality rate for those infected No vaccine currently available |

Charting Development Capacities

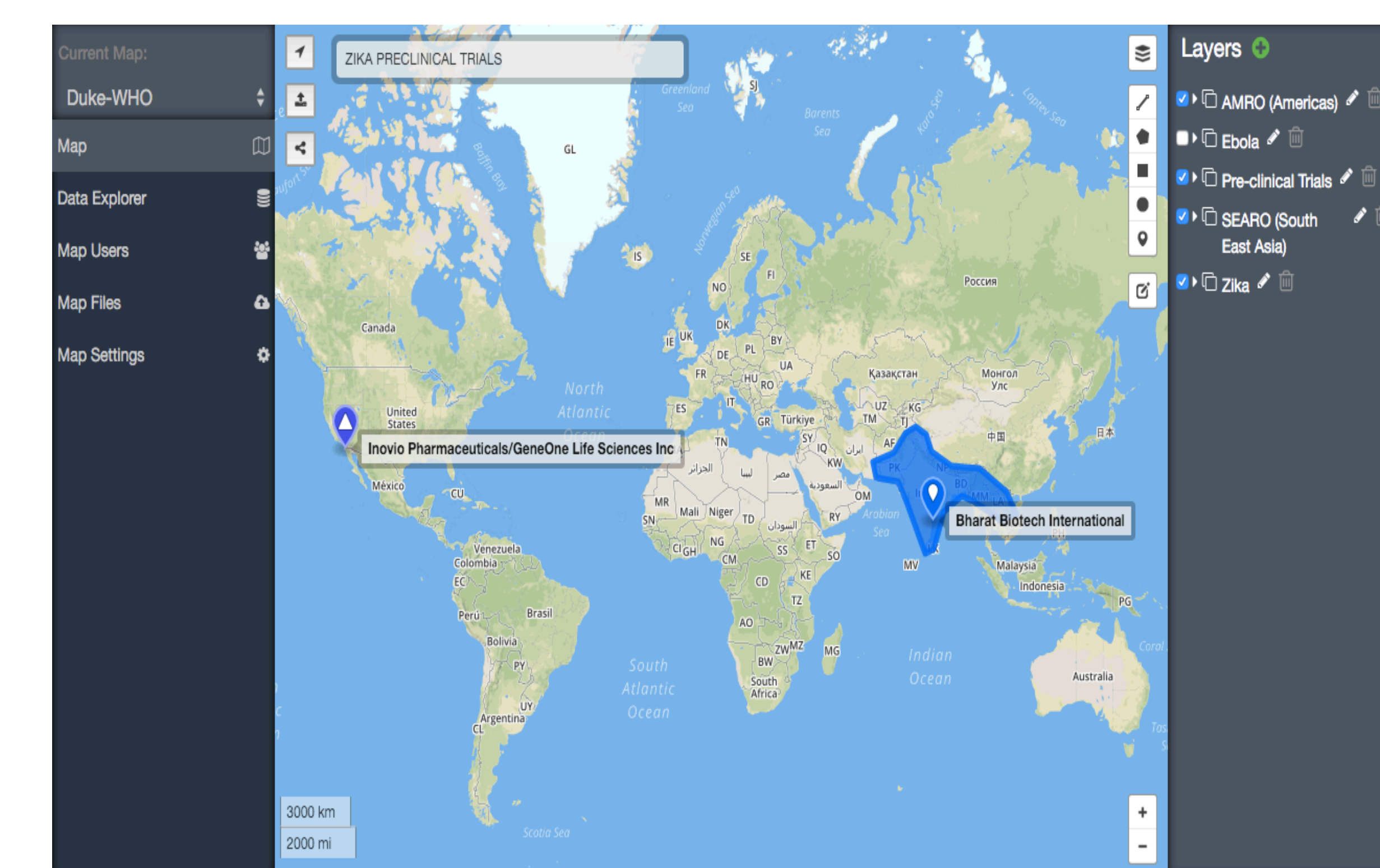
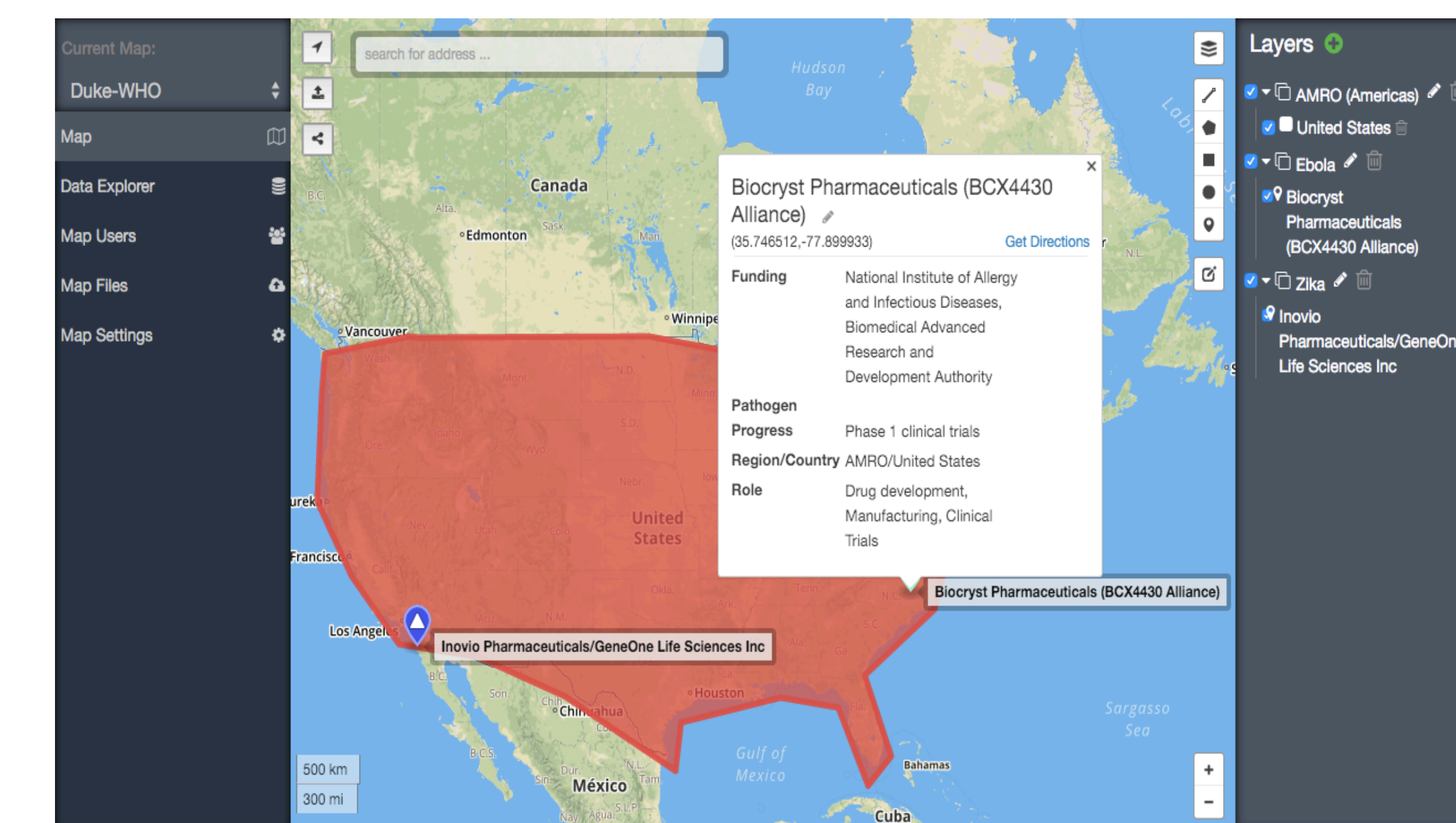
| Player | Region | Role | Progress |
|--|-----------------------|------------------------|--|
| Inovio Pharmaceuticals/GeneOne Life Sciences Inc | United States/Asia | Research & Development | preclinical trials (expect to perform clinical trials on humans by August 2016) |
| Bharat Biotech International Ltd | Asia | Research & Development | preclinical trials (expect to perform clinical trials on humans by mid 2017) |
| Takeda Pharmaceuticals | Asia | Research & Development | preclinical trials |
| Sanofi | Europe | Research & Development | preclinical trials |
| NIH | United States | Research & Development | preclinical trials (expect to perform clinical trials on humans by summer of 2016) |
| Merck & Co | United States | Research & Development | preclinical trials |
| New Link Genetics Corp | United States | Research & Development | preclinical trials |
| Johnson & Johnson | United States | Research & Development | preclinical trials |
| GlaxoSmithKline | Europe | Research & Development | preclinical trials |
| Sementis Ltd/ University of South Australia | Australia | Research & Development | preclinical trials |
| Hawaii Biotech | United States | Research & Development | preclinical trials |
| Repligen Ltd | United States | Research & Development | preclinical trials |
| Pfizer Inc | United States | Research & Development | preclinical trials |
| GeoVax Labs Inc. / University of Georgia | United States | Research & Development | preclinical trials |
| UNICEF/ Google | United States/ Europe | Funding | N/A |
| Global Zika Task Force | Global | Research & Development | preclinical trials |
| Novavax | United States | Research & Development | preclinical trials |

| Player | Region | Role | Progress |
|---|---------------|------------------------|--------------------|
| Medigen Inc | United States | Research & Development | preclinical trials |
| SAFC Pharma | | Research & Development | |
| University of Maryland School of Medicine | | Research & Development | |
| National Institutes of Health | | Funding | |
| Southwest Foundation for Biomedical Research | | Research & Development | |
| University of Buenos Aires | Argentina | Research & Development | |
| Unite de Biologie des Infectieux Virales Emergentes | France | Research & Development | |
| Leiden University Medical Center | Netherlands | Research & Development | |
| Scripps Research Institute | United States | Research & Development | preclinical trials |

| Player | Region | Role | Progress |
|--|-----------------------|------------------------|---|
| Greffex | United States/ Europe | Research & Development | preclinical trials |
| Novavax/ University of Maryland | United States | Research & Development | preclinical trials |
| Ludwig - Maximilians University | Germany | Research & Development | planning to enter phase I clinical trials |
| Marburg University | | Research & Development | |
| Erasmus Medical Center | | Research & Development | |
| German Center for Infection Research | | Funding | |
| Inovio Pharmaceuticals | United States | Research & Development | phase I clinical trials |
| GeneOne Life Sciences | South Korea | Clinical Trials | |
| Walter Reed Army Institute of Research | United States | Research & Development | Clinical Trials |

| Player | Region | Role | Progress |
|-----------------------------|---------------|------------------------|--------------------|
| Profectus Biosciences, Inc. | United States | Research & Development | preclinical trials |

Updateable Mapping Tool



- Online geospatial database with search capabilities that allow for :
 - Filtering by region, country, and pathogen
 - Clickable markers that reveal further details of organization
 - Bubble Map that displays linkages between organizations and their roles in development
- Able to provide critical knowledge of vaccine development landscape and facilitate the formation of alliances

Acknowledgments

Mentors:
 • Professor Julia Barnes-Weise – Duke
 • Professor Ana Santos-Rutschman – Duke

Funding:
 • The Bass Family
 • The World Health Organization