



Infectious Lifesciences Laboratory

Hypothetical Bioscience Facility for
Case Studies¹

International Biological Threat Reduction Department
Sandia National Laboratories
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Republic of Prowazekii

Government

The modern Republic of Prowazekii was established in 1752 and is divided into five provinces. The first half of the 20th century saw many changes in regime and leadership from multiple parties, but the government has settled into a stable two-party democratic government. The Executive Branch consists of the President, who serves as Chief of State and Head of Government, and the Cabinet, to which the President makes appointments. The legislative branch consists of a bicameral National Congress containing the Senate (20 seats elected by popular vote; members serve eight-year terms; half are elected every four years) and the Chamber of Deputies (60 seats; members are elected by popular vote to serve four-year terms). The Supreme Court heads the judicial branch. The president appoints judges to the Supreme Court from a list of candidates provided by the court itself. The Senate must ratify the appointments.

Population

As of the latest census, the population of Republic of Prowazekii is 52,821,286 with a density of 87 persons per km². The society is heterogeneous with 14 different ethnic groups. A recent survey identified 42% of the population as Christian, 35% as Muslim, 10% Buddhist, 3% Jewish, and 10% as “other”. Many languages are spoken throughout the country, but English is the official working language. The Mallie Misanthropes group in the southern part of the country is seeking to secede from the Republic. This is a vibrant political movement with strong support in the southern province. A small, more radical subgroup of Mallie Misanthropes uses periodic acts of “terrorism” to draw political attention to its struggle for independence.

Economy

The economy depends primarily on agriculture, petroleum exports from off-shore oil fields, and tourism. The agricultural sector accounts for 20% of both GDP and total exports. The sector also employs 23% of the workforce.

Infectious Diseases

In general, the incidence of infectious diseases in the Republic of Prowazekii has decreased over the past two decades. Last year the government spent approximately 6% of its total expenditures on public health. Influenza is the most frequent disease of public health concern followed by food-borne illnesses. The large majority of these food-borne infections are attributed to *Salmonella sp.* Other human infectious diseases of importance include viral hepatitis B and C, which had incidences of 4.1 and 5.6 per 100,000. The country is also experiencing a reemergence of tuberculosis. There are a high number of highly infectious, potentially zoonotic diseases endemic throughout the country, including *Bacillus anthracis*, *Yersinia pestis*, *Brucella* species and Rabies Virus. Outbreaks in the agricultural industry are common. This has the potential to become a significant public health concern because of the large population who works in the agriculture industry and has close intimate contact with livestock. The Republic of Prowazekii is officially free of Foot-and-Mouth Disease and Rinderpest, but has almost annual outbreaks of avian influenza and Newcastle Disease. The country experiences occasional outbreaks of Vesticular Stomatitis.

Typhusville City, Republic of Prowazekii

The city covers 485 square kilometer with a population of 570,000. The median age is 34 years. Typhusville’s largest employers are the public school system, Rickettsia National University, the City of Typhusville, and Typhusville General Hospital.

Last Year’s Crime statistics

Crime	per/100,000 people
Aggravated Assault	4.3
Arson	0.2
Bribery	0.11
Burglary	9.25
Vandalism	15.8
Disorderly Conduct	4.2
Embezzlement	1.65
Fraud	6.93
Homicide	0.06
Kidnapping	0.62
Motor Vehicle Theft	8.42
Narcotics Offenses	5.75
Simple Assault	10.5
Weapons Law Violations	0.78
All Other Offenses	43.7

Emergency Services distance to Rickettsia National University

Typhusville City Police Department: 5 km from RNU, which is a 20-minute drive time with sirens during peak traffic and 10 minutes drive time with no traffic.

City Fire and Ambulance: 2 km from RNU, which is a 5-minute drive time with sirens even during peak traffic times.

Rickettsia National University

Overview

Rickettsia National University (RNU), located in Typhusville City, is one of the leading universities in the Republic of Prowazekii. RNU employs 4,500 people and has 18,500 students from across the Republic of Prowazekii and 25 countries. The university’s highly regarded liberal arts, sciences, and engineering programs draw outstanding students from around the region. There are seven graduate and professional schools, including: College of Veterinary Medicine, College of Medicine, College of Engineering, College of Arts and Sciences, College of International Relations, the Teacher’s College, and the Business College.

College of Veterinary Medicine

The College of Veterinary Medicine employs approximately 75 faculty and 195 staff. There are 220 students in the four-year, post-baccalaureate doctor of veterinary medicine program, a four-year veterinary medical curriculum of classroom and laboratory instruction and clinical rotations in the University Hospital for Animals. The College also has a graduate program (MS and PhD).

Graduate fields of study within the College include comparative biomedical sciences, microbiology, immunology, pharmacology, physiology, biochemistry and cellular and molecular biology, and zoology. All fields except zoology are administered through the Biological and Biomedical Sciences Program in the College of Arts and Sciences. A core group of veterinary faculty has a newly expanded emphasis on bacterial pathogenesis and post-genomics research against microbes.

College of Medicine

There are approximately 525 medical students, 500 interns and residents, and approximately 200 graduate students and post-doc fellows studying medicine at RNU. The College of Medicine has 25 academic departments, 19 clinical and 6 basic sciences, as well as the Unit for Laboratory Animal Medicine and Department of Medical Education. Teaching, research, and clinical care often cross traditional departmental boundaries; researchers and clinicians frequently collaborate. Research specialties in the College include geriatrics and aging (focused on how genes and hormones affect the rate of aging), cancer, and neuroscience studies. In addition to their work in research and education, faculty in clinical departments provide inpatient and outpatient care at the University Hospital and Out Patient Clinic.

Biosciences Department

The Biosciences Department resides in the College of Arts and Sciences. With 41 tenured and research faculty, 66 professional staff, 75 graduate students, and 125 undergraduate students, the Department is a dynamic research and teaching environment. Facilities for cell biology, genomics, immunology, environmental microbiology, and molecular biology include the capacity for small animal studies. Large animal research is done in partnership with the College of Veterinary Medicine. The cornerstone of RNU's biosciences research program is the Infectious Lifesciences Laboratory (ILL). ILL is the country's premier bioscience research and educational institution. The laboratory primarily focuses on zoonotic emerging infectious diseases, since these are the source of almost all emerging diseases throughout the world. ILL's mission is to conduct research and development of new vaccines, drugs, and diagnostics for these emerging diseases. The Republic of Prowazekii has recently awarded RNU a grant to build a new infectious disease laboratory.

RNU Campus

Campus Police

The campus police force has a total of 50 officers. The campus police work shifts to provide coverage 24 hours per day, 7 days a week, and 365 days a year. Nights and weekend shifts consist of one deputy commander and four officers. The commander and eight officers staff the day shift. Campus police officers are equipped with the following:

- A straight baton,
- One set of handcuffs,
- A small flashlight,
- A handheld radio, and
- Keys to all buildings, doors, and gates.

The commander or deputy commander is stationed in the control station. It is approximately a 5-minute drive, 7-minute bike ride, or 20-minute walk from the campus police control station to

the Biosciences Quad. The on-duty officers patrol the campus in pairs and respond to radio calls from the control station.

Threats of Concern to Campus Police

Since the establishment of the Band of Mercy in 1973, radical extremist groups sympathetic to the animal rights movement have been active in the Republic of Prowazekii, and occasionally in Typhusville. The group appears to have two goals: 1) the liberation of captive animals and 2) the destruction of capital necessary to conduct such research. However, the Band of Mercy's website instructs its followers to "take all necessary precautions against harming any animal, human and non-human."

In the past few years, anti-Genetically Modified Organism activists have become active in Typhusville. Although they have not damaged property yet, similar groups in neighboring countries have targeted facilities that conduct research on genetically modified organisms (GMOs), particularly newly constructed biotechnology laboratories.

Last year, one graduate student in chemistry was arrested on charges of manufacturing methamphetamine in a RNU laboratory.

Memorandums of Understandings (MOUs)

The University has established Memorandums of Understandings between RNU and the city police force, the fire department, and emergency medical services. All responders have campus keys and will enter standard campus buildings as needed to respond to calls. None of the responders will enter bioscience laboratories without being accompanied by RNU's biorisk officer.

Access to Campus Buildings

The University has an open campus; there is no controlled perimeter. All classroom and research buildings are unlocked from 6 am – 8 pm Monday through Friday. Buildings are locked outside of these hours.

For a given laboratory building, one master key opens the exterior doors and a second master key opens all laboratories. Thus, all students, technicians, faculty, and custodial staff working in a particular building have the same key. Keys are handed out by the facilities building representative. A student receives a key to the laboratory building if a faculty member completes a Key Authorization Form for that individual.

Bioscience Quad

The Bioscience Quad is the central focal point for all of RNU's bioscience and biomedical programs. The medical school, teaching hospital and clinic, veterinary school, animal hospital and clinic, and the biosciences department all reside on this quad. The teaching hospital and the animal hospital each house several small clinical laboratories. The main biosciences department building is principally classrooms, faculty offices, and some laboratories (for non-infectious studies). All of the department's work with infectious substances is currently conducted in the Infectious Lifesciences Laboratory. The campus incinerator is located behind the barns on the

outskirts of the Quad. The Quad also has a centralized shipping and receiving facility. A cafeteria is located on the first floor of the administration building.

Infectious Lifesciences Laboratory

Facilities

ILL currently has BSL2 laboratories and BSL3 laboratories in the Sabin Research Laboratory Building (which is part of the ILL facility). Currently, ILL does not have the capacity for animal work at BSL3. The BSL3 has one pass-through autoclave, and there are several small autoclaves in individual labs. The ILL Enteric Pathogens group has one of the BSL2 laboratories for its research efforts. ILL has recently secured funding to build a new Containment Laboratory Complex. This new laboratory will greatly expand their BSL2 and BSL3 research space; it will also have dedicated ABSL2 and ABSL3 space.

ILL Staff

The following staff have access to the BSL2 and BSL3 laboratory space: faculty, research technicians, graduate students, undergraduate students (not allowed in the BSL3 laboratory), housekeeping, facility staff, and the biorisk officer.

Current Research Efforts Underway at ILL

Bacillus anthracis

PCR-based detection methods are being developed for use in identifying virulence genes specific to *B. anthracis* to facilitate the identification of *B. anthracis* from other closely related species. Faculty in the Biosciences Department and Medical School are collaborating to study the use of anthrax toxin as cancer chemotherapy.

Bovine Spongiform Encephalopathy (BSE) Prion

BSE research is a multi-disciplinary activity at ILL with research groups from physics, chemistry, biology, and computing working together to understand the mechanisms of BSE protein misfolding. ILL faculty are also interested in understanding the progression of prion diseases in livestock.

Chlamydia psittaci

Chlamydiae are obligate intracellular bacteria that occupy a non-acidified vacuole (the inclusion) throughout their developmental cycle. Little is known about events leading to the establishment and maintenance of the chlamydial inclusion membrane. Researchers are trying to identify chlamydial proteins unique to the intracellular phase of the *Chlamydia psittaci* life cycle. The ultimate objective of the *Chlamydia psittaci* research is the development of vaccines against chlamydial infections. Real-time PCR is used to detect and quantify chlamydial DNA in efforts to identify vaccine candidates.

Cryptosporidium parvum

Current research efforts are focused on studying the molecular pathogenesis of *Cryptosporidium parvum*, including host cell recognition, attachment, and invasion. The research team is also interested in improved methods for detection of the oocysts in water.

H5N1 Avian Influenza

Research on H5N1 at RNU has been limited to providing assistance to the Ministry of Agriculture in the testing of clinical samples. Positive samples have been sent to the closest World Health Organization Influenza Collaborating Center for confirmation. Pending completion of the new ILL Containment Laboratory Complex, the faculty propose to study the efficacy of oseltamivir therapy in ferrets.

***Mycobacterium tuberculosis* and MDR-TB**

Researchers seek to develop tools for improved diagnostics of *M. tuberculosis* and monitoring disease progression of drug-resistant tuberculosis. Efforts are aimed at developing immunological reagents for early diagnosis and disease monitoring. Current projects utilize green fluorescent proteins.

Rabies Virus

Researchers are studying how the rabies virus crosses the blood-brain barrier, where it is most lethal. The team is also exploring why the T and B effector cells of the immune system do not cross the barrier, and thus cannot clear the infection.

***Salmonella enterica* (serotype typhi)**

Researchers are investigating the distribution of drug resistance in *S. typhi* across the Republic of Prowazekii. Clinics from throughout the country send isolates to the ILL Enteric Pathogens Group. The Group is testing the isolates for susceptibility to ciprofloxacin, chloramphenicol, and tetracycline. This is a long-term study to examine the change in distribution of drug resistant strains that began a decade ago.

***Shigella dysenteriae* serotype 1**

There is no vaccine available for *Shigella spp.*, and only limited treatment options for infection with antibiotic resistant strains. ILL researchers are pursuing studies that will provide insights into the development of an attenuated strain suitable for use a vaccine.

Agents in Repository Collection

All agents used in current research efforts plus:

Burkholderia mallei

Eastern Equine Encephalitis Virus

Yersinia pestis

Botulinum toxins A and F

Maps

Map of RNU's Biosciences Quad



