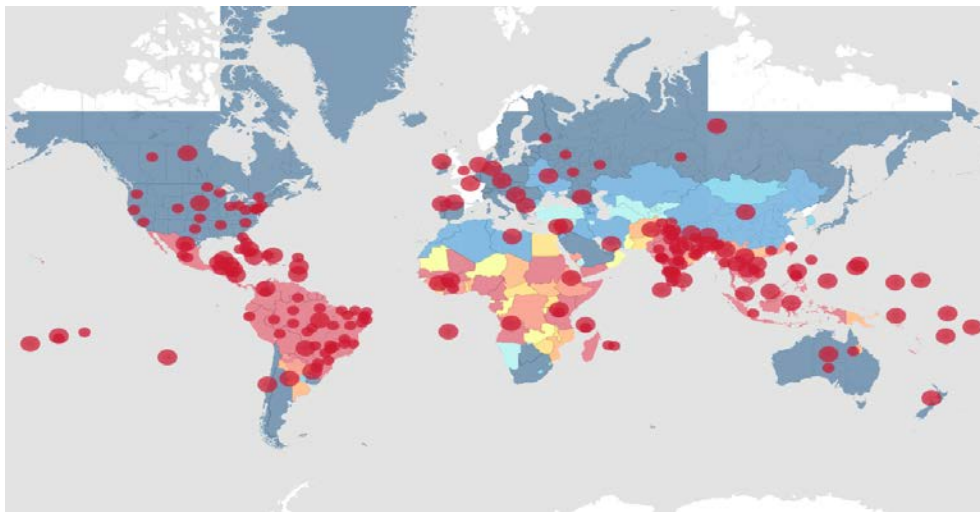


STANDARD DEVIATIONS: Dengue! Dengue! Dengue! It's Everywhere (almost).

Greetings,

Here we go again. The world is sick of dengue, or more precisely, the world is sick with dengue. You see, you're not the only one.

From Asia to the Americas, this arbovirus has emerged as a global concern. Let's take a tour of the world to see the affected areas from a bird's eye view, then we'll go to street level and talk about what it means.



(Geographic dengue outbreak)

On Aug. 6, the **Philippine** Department of Health (DOH) declared a National Dengue Epidemic. Nationally, the Philippines has seen 167,607 dengue cases, **97% higher than in 2018**.

Thailand health officials reported an additional 4,500 dengue fever cases during the second week of August, which has brought the total dengue case tally to 49,174 cases.

The number of dengue fever cases in **Sri Lanka** has reached 34,078 through Aug. 2. A total of 234,078 dengue cases were reported in the first seven months of '19.

Bangladesh reported 15,699 dengue cases in the third week of August, alone. Officials put the dengue tally in the country at 41,178 to date.

The Ministry of Health in **Vietnam** reported **9,449 dengue cases for the week** ending July 21. Since Jan. 1, there have been a total of 115,186 cases.



Malaysian health officials have reported **81,120 dengue fever cases this year**, including 113 deaths.

48 people died and over 10,757 others were infected by dengue hemorrhagic fever (DHF) across **Myanmar** in the past 7 months (Ministry of Health, Aug 14, 2019).

India has been harder to pin down for case totals, but this little graphic says a lot:

State	Cases in June 2018	Cases in June 2019
Tamil Nadu	98	1100
Puducherry	2	295
Telangana	33	953
Karnataka	415	1933
Maharashtra	550	969

Source: Government reply in Rajya Sabha on July 16, 2019

(2018-19 dengue comparison in 5 Indian states)

In the Americas reporting is spotty, but, unofficially, 2,052,914 cases are recoded through week 32 of '19. Here are the biggies (with 2018 totals to compare):

Brazil – 1,748,473 (2018: 426,326)

Columbia – 74,722 (2018: 44,825)

Nicaragua – 61,058 (2018: ~22,500)

Honduras – 49,326 (2018: 7,942)

Mexico – 44,210 (2018: ~10,000)

Okay, I think we can see where this is headed.

In the US the picture is a little different. There have only been a couple recorded cases of local transmission (Florida) and 244 confirmed imported cases (8/19). But...we have a limited exposure to *Aedes*, abatement strategies, and no monsoon to provide habitat. That may change.

Remember, **every one** of these patients with dengue were bitten by a female mosquito carrying virus.

An interesting way to think about this is that most mosquitoes will travel less than 100 meters from their hatch. It's the people moving through their territory that spread the virus. Urbanization is what has pushed disease into naïve populations. And it's the reason that areas see different serotypes.

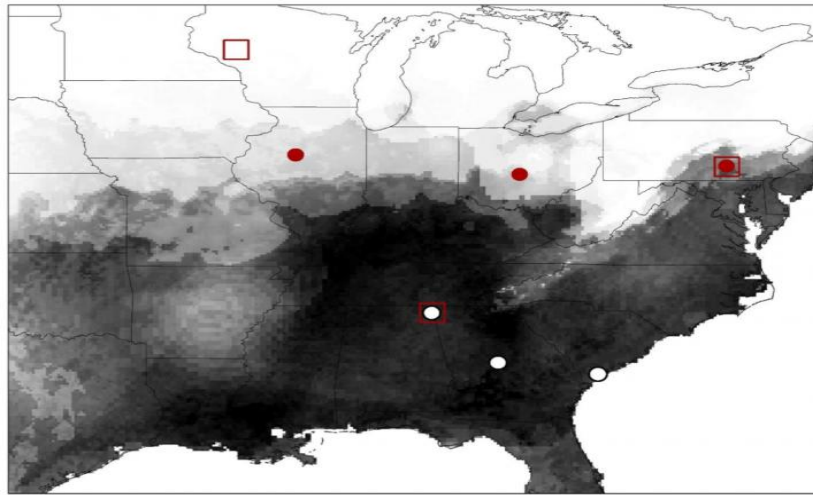
But they do move. And their range is expanding. Climate change? Of course. But *Aedes* is adapting too.

Briefly, these gals lay eggs with an idea about conditions for their hatch. They are able to generate an egg capable of surviving stress -diapause eggs - literally, delayed development eggs.



These special eggs contain a fertilized embryo that's in a state of almost-hibernation and has a very slow metabolism. The result is almost like a mosquito time capsule.

The ability to produce eggs that can wait to hatch is not something new. This technique helps mosquitoes survive the winter cold, but it works for dry conditions as well. All mosquitoes lay their eggs in or near standing water, and the larvae need to hatch into standing water. But they can survive getting dried out in between. Warming climate, adaptive embryology, and active urban lifestyles are all expanding the *Aedes* (and virus) reach.



(Expanding *Aedes* range: Diapause eggs allow for colder/drier habitat adaptation)

While there is no specific treatment for dengue, dengue fever, or dengue shock syndrome, there is a vaccine. Sort of.

In 2016 the Philippines brought in DENVAXIA (Sanofi Pasteur) as a commercial vaccine for dengue. It soon became apparent that children who had been given vaccine were developing severe dengue at alarming rates. 10% of the 733,000 schoolchildren vaccinated were shown to be at risk. If a person has not had a previous dengue exposure the vaccine promotes the Antibody Dependent Enhancement (ADE) phenomenon where the virus fools the immune system. Its use was soon banned. And Sanofi Pasteur now recommends that **the vaccine is only safe for seropositive individuals over 9 years of age**. Several deaths were attributed to vaccine.

This virus is emerging as a threat to health around the world. Exposure to new serotypes increases risk of severe disease. Severe disease burdens hospitals and labs. Understanding the threat prepares us to respond effectively.



Dengue is designated as a “Risk Group 2” human pathogen (NIH, 2016). Risk Group 2 (RG2) agents are associated with human disease which is rarely serious and for which preventive or therapeutic interventions are often available. Fourteen cases of **lab-acquired** dengue disease have been documented as of 2011 (no deaths). It’s pretty typical of what you work with on the bench every day. Why on Earth did I spend three weeks of your time talking about it?

Dengue is the world’s biggest and fastest growing mosquito-borne disease.

Identifying and understanding hazard is the backbone of biosafety. What we work with may not be incredibly dangerous, as long as we know what it is. Knowing what we don’t know is the important part.

There is an understood, inherent risk in the job we do in the laboratory. Whether agents, organisms, or samples pose a risk is not the concern. **Understanding that we actively behave as though every sample has risk allows us to prioritize our behavior toward safety**. Working with unknowns is explanation enough to guide our biosafety thinking.

Have a great week and be safe,

Bryan

References:

https://mrcdata.dide.ic.ac.uk/_dengue/dengue.php

<http://www.paho.org/data/index.php/en/mnu-topics/indicadores-dengue-en/dengue-nacional-en/252-dengue-pais-ano-en.html>

<https://www.reuters.com/article/us-sanofi-dengue-science-insight/did-sanofi-who-ignore-warning-signals-on-dengue-vaccine-idUSKBN1E7072>

<https://www.canada.ca/en/public-health/services/laboratory-biosafety-biosecurity/pathogen-safety-data-sheets-risk-assessment/dengue-fever-virus-1-2-3-4-pathogen-safety-data-sheet.html>

<https://www.nature.com/scitable/topicpage/dengue-transmission-22399758/>

cdc.gov

who.int

and on and on

