

# Public Health

“The neglected tropical diseases (NTDs), a group of chronic, debilitating, and poverty-promoting parasitic, bacterial, and some viral and fungal infections, are among the most common causes of illness of the poorest people living in developing countries.” <sup>a</sup>

Abiotic environmental factors are important in determining the distribution of disease-causing vectors and their life-cycles.

Temperature

Precipitation

Relative humidity

Solar radiation

Topography

Soil moisture

Presence & extent of fresh water rivers, ponds, lakes

Biotic factors – ecosystem structure and health

Human factors- Land use, social-economic

“Neglected Tropical Diseases,  
“Maladies Tropicales Négligées”

Succès ignorés  
Nouvelles opportunités

World Health Organization

Hidden successes,  
Emerging opportunities”

WHO is currently focusing on **14** neglected tropical diseases:

- Buruli ulcer
- Chagas disease
- Cholera/Epidemic diarrhoeal diseases
- Dengue/dengue haemorrhagic fever
- Dracunculiasis (guinea-worm disease)
- Endemic Treponematoses (yaws, pinta, endemic syphilis...)
- Human African trypanosomiasis

- Leishmaniasis
- Leprosy
- Lymphatic filariasis
- Onchocerciasis
- Schistosomiasis
- Soil-transmitted helminthiasis
- Trachoma

Major NTD Target Sub-Regions and Unique Ecologies.

Scenario	Sub-Region	NTDs	Indigenous Populations	Co-Factors <sup>a</sup>
1	Southern cone of South America	Chagas, leishmaniasis, cysticercosis, echinococcosis, hemorrhagic fevers	+	Cattle ranching, minifundios, urban migration
2	Chaco (Bolivia, Paraguay, Argentina)	Chagas, leishmaniasis, STH	+++	Cattle ranching, minifundios, animal husbandry
3	Andean region (Altiplano or Highland)	Fascioliasis, Chagas, leishmaniasis, plague, bartonellosis, STH, cysticercosis, echinococcosis, ectoparasites	++++	Minifundios, urban migration
4	Amazonian basin	Chagas, leishmaniasis, STH, onchocerciasis, leprosy, trachoma, ectoparasites	++	Deforestation, mining, guerillas, urban migration, indiscriminant colonization
5	Eastern Brazil	STH (esp. hookworm) schistosomiasis, Chagas disease, leishmaniasis, LF (NE only), echinococcosis, leprosy, leptospirosis	++	Cattle ranching, deforestation, minifundios, urban migration, monoculture
6	North Pacific of South America	STH, cysticercosis, leishmaniasis, onchocerciasis, echinococcosis	++	Deforestation, gold mining, guerillas
7	Caribbean basin	STH, schistosomiasis, LF, leprosy, leptospirosis, fascioliasis	+	Economic dependence on tourism, deforestation, urban migration
8	Central America and Panama	STH, leishmaniasis, Chagas, onchocerciasis, cysticercosis, leptospirosis	+++	Deforestation, desertification, migration
10	South and Central Mexico	STH, Chagas, cysticercosis, leishmaniasis, trachoma, onchocerciasis	+++	Deforestation, migration
11	Northern Mexico	STH, Chagas, cysticercosis, leishmaniasis	++	Desertification, migration

<sup>a</sup>Hotez PJ, Molyneux DH, Fenwick A, Kumaresan J, Ehrlich Sachs S, et al. Control of neglected tropical diseases. *New Eng J Med*. 2007;357:1018–1027.

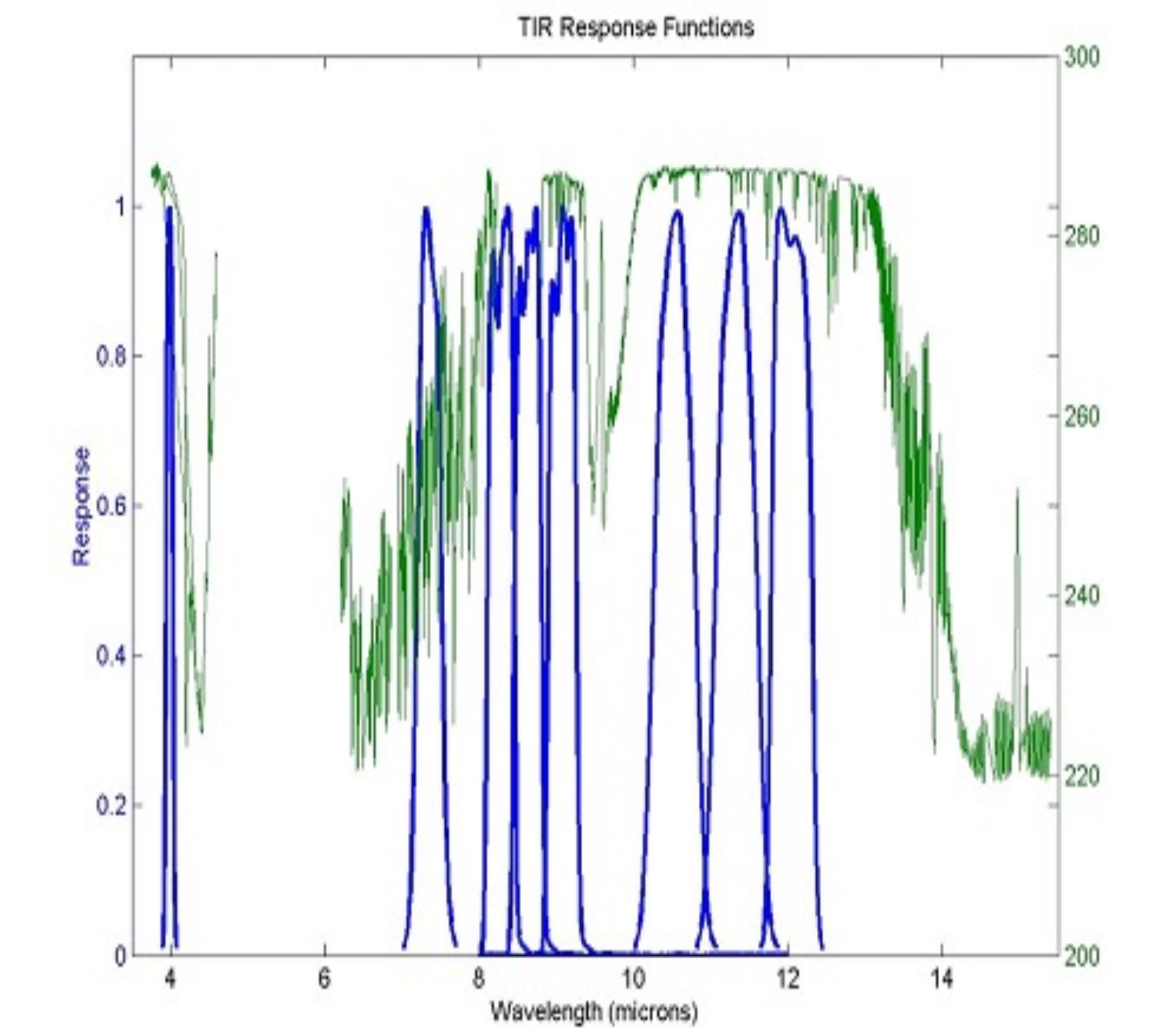
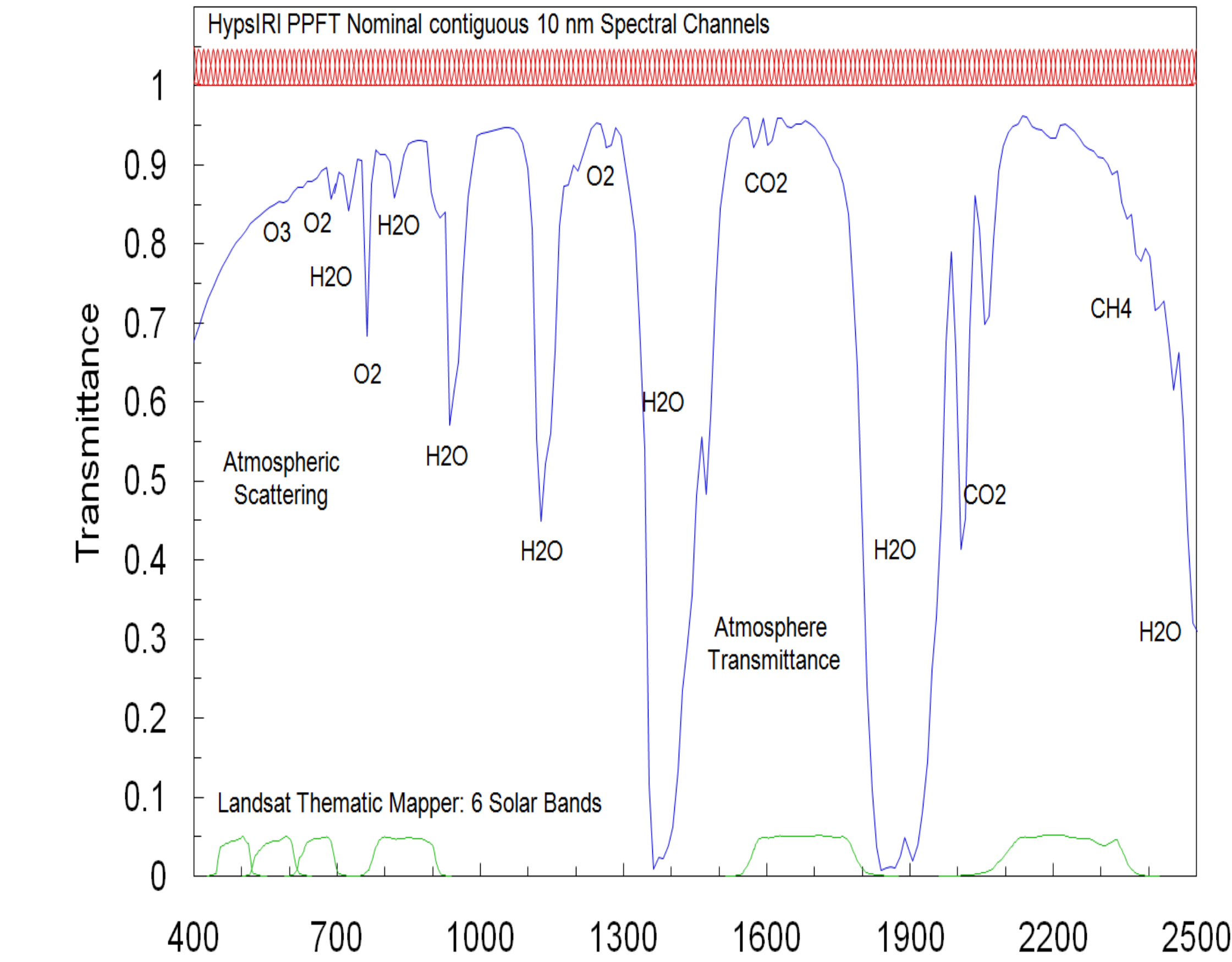
<sup>b</sup> P. J. Hotez, M. E. Bottazzi, C. Franco-Paredes, S. K. Ault, and M. R. Periago. 2008 The Neglected Tropical Diseases of Latin America and the Caribbean: A Review of Disease Burden and Distribution and a Roadmap for Control and Elimination. *PLoS Negl Trop Dis*. 2008 September; 2(9): e300.

# The Hyperspectral Infrared Imager (HyspIRI)

## Public Health & Air Quality Applications

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HyspIRI observations can be merged through a Land Data Assimilation System (LDAS) be used to drive spatially-explicit ecological models of NTD vectors distribution & life cycles. Assimilations will be driven by observational data LDAS and satellite-derived meteorological forcing data, parameter datasets, and assimilation observations, including:

- Precipitation from TRMM, and GPM
- Land Cover Type from HyspIRI
- Soil Moisture from AMSR-E (where applicable), SMAP and HyspIRI.
- Terrestrial Water Storage from GRACE and GRACE II.
- Surface temperature, Vegetation Fraction/ Leaf Area Index, and canopy physiology from HyspIRI.
- Topography from SRTM.

HyspIRI hyperspectral measurements would provide global measurements of surface mineralogy and biotic crusts important in accessing the impact of dust in human health.

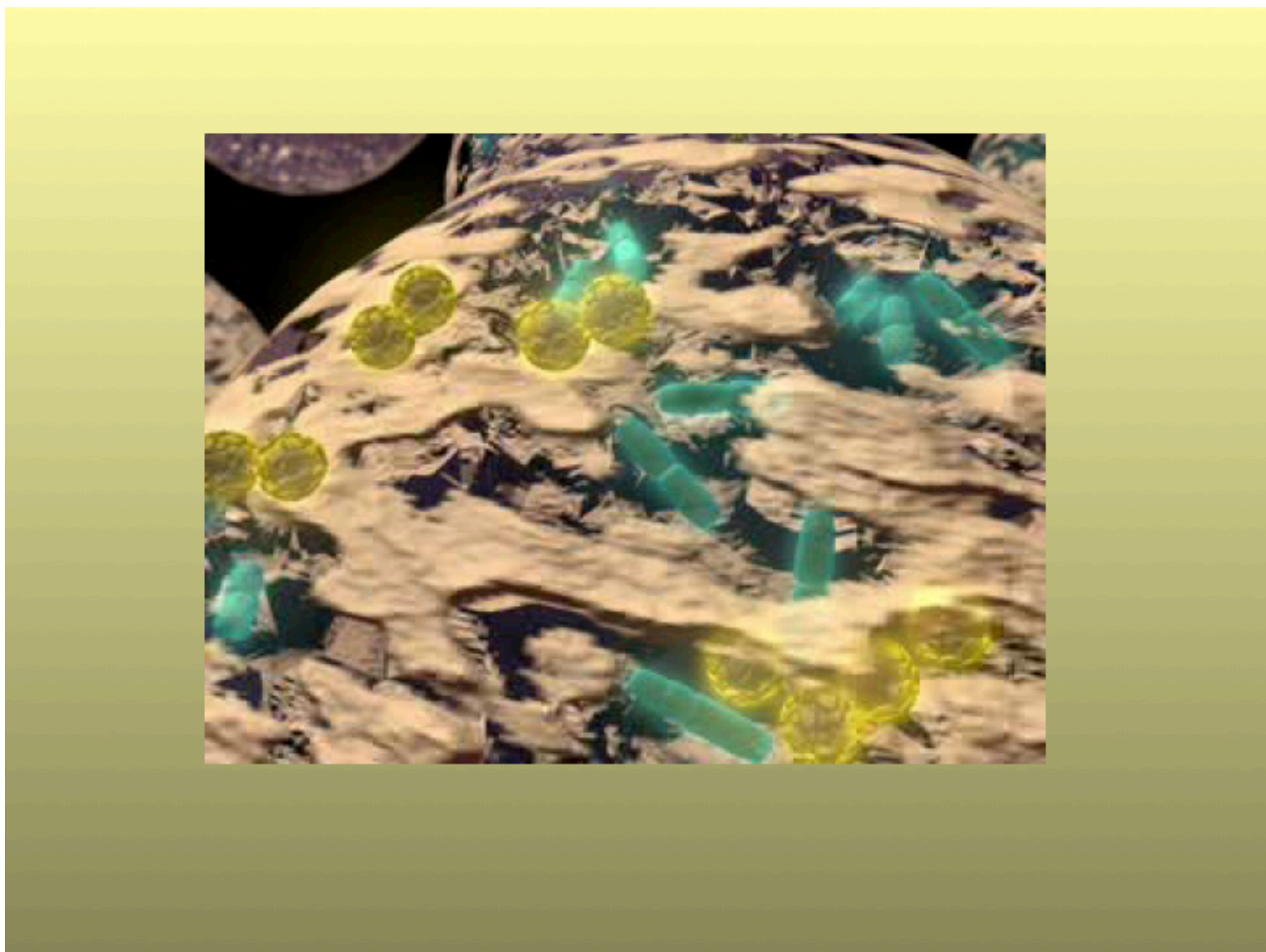
HyspIRI surface thermal measurements would also help identify the variability of dust sources due to surface moisture conditions and map mineralogy

### Biotic Crusts: where the action is

Cold desert crust - NV

Warm desert Crust - NV

Microscopic view of biotic crusts



## Air Quality (Dust)<sup>c</sup>

### The Health Effects of Dusts

- Some aspects have been well known for decades
  - General effects of industrial / commercial asbestos
  - Silicosis (hard rock mining)
  - Black lung (coal mining)
- New issues and problems are arising
  - Effects of mineral dust (ie, trace asbestos)
  - Valley fever (Coccidioidomycosis)
  - Trans-oceanic dust transport

Middle East Dust – Trace Composition		
Links between selected elements and some known lung function conditions and diseases		
	Desert Dust <10 µm	Desert Dust 20-40 µm
Mn (ppm)	450	331.98
Fe (ppm)	25500	18111.61
Co (ppm)	11.72	8.24
Pb (ppm)	17.22	9.45
Cu (ppm)	220	152.64
Cd (ppm)	1.24	0.70
Mg (ppm)	13230.49	10572.70
Al (ppm)	15912.39	13154.60
Ca (ppm)	139577.64	140250.15
Na (ppm)	1098.28	1476.86
Cr (ppm) [but species critical]	181.32	187.36
Zn (ppm)	105.18	72.30
Ni (ppm)	93.28	60.44
Ti (ppm)	1095.52	539.81
Cancer	Cancer suspected	Cancer & asthma
Emphysema	Asthma	

### Kuwait dust, Camp Buehring, size fraction 10 to 20um

Particle edge

Individual and grouped bacteria

bacteria

grouped bacteria

This photo shows a particle that appears to contain numerous bacteria in its core rather than on its surface. Bacteria size ~1um. 1000X with digital zoom.

**Sterilization Problems!**

bacteria

Virus-like particle

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