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# *Science Without Borders*

Geneticist Dyann Wirth:

*Understanding the DNA of Parasites*

**FINDINGS**

National Institutes of Health  
National Institute of General Medical Sciences

# *Dyann Wirth Probes Parasites*

*Geneticist Wirth wants to wipe out malaria by overcoming a parasite's drug resistance.*



## *Plasmodia*

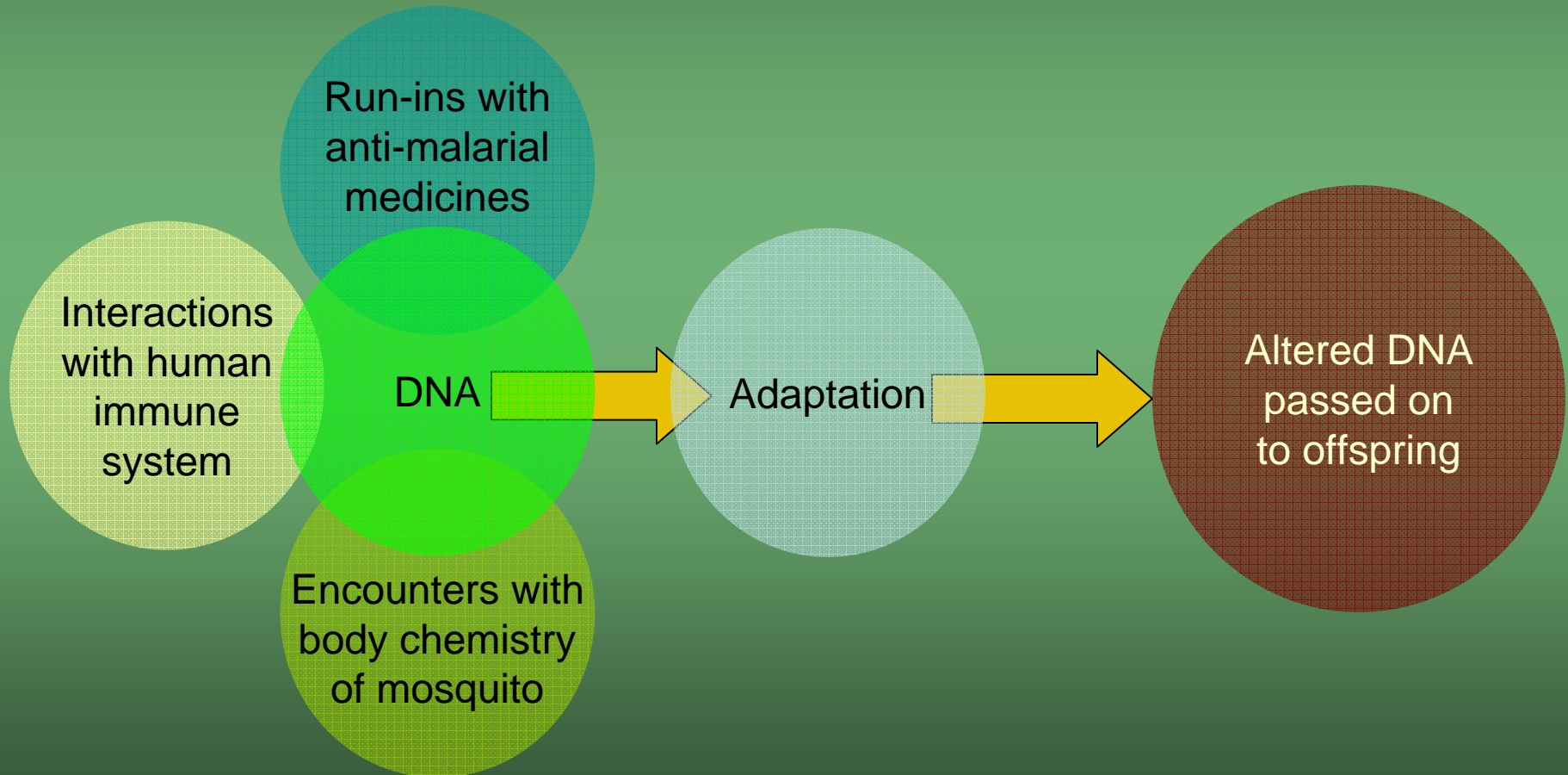
- Are parasitic protozoans
- Cause malaria
- Infect humans and mosquitoes

*Question:*

How do *Plasmodia* survive antimalarial medicines?

# Answer: Genetic adaptation

DNA: altered over time by adaptation to many events



# *Deadly Differences*




- Four species of *Plasmodium* parasite cause malaria in humans
- *Plasmodium falciparum*

- Most widespread and dangerous
- Accounts for 80% of human malarial infections and 90% of deaths

How can scientists pinpoint what makes *Plasmodium falciparum* so deadly?

# Exploring Parasite Secrets

Scientists study genetic variation:

- Across populations 
- Single-nucleotide polymorphism (SNP) 
- Patterns of SNPs 

Why do scientists study more than one genome?

Give an example of a SNP.

What is the name for these DNA patterns?

# *Global Team Science*

Exploration begins with patient volunteers from malaria clinics on 3 continents



**FINDINGS**

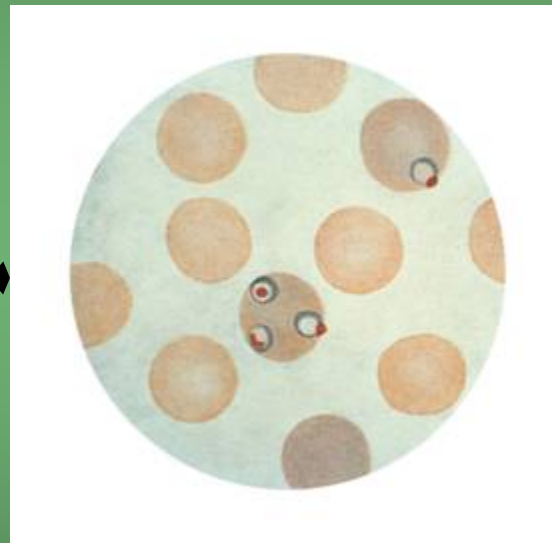
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# *Plasmodia Parasites in Human Blood*

**Africa**

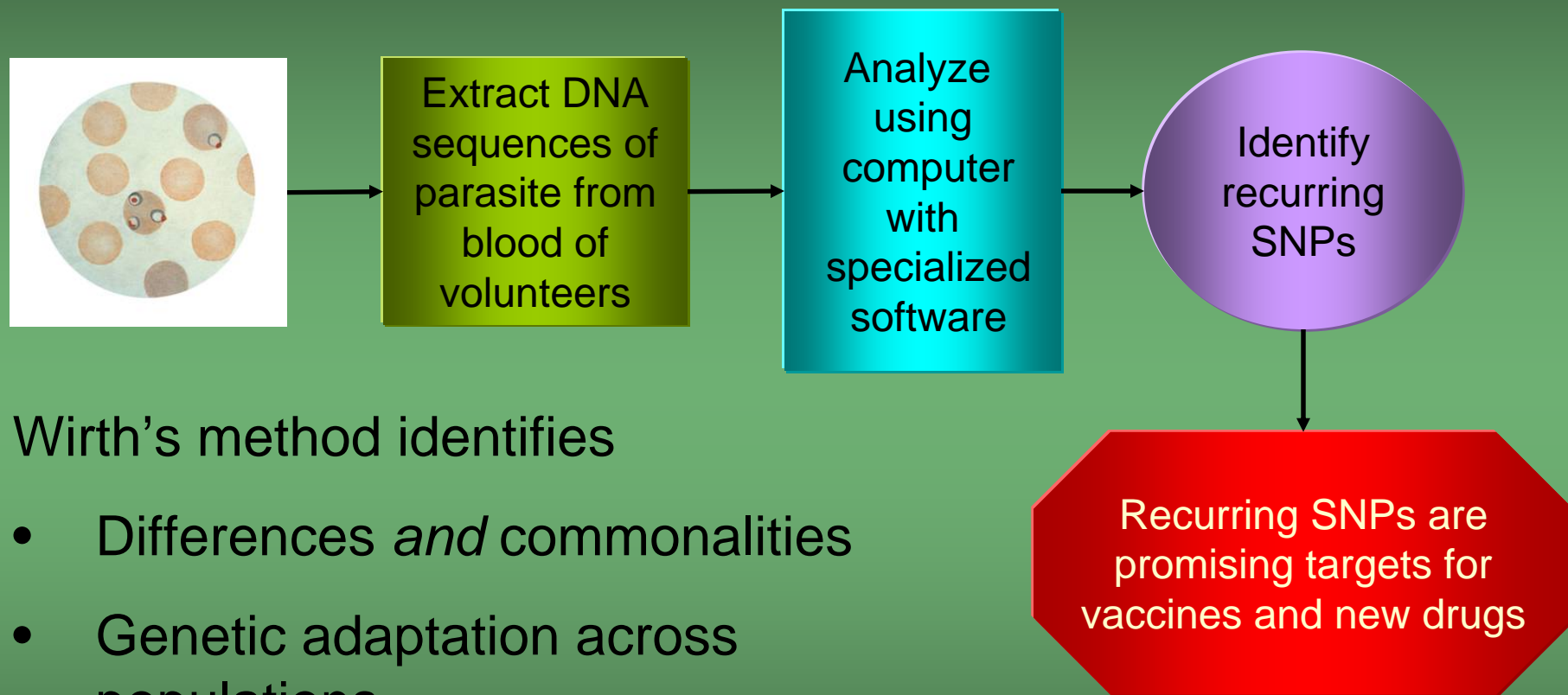
**South America**

**Asia**



Malaria  
parasite  
*Plasmodium  
falciparum*  
growing  
inside human  
red blood  
cells

# Wirth's Experiments



Wirth's method identifies

- Differences *and* commonalities
- Genetic adaptation across populations
- Promising targets for intervention



# *The Human Touch*

Human activity can spread drug resistance



How do humans help mosquitoes spread resistance across extremely wide geographic areas?

What human-made environments make great breeding sites for mosquito larvae?

# *The MIDAS Touch*

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## Model of Infectious Disease Agent Study

- Brings together international network of scientists from different fields
- Simulates infectious disease outbreaks
- Identifies most effective interventions
- Prepares public health experts to control infectious disease disasters *before* they happen

# *Research Applications*

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How might knowledge that Wirth and her team have gained about *Plasmodium* DNA be used to develop an early warning system for malaria drug resistance?