

State of Malaria Vaccine Development

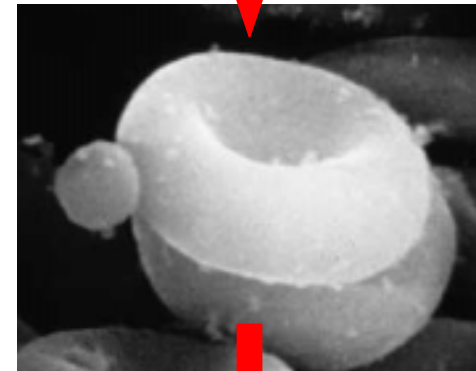


State of Malaria Vaccine Development

- Global snapshot of malaria vaccine concepts
- Recent temporal trends
- Malaria vaccinology unknowns

The Global Malaria Vaccine Development Effort

The Parasite Life Cycle (as a vaccinologist might see it)



Pre-erythrocytic

(vaccines to prevent infection and *impact clinical disease*)

Development: 24

Clinical trial: 8

Product-like: 7

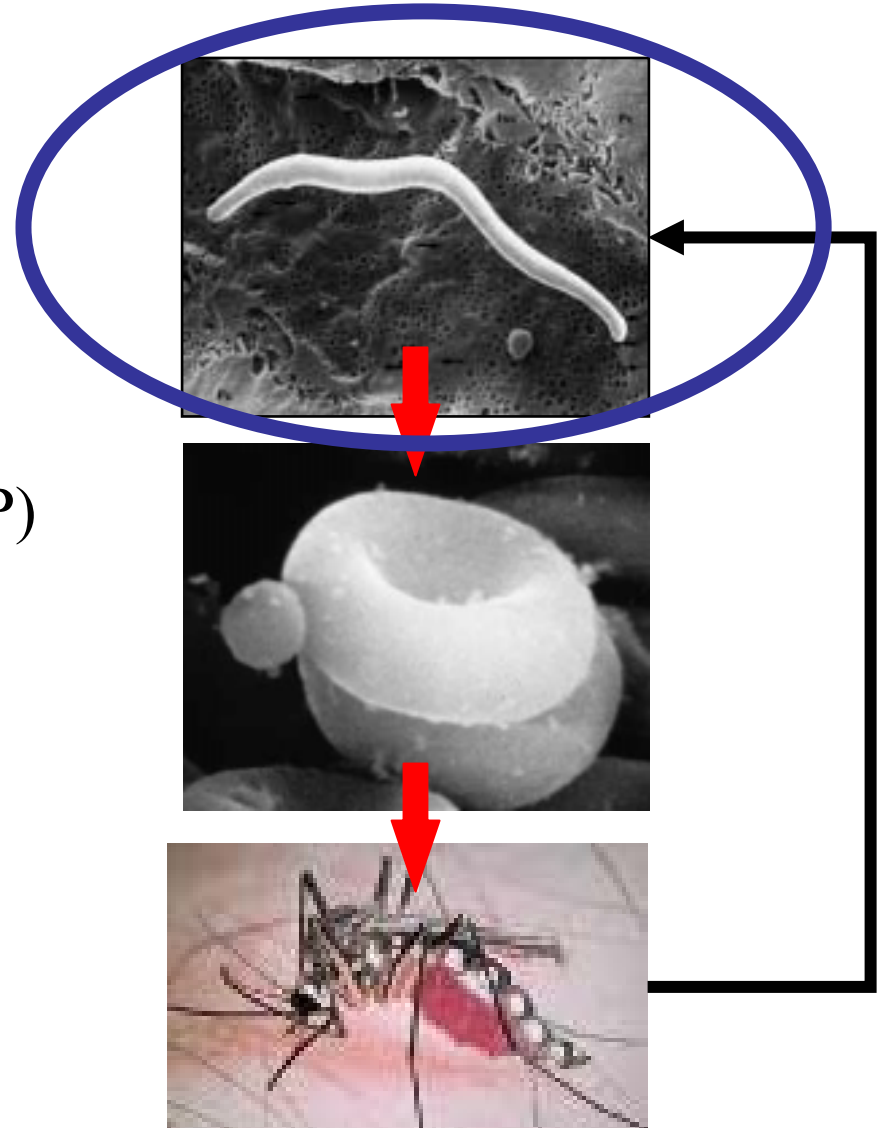
11/24 are the same antigen (CSP)

P. Vivax

Development: 3

Clinical trial: 3

Product-like: 0



Blood-stage (vaccines to lessen disease)

Development: 43

Clinical trial: 8

Product-like: 30

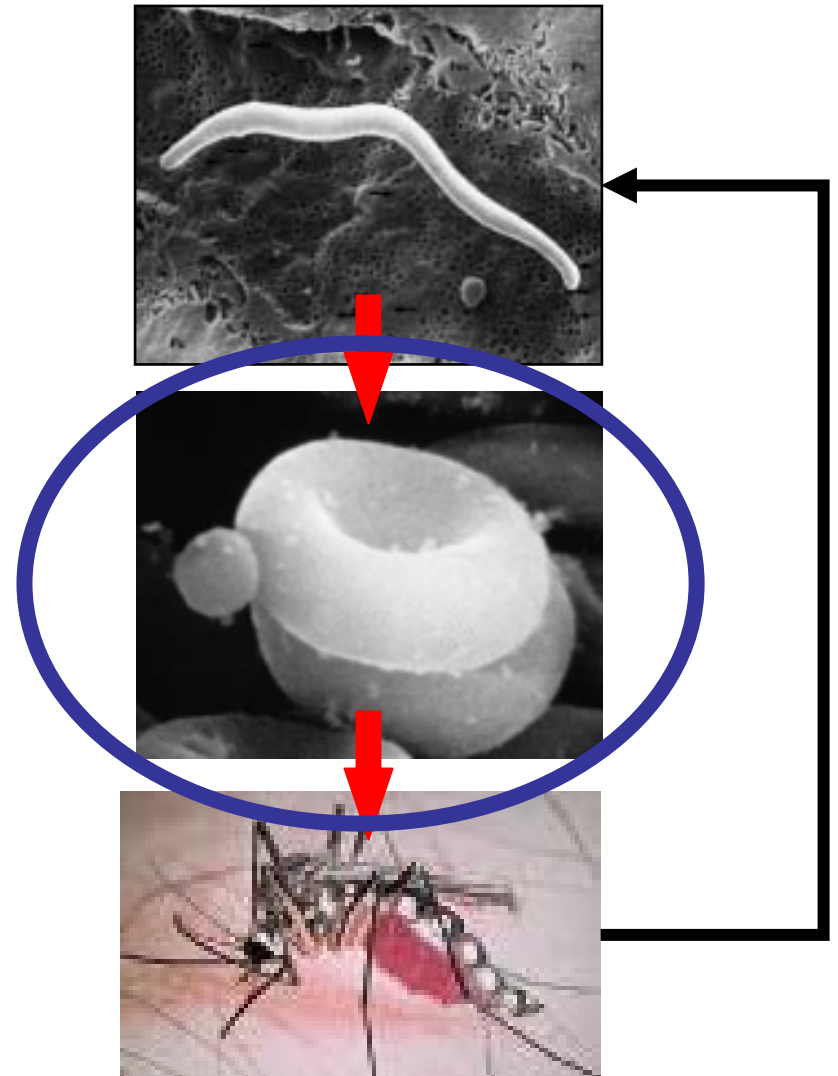
17/43 are same antigen (MSP-1)

P. Vivax

Development: 1

Clinical trial: 0

Product-like: 1

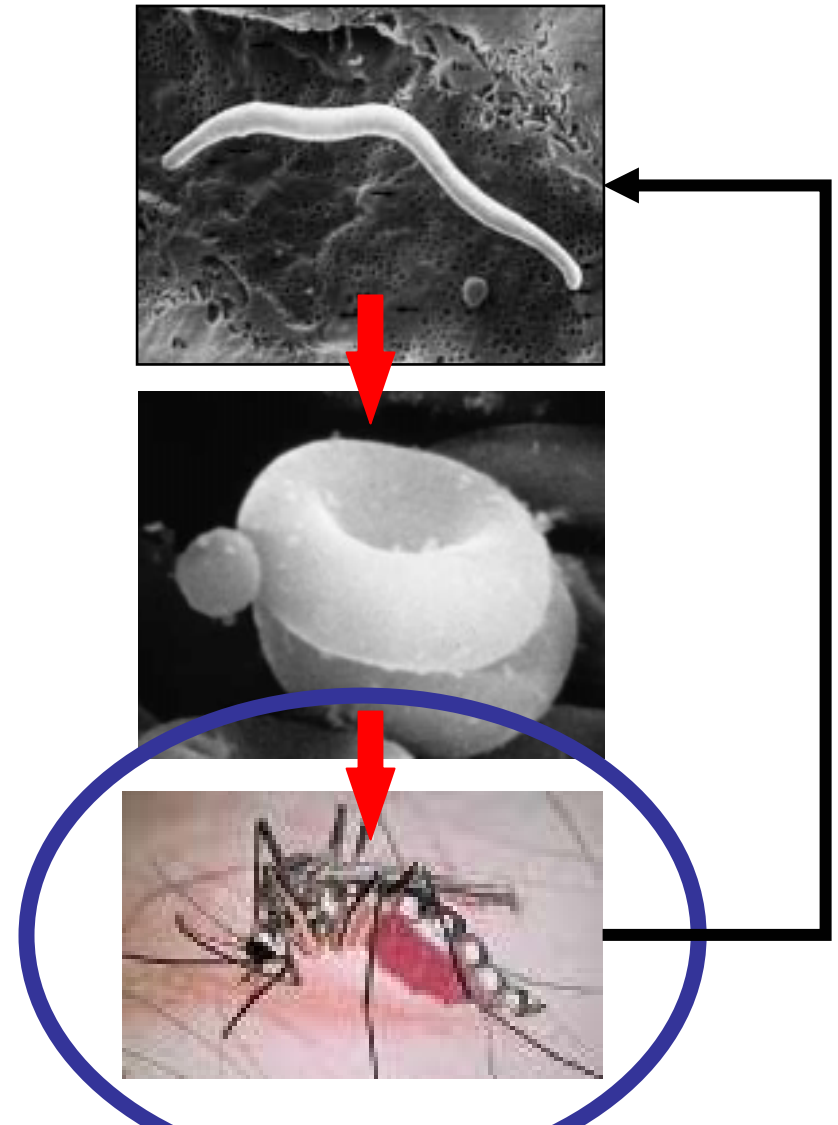


Mosquito-stage (vaccines to prevent transmission)

Development: 5
Clinical trial: 0
Product-like: ?

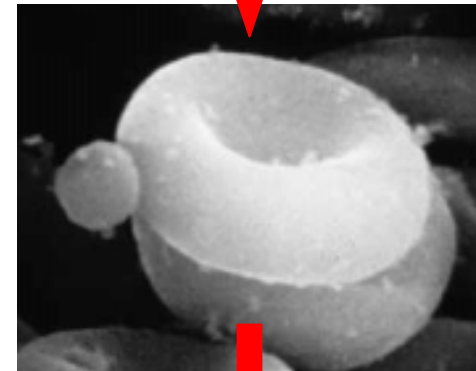
P. Vivax

Development: 3
Clinical trial: 1
Product-like: ?



Multi-stage

Development: 11
Clinical trial: 2
Product-like: 2



The Global Malaria Vaccine Development Effort

Development: 83

Clinical Trials: 18

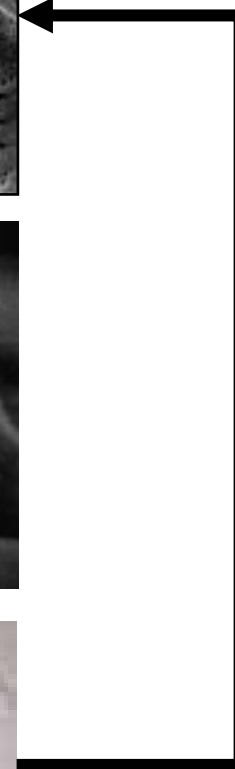
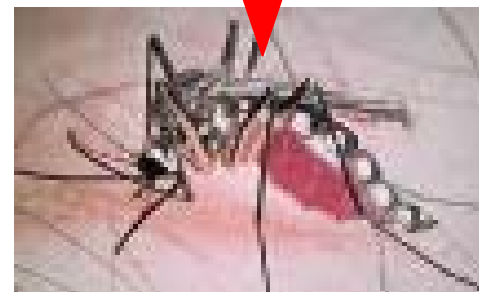
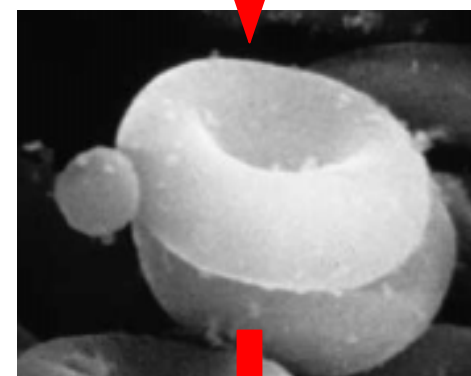
Product like: 40

P. Vivax

Development: 7

Clinical trial: 4

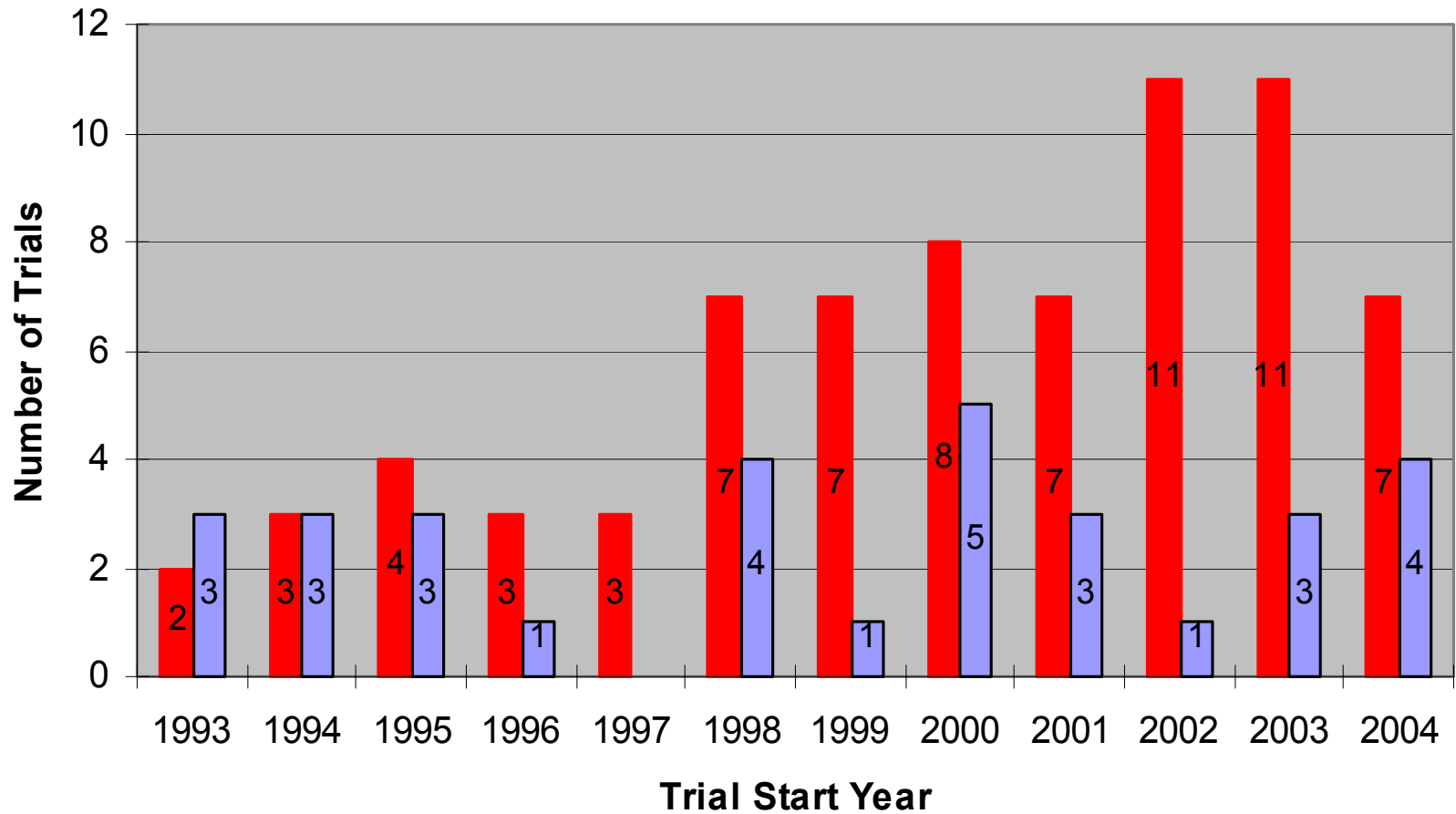
Product-like: 1



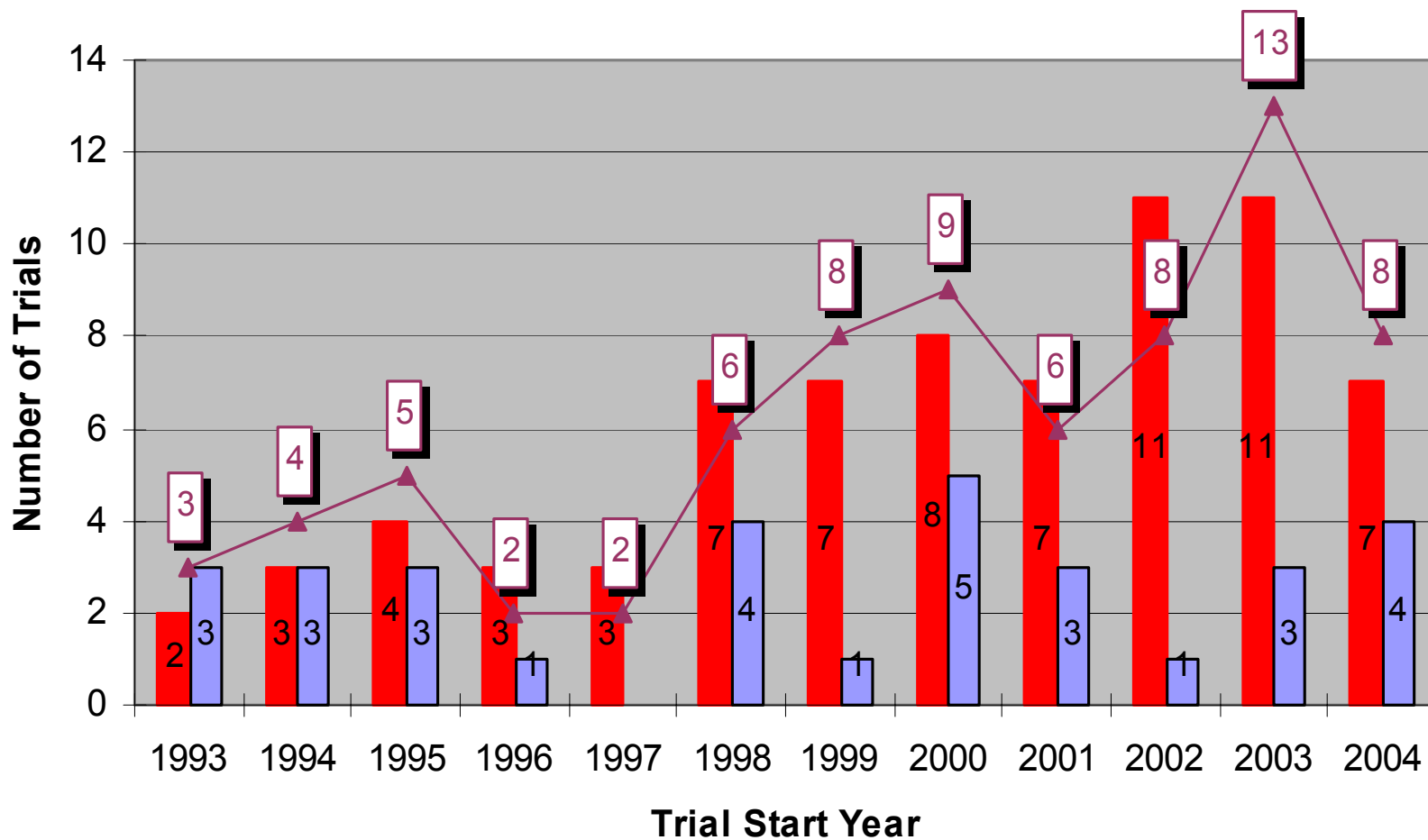
Assessment

- Most vaccine concepts in research (vs development)
- “classical/historical” antigens are overrepresented
- A minority of candidates are amenable to being directly turned into products (mostly CSP & MSP-1)
- 60% are protein based vaccines
- But the number of “product like” has doubled in past 2-3 years

Malaria Vaccine Clinical trials



Malaria Vaccine Clinical trials



Malaria Vaccine R&D Expenditures

(US Dollars in thousands)

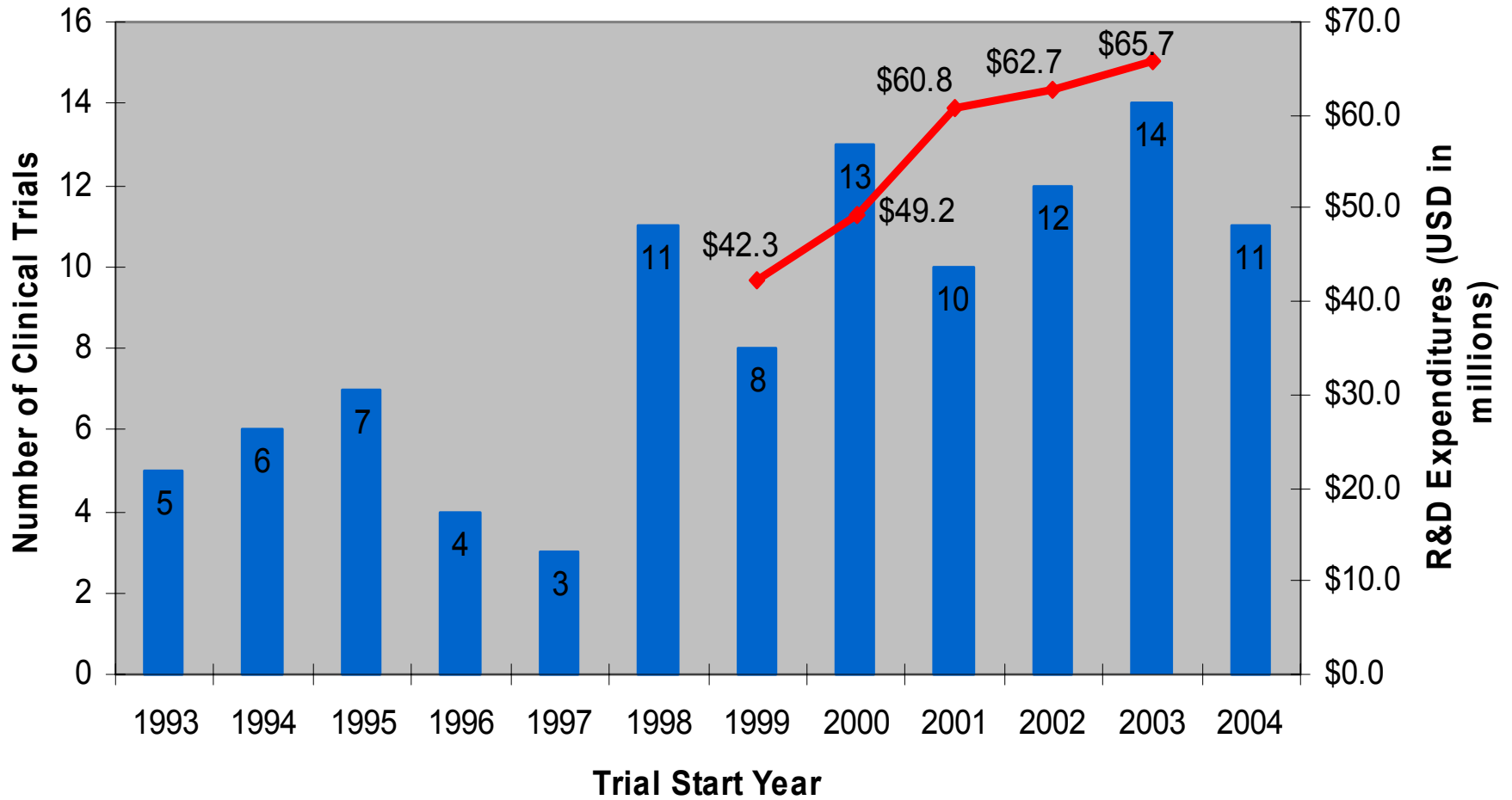
	1999	2000	2001	2002	*2003
EC**	4,250	4,250	4,250	4,250	5,000
EMVI**	654	998	1,148	3,400	2,750
MVI	334	2,497	13,140	12,799	14,046
NIH (NIAID)	28,000	31,700	28,700	29,600	33,000
TDR/WHO	1,210	969	860	400	350
USAID	3,000	2,980	4,250	4,700	4,700
DOD (NMRC/WRAIR)	4,856	5,774	8,496	7,510	5,889
<i>Annual Total</i>	42,304	49,168	60,844	62,659	65,735

*2003 budget figures are projected, all others are actual

**Euro converted on 1.0 exchange rate

(Figures from The Wellcome Trust to be included in the near future)

Malaria Vaccine Clinical Trials and Expenditures

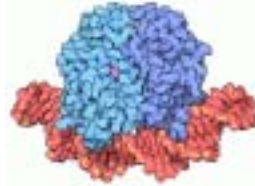


Antigen Selection



Identity and number of relevant antigens is unknown

Vaccine Design



Characteristics of protective immune response is unknown

Pre-clinical Testing



Predictive nature of models is unknown

Parasite Impact Trials

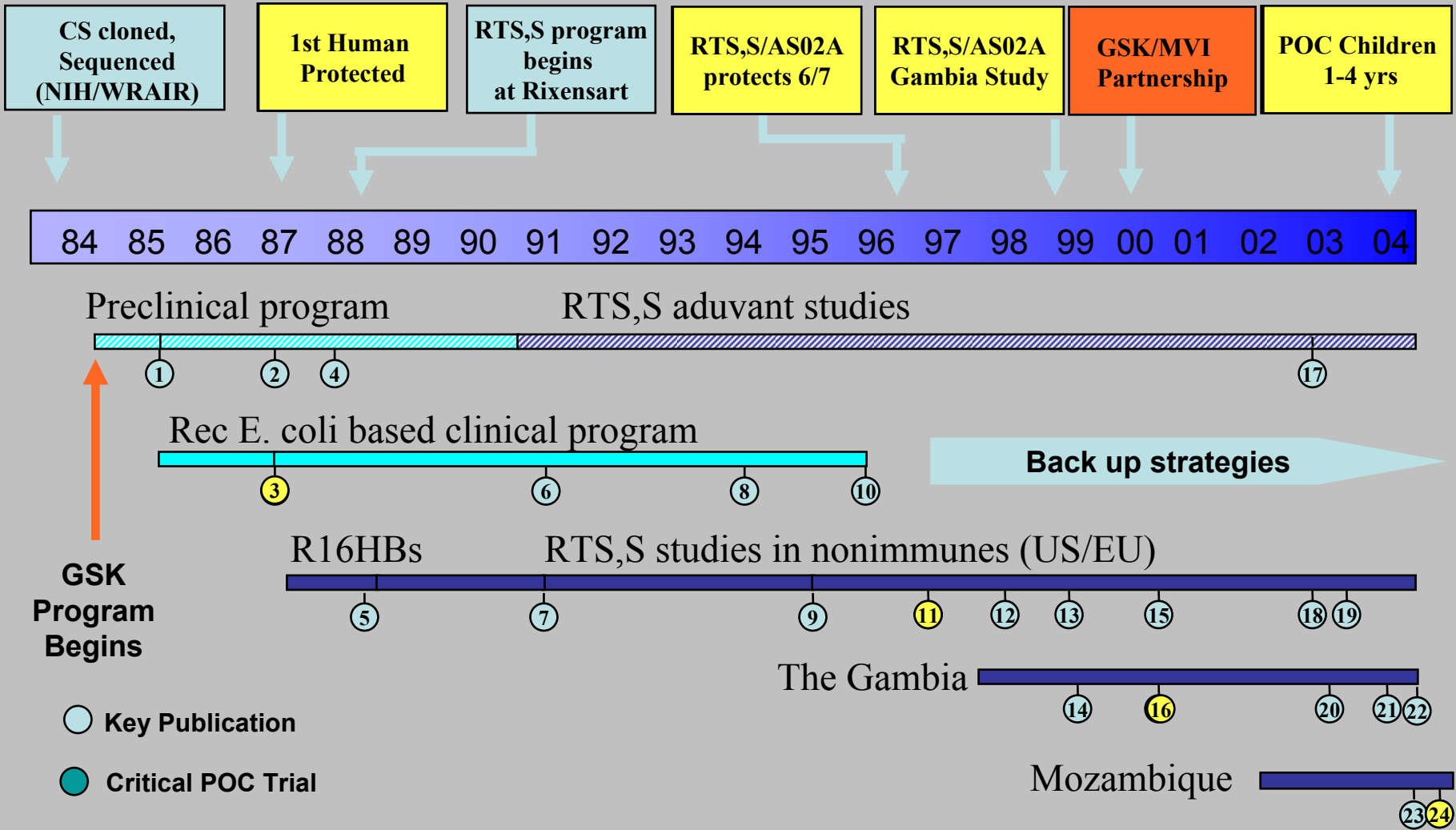


Correlation between impacting parasite and disease is unknown

Clinical Efficacy Trials



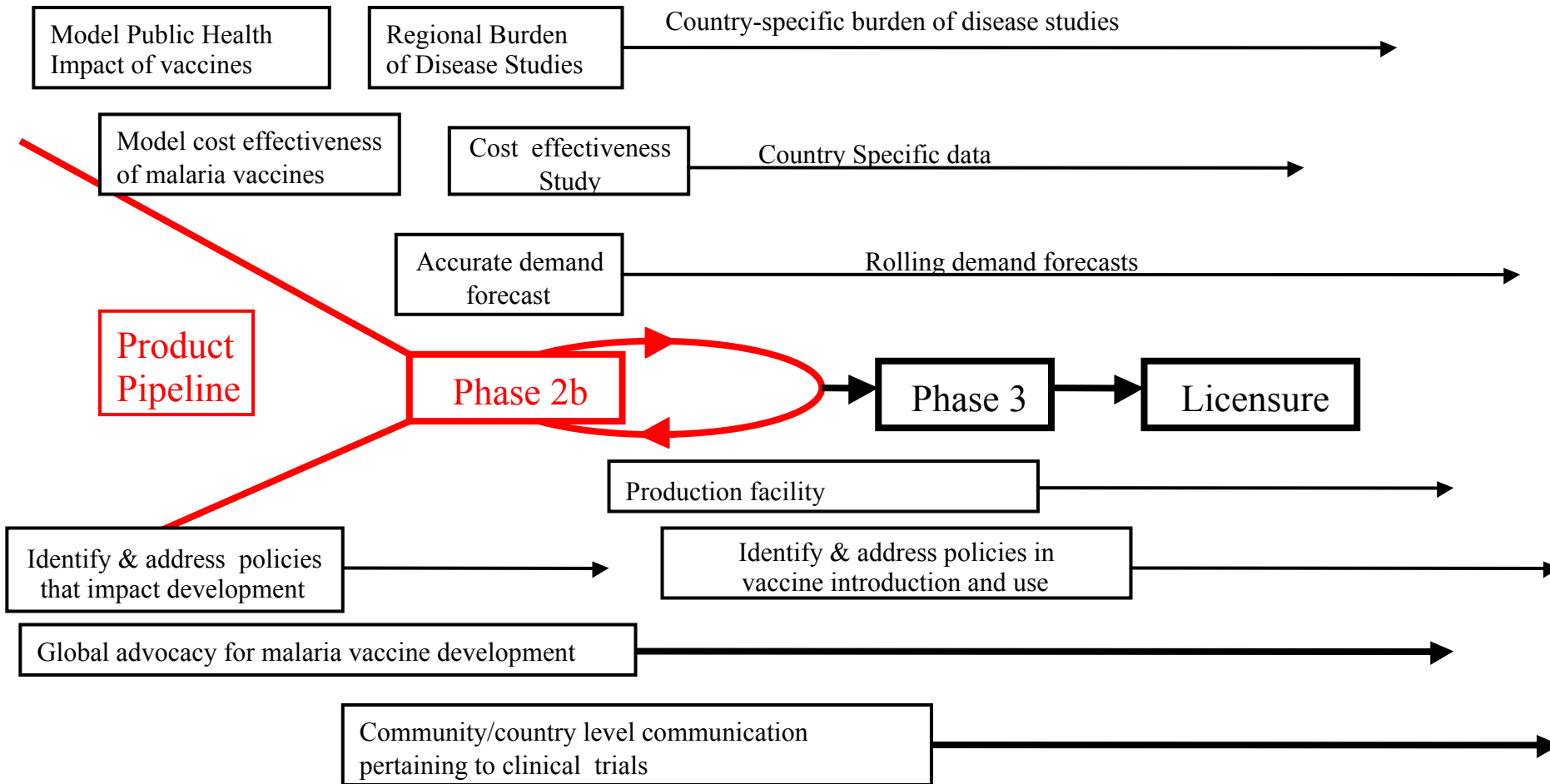
Program History



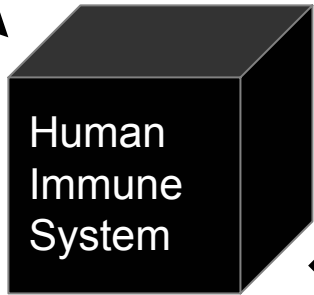
Since 1984, WRAIR has been GSK's major research partner



Vaccine Development and Introduction Framework

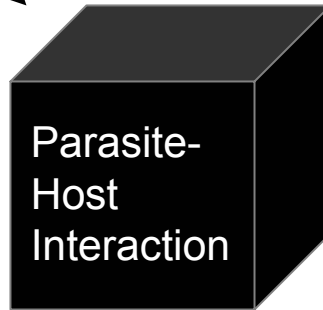


Vaccine
Concept



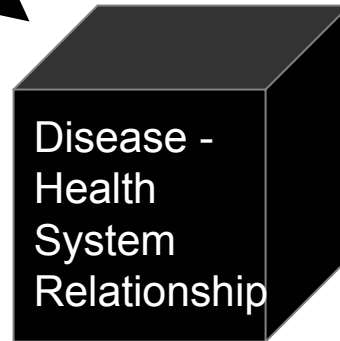
Immune Response

- Humoral
- Cellular
- Functional



Vaccine Efficacy

- Disease
- Severe Disease
- Death
- Anemia
- Parasite density
- Genotypic breakthrough



Public Health Impact

- Cost effectiveness
- DALYs

Knock-outs
Structure/Function
Antigen location
Polymorphisms
Ortholog models
Aotus/Saimiri models
ADCI GIA ISI
Immuno-epidemiology
Process inhibition
Manufacturability



The Vision

