Preparing for tsetse eradication

C.J. Schofield* and J.S. Patterson*

TSETSE-FLYES OCCUR THROUGHOUT MOST
of sub-Saharan Africa, over an area
approaching 10 million km². They
suck blood and transmit a range
of trypanosome species, including those
that cause human sleeping sickness, and
others that are responsible for a fatal syn-
drome of anaemia and wasting in cattle
known as ‘nagana’ (from a Zulu word
meaning to be low or depressed in spirit).
Not only does this limit the availability
of meat and dairy products, it also curtails
the availability of oxen or horses for trans-
port and ploughing. This severely restricts
agricultural production. Without oxen,
only small areas of land can be tilled by
hand, leaving communities vulnerable to
food shortages, hunger, and even famine.

Since the 1960s, the incidence of sleeping
sickness has risen steadily, with epidemic
outbreaks in several areas. The World
Health Organization (WHO) now esti-
mates that over 300 000 people are in-
fected with African trypanosomiasis, and
the UN Food and Agriculture Organiza-
tion estimates that economic losses due to
the livestock infections may reach around
US$4.5 billion each year.

Because African trypanosomes are able
to present successive waves of different
surface proteins (a process known as ‘an-
tigenic variation’), it is unlikely that an
effective vaccine can be developed. Treat-
ment is possible, but relies largely on
antiquated drugs such as melarsoprol,
which is — loosely speaking — a mixture
of arsenic and anti-freeze that will kill up
to 10% of those treated (although all
would succumb to the disease without
treatment). There are other drugs with
less severe side effects, and the WHO has
now arranged that these can be provided
free of charge to national treatment
programmes. But it is a difficult task to
find, diagnose, and treat all the patients
who require such care.

Recognizing the problems of tsetse-
borne trypanosomiasis, the heads of state
and government of the 36 affected coun-
tries, meeting at the 2000 OAU summit in
Togo, declared as priority the aim of ‘ren-
dering Africa free of tsetse in the shortest time possible’. In response, the OAU (now the
African Union) has set up a Pan-African
initiative (known as AU-PATTEC) to
promote and coordinate national and
regional programmes to eliminate the
problem of tsetse and trypanosomiasis.
Several countries have already reflected
this goal in their official poverty reduction
strategy papers, developing or revitalizing
their national programmes, and the
African Development Bank is now pro-
viding a series of grants and loans through
PATTEC to assist the first six countries
(Ethiopia, Uganda, Kenya, Mali, Burkina
Faso and Ghana) in their tsetse elimina-
tion programmes. Further grants are
under discussion.

Techniques to eliminate tsetse have
been known since the eradication of
Glossina palpalis from the Island of
Principe in 1914, using a form of sticky
traps carried by plantation workers.

Today, a series of highly effective tech-
niques is available, including an array of
odour-baited traps and targets, sequential
aerial spraying with ultra-low doses of
biodegradable insecticides, and, where
necessary, SIT — the use of sterilized male
flies to reduce the already low reproduc-
tive rate of wild tsetse. The ‘proof-of-
principle’ of this technological package
was successfully demonstrated by eradi-
cation of tsetse (Glossina austeni) from the
Island of Zanzibar during the 1990s.

Zanzibar is now a nett exporter of meat
dairy produce, where previously it
was a nett importer when tsetse and
trypanosomiasis limited cattle and agri-
cultural production.

But this demonstration of the feasibility
of tsetse elimination has been criticized,
on the grounds that Zanzibar is a relatively
small island whereas Africa is a rather
large continent. So, the African Union,
together with other organizations sup-
porting the PATTEC initiative, is harness-
ing modern techniques of population
geographic information
systems (GIS) in order to find the ‘biologi-
cal islands’ of tsetse distribution within
the continent of Africa, so that these popu-
lations can be progressively targeted for
elimination. The work is supported by the
Leverhulme Trust in England, through a
network currently involving research in-
stitutions in 19 African countries, the
United Kingdom, France, and the United
States.

The article on page 132 of this issue
presents the first study resulting from this
new initiative. It is a comparison between
gene sequencing and the developing
science of morphometry as a means to dif-
ferentiate tsetse populations. The tech-
niques of geometric morphometry are
statistically complex, but offer a very
rapid way to screen large numbers of in-
dividuals (similar techniques are now
used by the US immigration services to
identify travellers by means of morpho-
metric analysis of photographs taken
when you present your passport).

Those familiar with Greek mythology
will perhaps recognize the concept of
Procrustean analysis, through which
shapes are compared by measuring the
deformations required to superimpose
one shape on another. (Procrustes was
reputed to fit his victims into a bed —
stretching them if they were too short,
cutting their extremities if they were too
long.) And although morphometrics
relies on phenetic rather than genetic
characters, the preliminary study re-
ported here reveals strong congruence
between the two, offering hope that the
large-scale analysis required in prepara-
tion for effective tsetse elimination can be
carried out quickly and at low cost.

NSTF awards for 2004

The National Science & Technology Fo-
um (NSTF) has made the following
awards for 2004, from many more nomi-
nations than in previous years. Category:
Individual over a lifetime: George F.R.
Ellis (University of Cape Town); individ-
ual through research and its outputs over
the last five years or less: Paul D. van
Helden (University of Stellenbosch);
individual through activities other than
research and its outputs over the last five
years or less: Steve J. Lennon (Eskom); 
corporate organization over the last 10
years: the joint winners are the
Kirsten-
bosch Research Centre, South Afri-
can National Biological Institute,
Cape Town, and the Kumba Resources
Research and Development, Pretoria;
SMME over the last three years: Group-
line Technical Ceramics (Pty) Ltd, Jet
Park, Ekhundlu; not-for-profit organi-
zation over the last three years:
Agri-
business for Sustainable Natural
African Plant Products (Stellen-
bosch); Eskom Research Capacity De-
velopment Awards: S. Priscilla Reddy
(Medical Research Council) and Jon-
athan D. Jansen (University of Pretoria);
T.W. Cambule NRFS Research Awards
(senior black researchers): Olive Shisana
(Human Sciences Research Council) and
Giovanni Hearne (University of the
Witwatersrand); (junior black research-
ers): Debra Meyer (University of Johan-
nesburg) and Vikash Sewram (Medical
Research Council).

*Department of Infectious and Tropical Diseases, London
School of Hygiene and Tropical Medicine, London, U.K.