In its first 25 years of existence, TDR has become a key player in the development of new tools for the control of tropical diseases and the training of researchers from disease-endemic countries. In order to maintain its leading position, cope with new health challenges and profit from new avenues opened by science and technology breakthroughs, a new strategic vision is now being implemented. It aims at a closer interaction with health systems and disease control programmes, capacity strengthening based on selected research initiatives and full exploitation of scientific and technological advances in the biomedical, social and information sciences, as discussed here by Carlos Morel.

Twenty-five years ago, a handful of visionaries gained the approval of the 27th World Health Assembly for the creation of an international special programme for research and training in tropical diseases, co-sponsored by three United Nations organizations and hosted at the WHO. This was in response to pleas from disease-endemic countries, where neglected diseases exact a huge toll on lives and productivity. A clear and simple mandate guided its mission: (1) to conduct research on a defined group of tropical diseases aimed at developing new tools to help control them; and (2) to train scientists and strengthen institutions from the endemic countries, so that they could play a major role in this endeavour.

This was the beginning of ‘TDR’ (the acronym for its official name of ‘UNDP/World Bank/WHO Special Programme for Research and Training in Tropical Diseases’), an organization funded entirely by contributions from a variety of donors. The creation of TDR represented a significant first shift of focus of a highly distorted global health research agenda, where 90% of the resources invested in health research are directed to diseases that affect only 10% of the global population – a disparity now known as the ‘10/90 disequilibrium’.

TDR’s mandate represents an immense challenge. The TDR ‘disease portfolio’ encompasses diseases (Table 1) for which there are no licensed vaccines, front-line drugs are losing their effectiveness, and solutions (when they exist) do not reach those who need them. Partly as a result of market forces, the private sector has failed repeatedly in developing efficient interventions.

Today, previously neglected diseases of the poor are under coordinated attack. Some have almost been conquered, others have survived, and new ones have emerged. The battle is far from won. The need for assistance to help disease-endemic countries to realize their full human and economic potential remains as essential now as it was 25 years ago.

TDR achievements

TDR works with a diverse range of partners, occupying a unique position as trusted broker linking academia, governments, donors, industry, non-governmental organizations (NGOs), health professionals and affected communities. It is a formula that is well-proven: external reviews have shown that TDR has made many significant contributions to disease control in its 25 years (Fig. 1), as documented in relation to TDR’s role in the development of multidrug therapy, ivermectin and fumigant canisters for leprosy, onchocerciasis and Chagas disease, respectively (Table 2).

In fact, these three diseases and lymphatic filariasis are in the process of being eliminated as public health problems.

TDR has made significant and often pathfinding contributions in four main areas:

- **Basic and strategic research.** TDR pioneered the organization of networks of researchers and institutions dedicated to the study of parasite genomes, because it is envisaged that genome sequencing and mapping, gene discovery and functional genomics research will provide new ways for drug, vaccine and diagnostics development.
- **Product research and development.** TDR has worked with a variety of partners – public and private sectors, NGOs, civil society – to develop various tools for the control of tropical diseases. The latest developments include the successful Phase II clinical trials of miltefosine as an oral drug against visceral leishmaniasis, and the initiation within TDR of the Medicines for Malaria Venture (MMV) – now a non-profit Swiss Foundation (Box 1). TDR is also recognized as a major global contributor to the field of vaccine research and development for malaria, leishmaniasis and schistosomiasis, especially in the development of guidelines and protocols and in the monitoring of field trials.
- **Field research.** TDR’s comparative advantage in organizing and implementing large-scale, multi-centric field studies at the global level has yielded exceptional results. TDR was a key player in demonstrating the usefulness of insecticide-impregnated bednets in the prevention of malaria mortality, and the potential of combination therapy in the prevention of drug resistance. The principal strategy of both the African Programme for Onchocerciasis Control (APOC) and the Onchocerciasis Elimination Programme of the Americas (OEPA) derives directly from research conducted by TDR in collaboration with Merck & Co. Inc., which showed that the drug ivermectin is effective and suitable for mass administration in the control of onchocerciasis. TDR research also led to the development of appropriate tools and procedures that have become standard practice in the execution of control programmes.

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Parasitology Today, vol. 16, no. 12, 2000

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Reaching Maturity – 25 Years of the TDR

C.M. Morel

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and lymphatic filariasis (RAGFIL)\textsuperscript{26}, as well as the community-directed treatment (ComDT)\textsuperscript{27} approach that ensures drug administration coverage reaches, and is sustained at, levels that are needed to achieve disease control.

- **Training of human resources and research capability strengthening.** TDR is recognized as a global leader in this area, particularly regarding Africa, and invests 25\% of its budget in these activities\textsuperscript{28,29}. During its existence, TDR has awarded 1115 Research Training Grants to 1048 trainees from 416 institutions/research groups from 76 developing countries, and 275 Institutional Strengthening Grants to 230 principal investigators from 175 institutes/research groups from 60 developing countries. These grants have helped establish a core group of skilled scientists and strong institutions in developing countries.

**Taking stock**

TDR’s 25th anniversary represented an opportunity for critically evaluating its overall performance and for shaping a new strategy targeted specifically at today’s changing priorities – as well as those of tomorrow. As a first step in this process, in July 1999, TDR’s governing body, the Joint Coordinating Board (composed of representatives of governments, donors and of co-sponsors), approved the inclusion of TB and dengue in TDR’s disease portfolio and, in 2000, endorsed the new ‘TDR Strategy 2000–2005’ (the full version of the Strategy is available on the TDR website – see Box 1). TDR’s new strategy is in synergy with the new vision of health research and the new corporate strategy of WHO\textsuperscript{30,31}, and proposes a natural evolution of the TDR’s disease portfolio and, in 2000, endorsed the new ‘TDR Strategy 2000–2005’ (the full version of the Strategy is available on the TDR website – see Box 1). TDR’s new strategy is in synergy with the new vision of health research and the new corporate strategy of the WHO\textsuperscript{30,31}, and proposes a natural evolution of the Special Programme as it reaches maturity (Box 2).

In order to implement its new strategy, TDR will need to interact much more actively with ministries of health, health systems and disease control programmes at country and regional levels. Although such interactions did occur occasionally in the past, the new strategy calls for a much more proactive role of TDR in this direction. This will require stronger partnerships with the donor community, international organizations and foundations, as well as the continuing participation of the global scientific community in all areas – from basic to applied research, from biomedical to human sciences, and from laboratory-based to field research.

It will not be an easy task. Although much has been accomplished in the first 25 years of TDR, the challenges today (Box 3) are even more formidable than when TDR was created. Meeting these challenges will require renewed commitment. TDR will remain one of the leaders in setting the public-sector agenda for research and development in tropical infectious diseases – eg. TDR plays a lead role in the Multilateral Initiative for Malaria (MIM) (Box 1). But TDR must also strengthen other present collaborations (Box 1), such as with the Roll Back Malaria global partnership and the Stop TB initiative, and build new ones, engaging in global public–private partnerships\textsuperscript{47,48}. TDR itself was one of the first such partnerships to emerge in the 1980s\textsuperscript{19,47} and is now actively involved in partnerships such as the Global Alliance for Vaccines and Immunization (GAVI) (Box 1) and the Global Alliance for TB Drug Development\textsuperscript{49}. In addition, work initiated\textsuperscript{50} and carried out in TDR has given rise to the Global Forum for Health Research and the MMV, both independent, non-profit organizations (Box 1). As well as its partnership activities, TDR will continue to focus and develop its key operational strengths, which are found in knowledge management, global overview of tropical disease research issues, and the ability to foster North–South and South–South collaborations, thus strengthening research capacity. The new strategy emphasizes the need for TDR to act as a bridge between research potential and the realities of country-level control operations and their implementation – and the need to engage the world’s scientific community, interdisciplinary experts and affected communities at every step in the process. TDR will have to both gather and distribute knowledge and wisdom, new and old, from and to all sources. To help accomplish this, TDR will continue to expand and diversify its information gathering and dissemination systems and make extensive use of electronic communications, including a website (TDR website, Box 1).

With the new strategy, TDR reaches maturity as a knowledge-management network organization, harnessing the full potential of science and technology in the fight against tropical diseases.

**Acknowledgements**

I thank Andy Crump and Lisa Schwarb for Fig. 1, Nina Mattock for final revision, and all TDR staff for valuable contributions, comments and suggestions.

**References**


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**Table 1. Tropical disease data\textsuperscript{a}**

<table>
<thead>
<tr>
<th>Disease burden</th>
<th>Male</th>
<th>Female</th>
<th>Total\textsuperscript{b}</th>
<th>Deaths</th>
<th>Male</th>
<th>Female</th>
<th>Total\textsuperscript{b}</th>
</tr>
</thead>
<tbody>
<tr>
<td>Malaria</td>
<td>22 758</td>
<td>22 240</td>
<td>44 998</td>
<td>553</td>
<td>532</td>
<td>1086</td>
<td></td>
</tr>
<tr>
<td>Tuberculosis</td>
<td>19 030</td>
<td>14 257</td>
<td>33 287</td>
<td>1003</td>
<td>666</td>
<td>1669</td>
<td></td>
</tr>
<tr>
<td>Lymphatic filariasis</td>
<td>3777</td>
<td>1141</td>
<td>4918</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>African trypanosomiasis</td>
<td>1111</td>
<td>937</td>
<td>2048</td>
<td>37</td>
<td>30</td>
<td>66</td>
<td></td>
</tr>
<tr>
<td>Leishmaniasis</td>
<td>1200</td>
<td>782</td>
<td>1983</td>
<td>32</td>
<td>25</td>
<td>57</td>
<td></td>
</tr>
<tr>
<td>Schistosomiasis</td>
<td>1174</td>
<td>758</td>
<td>1932</td>
<td>8</td>
<td>6</td>
<td>14</td>
<td></td>
</tr>
<tr>
<td>Onchocerciasis</td>
<td>623</td>
<td>461</td>
<td>1085</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Chagas disease</td>
<td>400</td>
<td>277</td>
<td>676</td>
<td>11</td>
<td>10</td>
<td>21</td>
<td></td>
</tr>
<tr>
<td>Leprosy</td>
<td>253</td>
<td>223</td>
<td>476</td>
<td>2</td>
<td>1</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Dengue</td>
<td>220</td>
<td>245</td>
<td>465</td>
<td>6</td>
<td>7</td>
<td>13</td>
<td></td>
</tr>
</tbody>
</table>

\textsuperscript{a} Global burden of disease in disability-adjusted life years (DALYs) and deaths for the ‘TDR diseases’ (1999 estimates), from The World Health Report 2000 (WHO, Geneva; WHO website, Box 1).

\textsuperscript{b} Discrepancies in totals are due to rounding up and down of figures.
Table 2. Products from TDR and its partners\textsuperscript{a,b}

<table>
<thead>
<tr>
<th>Years</th>
<th>Disease</th>
<th>Product</th>
<th>Partner(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1982</td>
<td>Leprosy</td>
<td>Combination drug regimens for pauci-bacillary leprosy</td>
<td>National leprosy programmes; various NGOs</td>
</tr>
<tr>
<td>1982</td>
<td>Leprosy</td>
<td>Combination drug regimens for multi-bacillary leprosy</td>
<td>National leprosy programmes; various NGOs</td>
</tr>
<tr>
<td>1983</td>
<td>African trypanosomiasis</td>
<td>CATT</td>
<td>Institute of Tropical Medicine ‘Prince Leopold’, Anvers, Belgium</td>
</tr>
<tr>
<td>1983</td>
<td>Schistosomiasis</td>
<td>Diagnostic urine filtration test</td>
<td>WHO/PDP</td>
</tr>
<tr>
<td>1983–1984</td>
<td>Onchocerciasis</td>
<td>Bacillus thuringiensis H-14 for black fly control</td>
<td>TEKNAR/Sandoz &amp; Thermotrilog; VECTOBAC/Abbott</td>
</tr>
<tr>
<td>1984</td>
<td>Malaria</td>
<td>Mefloquine</td>
<td>WRAIR; Hoffmann La Roche</td>
</tr>
<tr>
<td>1984</td>
<td>Malaria</td>
<td>Mefloquine plus sulphadoxine–pyrimethamine</td>
<td>WRAIR; Hoffmann La Roche</td>
</tr>
<tr>
<td>1984</td>
<td>Chagas disease</td>
<td>Rapid test for blood bank screening with defined antigens</td>
<td>Fundación Campomar and Laboratorios Gador, Buenos Aires, Argentina</td>
</tr>
<tr>
<td>1985</td>
<td>African trypanosomiasis</td>
<td>Tsetse traps for control of epidemics</td>
<td>WHO/PDP; ORSTOM, France</td>
</tr>
<tr>
<td>1985</td>
<td>Malaria</td>
<td>Microtest kit for drug sensitivity</td>
<td>Ministry of Public Health, Philippines; WHO/MAP</td>
</tr>
<tr>
<td>1987</td>
<td>Onchocerciasis</td>
<td>Ivermectin</td>
<td>OCP; Merck &amp; Co. Inc.</td>
</tr>
<tr>
<td>1990</td>
<td>African trypanosomiasis</td>
<td>Eflornithine</td>
<td>Hoechst Marion Roussel</td>
</tr>
<tr>
<td>1991</td>
<td>Malaria</td>
<td>Artemether</td>
<td>Rhône-Poulenc Rorer</td>
</tr>
<tr>
<td>1991</td>
<td>Onchocerciasis</td>
<td>DNA probes for Onchocerca volvulus</td>
<td>OCP</td>
</tr>
<tr>
<td>1993</td>
<td>Lymphatic filariasis</td>
<td>Single-dose DEC</td>
<td>WHO/ICTD</td>
</tr>
<tr>
<td>1993</td>
<td>Onchocerciasis</td>
<td>REMO</td>
<td>The World Bank</td>
</tr>
<tr>
<td>1993</td>
<td>Malaria</td>
<td>Integrated management of childhood illness</td>
<td>UNICEF; WHO/CHD; IDRC; WHO/ICTD</td>
</tr>
<tr>
<td>1994</td>
<td>Leishmaniasis</td>
<td>Lipid-associated amphotericin B</td>
<td>NexStar</td>
</tr>
<tr>
<td>1994</td>
<td>Leishmaniasis</td>
<td>Direct agglutination test</td>
<td>Institut de Médecine Tropicale Prince Leopold, Antwerp, Belgium; University of Amsterdam; WHO/ICTD</td>
</tr>
<tr>
<td>1994</td>
<td>Schistosomiasis</td>
<td>Praziquantel combinations</td>
<td>SmithKline Beechem; E. Merck Pharma; WHO/ICTD</td>
</tr>
<tr>
<td>1994</td>
<td>Lymphatic filariasis</td>
<td>Detection and monitoring of adult Wuchereria bancrofti</td>
<td>FIOCRUZ, FACEPE, Fundação Nacional de Saude, Clínica Radioiologia de Pernambuco (Brazil)</td>
</tr>
<tr>
<td>1995</td>
<td>Onchocerciasis</td>
<td>ComDT</td>
<td>OCP/APOC, The World Bank; Merck &amp; Co Inc.</td>
</tr>
<tr>
<td>1996</td>
<td>Malaria</td>
<td>Insecticide-treated bednets</td>
<td>UNICEF; USAID; IDRC; CDC; CIA; Wellcome Trust; Save the Children Fund; London School of Hygiene and Tropical Medicine, Italian cooperation; Ministries of Health in Ghana, Tanzania, Gambia, Kenya, and Burkina Faso</td>
</tr>
<tr>
<td>1997</td>
<td>Malaria</td>
<td>Iron supplementation for prevention of death from severe anaemia</td>
<td>UNICEF, Swiss Development Cooperation; Spanish Agency for International Cooperation</td>
</tr>
<tr>
<td>1997</td>
<td>Schistosomiasis</td>
<td>Schistosoma haematobium morbidity by ultrasonography</td>
<td>CERMEES/OCCGE; Ministry of Health, Niger</td>
</tr>
<tr>
<td>1997</td>
<td>Leprosy</td>
<td>Offoxacin plus rifampicin minus monocline</td>
<td>National leprosy programmes; various NGOs</td>
</tr>
<tr>
<td>1999</td>
<td>Lymphatic filariasis</td>
<td>Rapid mapping of filariasis</td>
<td>WHO/CEE; Liverpool School of Tropical Medicine</td>
</tr>
<tr>
<td>1999</td>
<td>Lymphatic filariasis</td>
<td>Alendazole combinations</td>
<td>WHO/CP; SmithKline Beechem; Merck &amp; Co. Inc.</td>
</tr>
<tr>
<td>2000</td>
<td>Malaria</td>
<td>Artemotil</td>
<td>Dutch cooperation; Arteceol and WRAIR</td>
</tr>
<tr>
<td>In the pipeline</td>
<td>Leprosy</td>
<td>Offoxacin plus rifampicin combination</td>
<td>National leprosy programmes; various NGOs</td>
</tr>
<tr>
<td>In the pipeline</td>
<td>Visceral leishmaniasis</td>
<td>Mitofosine oral</td>
<td>Asta Medica</td>
</tr>
<tr>
<td>In the pipeline</td>
<td>Malaria</td>
<td>LAPDAP oral</td>
<td>SmithKline Beechem</td>
</tr>
<tr>
<td>In the pipeline</td>
<td>Malaria</td>
<td>Artesunate rectal</td>
<td>Knoll; R.P. Scherer; Scanpharm</td>
</tr>
<tr>
<td>In the pipeline</td>
<td>Schistosomiasis</td>
<td>Artemether oral as a prophylactic</td>
<td>Chinese Academy of Preventive Medicine; Swiss Tropical Institute</td>
</tr>
</tbody>
</table>

\textsuperscript{a} For most, if not all, of the products listed, TDR had as partners individual scientists funded from various sources, as well as trainees and institutions that were recipients of TDR grants or research capacity strengthening projects (see also Fig. 1).

\textsuperscript{b} Abbreviations: APOC, African Programme for Onchocerciasis Control; CATT, Card agglutination test; CERMEES, Center for Research on Meningitis and Schistosomiasis; ComDT, Community-directed therapy for onchocerciasis; DEC, diethylcarbamazine; CDC, Centers for Disease Control and Prevention; CIDA, Canadian International Development Agency; FACEPE, Fundacao de Amparo a Ciencia e Tecnologia do Estado de Pernambuco; IDRC, International Development Research Centre; NGO, non-governmental organization; OCCGE, Organisation de Coordination de la Cooperation pour la lutte contre les Grandes Eendemies; OCP, Onchocerciasis Control Programme; ORSTOM, Institut Français de Recherche Scientifique pour le Développement en Coopération; REMO, Rapid epidemiological mapping of onchocerciasis; USAID, US Agency for International Development; WHO/CEE, WHO department for Strategy Development and Monitoring for Eradication and Elimination; WHO/CHD, WHO division of Child Health and Development; WHO/CPE, WHO department for Communicable Diseases Control, Prevention and Eradication; WHO/ICTD, WHO Control of Tropical Diseases unit; WHO/MAP, WHO Malaria Action Programme; WHO/PDP, WHO Parasitic Diseases Programme; WRAIR, Walter Reed Army Institute for Research.
Box 1. Websites relevant to TDR Activities

<table>
<thead>
<tr>
<th>Name (and acronym)</th>
<th>Website</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medicines for Malaria Venture (MMV)</td>
<td><a href="http://www.malariaomedicines.org">http://www.malariaomedicines.org</a></td>
</tr>
<tr>
<td>Multilateral Initiative for Malaria (MIM)</td>
<td><a href="http://mim.nih.gov">http://mim.nih.gov</a></td>
</tr>
<tr>
<td>Roll Back Malaria (RBM)</td>
<td><a href="http://www.rbm.who.int">http://www.rbm.who.int</a></td>
</tr>
<tr>
<td>Stop TB Initiative (STB)</td>
<td><a href="http://www.stoptb.org">http://www.stoptb.org</a></td>
</tr>
<tr>
<td>Global Alliance for Vaccines and Immunization (GAVI)</td>
<td><a href="http://www.vaccinealliance.org">http://www.vaccinealliance.org</a></td>
</tr>
<tr>
<td>Global Forum for Health Research (GFHR)</td>
<td><a href="http://www.globalforumhealth.org">http://www.globalforumhealth.org</a></td>
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<tr>
<td>TDR Website</td>
<td><a href="http://www.who.int/tdr">http://www.who.int/tdr</a></td>
</tr>
<tr>
<td>WHO Website</td>
<td><a href="http://www.who.int">http://www.who.int</a></td>
</tr>
</tbody>
</table>

Box 2. The New Strategy of the TDR

- A reinforced focus on ‘implementation research’, or the research needed during the introduction of a new tool into disease control by the health systems of disease-endemic countries. As the successful examples of the onchocerciasis and Chagas disease control programmes have demonstrated, research should be present during all phases of operations, from planning to implementation and evaluation11,32–35.
- Full exploration of the new opportunities provided by science and technology – such as genomics, bioinformatics and high-throughput screening – which open new ways for accelerated discovery of new drugs, vaccines and diagnostics4, as well as new perspectives for vector control36.
- Exploration of new opportunities of collaboration through public–private partnerships19,37.
- A renewed emphasis on social, economic and behaviour research to achieve a better understanding of the limitations and opportunities posed by contextual factors to control and prevent tropical diseases.
- Greater involvement of researchers and institutions from disease-endemic countries in all areas of TDR activity, with a high emphasis on capacity strengthening based on selected research activities.
- Intensive use of new information and communications technology38.

Box 3. Challenges for TDR in the Year 2000 and Beyond

- TB49,50, dengue41,42, malaria43,44 and African trypanosomiasis45, which continue to impose a heavy toll among the poorest populations2.
- Microbial drug resistance, which is closing some of the few windows of opportunity in disease control46.
- HIV/AIDS, unknown when TDR was created, which is undermining global health and exacerbating the clinical aspects of diseases such as TB and leishmaniasis.
- New patterns of disease transmission and distribution, which are being introduced by environmental, economic and political changes related to globalization.

10 Onchocerciasis Control Programme (1994) 20 Years of Onchocerciasis Control in West Africa, WHO
12 World Health Assembly (1997) Elimination of Lymphatic Filariasis as a Public Health Problem (Resolution 29 of the 50th World Health Assembly), WHO
23 Lengeler, C. et al. (1996) Net Gain: A New Method for Preventing Malaria Deaths, IDRC, TDR
Main industry partners (1975–2000)

- ACF Beheer (Netherlands)
- Air Liquide (France)
- Asta Medica (Germany)
- Aquila Biopharmaceuticals (USA)
- Bayer A.G. (Germany)
- Biobras-Bioquimica do Brasil (Brazil)
- Biotech Australia (Australia)
- Burroughs Wellcome Company (USA)
- Chemotecnia S.A. (Argentina)
- Ciba Geigy, Ltd (Switzerland)
- Daichi Pharmaceutical Co. Ltd (Japan)
- Eli Lilly and Company (USA)
- E. Merck Pharma (Germany)
- F. Hoffman La-Roche (Switzerland)
- Genetic Institutes (USA)
- Glaxo Group Research Ltd (UK)
- Hoechst Marion Roussel (France)
- IHARABRAS S.A. (Brazil)
- International Federation of Pharmaceutical Manufacturers Associations (Switzerland)
- Janssen Research Foundation (Belgium)
- Kunming Pharmaceuticals (China)
- Laboratorios Gador (Argentina)
- Merck and Co. Inc. (USA)
- NexStar (USA)
- Novartis (Switzerland)
- Novo Nordisk A/S (Denmark)
- Pasteur-Mérieux-Connaught (USA)
- Pharmacia Farmitalia Carlo Elba (Italy)
- Rhône-Poulenc Rorer Doma (France)
- SmithKline Beecham (UK/Belgium)
- Tibotec (Belgium)
- Vaccine Solutions (Australia)
- Vestar Inc. (USA)
- Zeneca Pharmaceuticals (UK)

1982 Leprosy
Drug combinations for paucibacillary leprosy

1983 Leprosy
Drug combinations for multibacillary leprosy

1983 African Trypanosomiasis
Card Agglutination Test

1987 Onchocerciasis
Ivermectin

1990 African Trypanosomiasis
Efornithine

1991 Onchocerciasis
DNA probes for *Onchocerca volvulus*

1992 Chagas disease
Dipstick test for blood bank screening

1994 Leishmaniasis
Direct Agglutination Test

1997 Leprosy
Ofloxacin plus rifampicin combination

1999 Lymphatic filariasis
Rapid Epidemiological Mapping

1990 African Trypanosomiasis
Efornithine
Research Capacity Strengthening
Institutional Grants (2000)
112 projects* in 41 countries (27 Least Developed Countries)

* Including Re-Entry Grants and Career Development Awards

Number of Grants
- 1–4
- 5–9
- > 10

1989 Chagas disease
Fumigant canister

1994 Schistosomiasis
Praziquantel combinations

1995 Onchocerciasis
Community-directed treatment with ivermectin

1996 Multidisease
Healthy Women Counselling Guide

1999 Lymphatic filariasis
Albendazole combinations

2000 Malaria
Artemotil

2000 Malaria
Germline transformation of Anopheles

Fig. 1. Examples of products, industry partnerships and capacity building.
The Interface Between Epidemiology and Population Genetics

S. Paterson and M.E. Viney

Modern biology increasingly integrates disparate disciplines. Here, Steve Paterson and Mark Viney examine the interface between epidemiology and population genetics. They argue that infection and inheritance can be considered as analogous processes, and that epidemiology and population genetics share many common features. They consider the potential for existing population genetic theory to dissect epidemiological patterns in field studies and they consider other relationships between genetics and epidemiology that provide a research challenge for the future.

Epidemiology is the study of disease dynamics within a population. Current models of infection dynamics attempt to describe the process of infection from one host to another and the consequence of this process on host and parasite populations. Population genetics is concerned with the inheritance of genes at the population level. There is, therefore, a clear analogy between inheritance – the transmission of genes from one generation to the next – and infection – the transmission of parasites from one host to another – and the population-level consequences of each of these processes. Inheritance and infection both occur within populations and, in this respect, both population genetics and epidemiology are concerned with problems of scale; specifically, to extend a basic biological process (inheritance or infection) that occurs at the individual level to the population-level consequence of that process.

The interface of inheritance and infection

Modeling drug resistance in parasite populations is one area where population genetics and epidemiology come together. The task is to construct a model that combines both the spread of drug-resistance genes through a parasite population and the spread of drug-resistant parasites through a host population (Box 1). Recent work by Smith et al. provides a good example of how this can be achieved. Here, the basic unit of the model is the parasite itself, rather than the infected host. Parasites of different anthelmintic genotypes (eg, RR, Rr or rr, where R is the anthelmintic-resistance allele) were modeled deterministically within a host population that was subjected to various anthelmintic dosing regimens. In each parasite generation, adult parasites mate and produce progeny whose genotype frequencies are determined by Hardy–Weinberg processes from the allele frequencies of the parents. This mating function allowed the frequency of the anthelmintic-resistant and -sensitive alleles to be followed within the parasite population. One important prediction from this model was that there was little difference in the rate of spread of anthelmintic-resistant parasites under chemophrophylactic or chemotherapeutic dosing regimens. Therefore, this model directly uses population genetic and epidemiological modeling to understand the movement of anthelmintic parasites through a host population subject to different dosing regimens and, thus, is powerfully predictive.