Neglected tropical diseases (NTDs) are a group of parasitic and bacterial tropical infections that primarily affect the most impoverished and vulnerable populations in the world, and as such have received scant attention until recently.¹ ¹ ¹ ² ³ Thirteen diseases represent the core group of the highest burden NTDs, grouped together due to their chronic, disfiguring, and stigmatizing impact, intricate association with poverty, and geographic overlap, and individuals are often infected with multiple NTDs simultaneously. Many NTDs, however, can be controlled and even eliminated with low-cost and effective interventions. The recommended approach is one of integrated control using preventive chemotherapy designed to target a group of NTDs simultaneously; a “rapid-impact package” combination of 4 drugs targeting the 7 most common NTDs is now available.

In recent years, growing awareness of the impact of NTDs, including their potential to threaten achievement of the UN Millennium Development Goals (MDGs), coupled with the availability of relatively low-cost control strategies, have led to important new global NTD initiatives. These include: the World Health Organization’s Neglected Tropical Diseases Program; the Global Network for Neglected Tropical Diseases; the U.S. government’s Neglected Tropical Diseases Initiative and new commitments by other G8 members; and efforts of foundations and the private sector. President Obama’s recently announced new global health initiative calls attention to and proposes increased funding for NTDs.⁴

**Figure 1: The 13 Neglected Tropical Diseases (NTDs) (*7 most common NTDs)**

- **Ascariasis** (roundworm)
- **Buruli Ulcer**
- **Dengue Hemorrhagic Fever**
- **Dracunculiasis (guinea worm)**
- **Hookworm**
- **Human African Trypanosomiasis (African sleeping sickness)**
- **Lymphatic Filariasis** (elephantiasis)
- **Leishmaniasis**
- **Leprosy**
- **Onchocerciasis** (river blindness)
- **Schistosomiasis** (snail fever)
- **Trachoma**
- **Trichuriasis** (whipworm)

**Current Global Snapshot**

- An estimated 1.4 billion people – one sixth of the world’s population – are infected with one or more NTDs and another two billion people are at risk.² The majority of the NTD burden is concentrated in Africa, Asia, and Latin America.⁴
- NTDs have low mortality but high morbidity rates, and are the fourth most devastating group of communicable diseases behind lower respiratory infections, HIV, and diarrheal diseases, but ranking higher than either malaria or tuberculosis. NTDs often result in severe disability, disfigurement, blindness, and malnutrition.² Lack of access to clean water, health services, adequate housing, and good sanitation contribute to their prevalence and impact.

- Of the thirteen highest burden NTDs, the seven most common are particularly controllable and the target of recent interventions, including the rapid-impact package.³ ⁵

- **Ascariasis** (roundworm): the most common human worm infection, affecting more than 807 million people worldwide; an estimated 60,000 people die each year. It causes swelling of the abdomen, intestinal blockage, malnutrition, and anemia. Contrasted by ingesting contaminated food, water, or soil, it is typically found in sub-Saharan Africa and Southeast Asia.

- **Trichuriasis** (whipworm): affects more than 604 million people, causing chronic and bloody diarrhea, anemia, malnutrition, and other more serious problems. It is transmitted by ingesting soil or unwashed vegetables contaminated with human feces, and cases are typically found in sub-Saharan Africa, Latin America, and East Asia, as well as in the southern United States.

- **Hookworm**: affects 576 million people and is the world’s leading cause of anemia and malnutrition. Pregnant women and children are most vulnerable to infection. Transmitted by contact with contaminated soil, hookworm is most prevalent in Africa, Latin America, Southeast Asia and China.

- **Schistosomiasis** (snail fever): ranks second only to malaria as the most common parasitic disease. An estimated 207 million people living in 74 countries worldwide are infected, with more than half of all infections in Africa. It is the most deadly NTD, causing an estimated 280,000 deaths each year, and severely disabling 20 million people. Women with urinary schistosomiasis (S. haematobium) develop lesions in their genital tract which significantly increases the risk of HIV infection.⁶ Schistosomiasis is transmitted via contaminated fresh water inhabited by snails carrying the parasite.

- **Lymphatic filariasis** (elephantiasis): affects more than 120 million people in over 80 countries worldwide. Symptoms include severe swelling of the extremities and genitals caused by the parasitic filariasis worms, which are transmitted by mosquitoes. Found worldwide, it is most prevalent in Africa, India and South Asia, the Pacific, and the Americas.
**Trachoma**: affects an estimated 84 million people in more than 56 countries and is the world’s leading cause of preventable blindness. An estimated 8 million people have lost their sight due to repeated exposure to the disease. Transmitted through contact with eye discharge from an infected person’s hands or clothes, or on the feet of flies, trachoma is most common in Africa and Asia.

**Onchocerciasis** (river blindness): affects more than 37 million people; 500,000 of which are severely visually impaired and another 270,000 are permanently blinded by the disease. It is caused by worms transmitted by black flies that breed near fast-moving rivers and streams in Africa, Yemen, and Latin America.

### NTD Control

A number of strategies have been successful in controlling and even eliminating some NTDs (e.g. control of schistosomiasis in China and Egypt, and near elimination of onchocerciasis in 10 countries worldwide). Although many interventions are relatively inexpensive, challenges persist to effectively and efficiently deliver tools and services to the most at-risk populations. In addition, until recently, most efforts were relatively uncoordinated. Today, the recommended strategy is one of integrated control, targeting multiple NTDs simultaneously through mass drug administration at the community level. The rapid-impact package, initiated by members of the Global Network for NTDs, the WHO, and other leaders in the NTD field, is a combination of 4 drugs used to treat the 7 most common NTDs for as little as $0.25–$0.50 per person per year; three of these drugs are donated by the pharmaceutical industry and the fourth is available at low cost. In addition to integrated control with preventive chemotherapy, other measures, such as promoting clean water, sanitation, and hygiene, also play a critical role in addressing the underlying causes of NTDs.

### The U.S. Government’s Response

Historically, the U.S. response to NTDs was relatively limited and focused largely on research and surveillance conducted by the National Institutes of Health and the Centers for Disease Control and Prevention. Attention to and funding for NTDs by the U.S., however, increased recently:

- In 2006, Congress appropriated funds specifically for NTD control and USAID created a Neglected Tropical Disease (NTD) Control Program, proposing $100 million over 5 years to target the 7 most common NTDs, with the goal of delivering treatment to 40 million people.
- In 2008, building on the USAID program, President Bush launched the Neglected Tropical Diseases Initiative, a 5-year, $350 million initiative to provide treatment to more than 300 million people in Africa, Asia, and Latin America, and increase the number of focus countries to 30 by 2013. USAID initially targeted 5 focus countries in 2006 (Burkina Faso, Ghana, Mali, Niger, and Uganda), and has since expanded to include 7 more (Haiti, Sierra Leone, Southern Sudan, Nepal, Bangladesh, Tanzania, and the Democratic Republic of Congo).
- Despite these initiatives, funding for NTDs was only $15 million per year from 2006–2008. It reached $25 million in FY 2009, after the launch of the U.S. NTD Initiative. President Obama’s new global health initiative, announced in May 2009, proposes $63 billion over 6 years to address a range of global health challenges including NTDs and requests increased funding of $70 million in the FY 2010.

### The Global Response

While there were earlier global efforts to address NTDs – for example a 1974 World Health Assembly Resolution (WHA27.52) which called on the WHO to intensify research on major tropical parasitic diseases, and the creation of the Training and Research in Tropical Diseases (TDR) Program by WHO, UNICEF, UNDP, and the World Bank the following year – a broader, integrated approach did not begin until much more recently:

- In 2001, the World Health Assembly unanimously set a global target to reduce helminth (parasitic worm) infections through Resolution 54.19, which aimed to treat at least 75% of all school aged children at risk of morbidity from schistosomiasis and other soil-transmitted helminths by 2010. As a result, WHO launched the Partners for Parasite Control (PPC).
- The MDGs led to several important initiatives and programs aimed at reducing the impact of NTDs, including: the Global Network for NTDs, an alliance of international organizations working to control and eliminate NTDs by 2020; the International Trachoma Initiative, founded by Pfizer and The Edna McConnell Clark Foundation; the Schistosomiasis Control Initiative, started by the Gates Foundation and Imperial College of London; Liverpool Associates in Tropical Health, which provides technical research on NTDs; the TDR Program; and WHO’s Global Plan to Combat Neglected Tropical Diseases 2008–2015.
- In 2008, governments and international organizations significantly scaled-up efforts to address NTDs. For the first time, G8 leaders put NTDs on the global health agenda and called for sustained action over the next 3 to 5 years to address NTDs. In addition to new U.S. commitments, the UK announced a commitment of $80 million over 5 years toward NTD control and elimination. Canada and Japan have also provided some funding for NTD control. The private sector has also made significant investments. The pharmaceutical industry provides deeply discounted and donated drugs (estimated $1 billion since 2006) to countries to treat NTDs. The Gates Foundation has provided new resources to the field, including a 2009 grant of $34 million to the Global Network for NTDs to establish regional strategies and funding mechanisms and leverage new investments to eliminate some NTDs and reduce disease burden by 2020.

### Looking Forward: Challenges & Opportunities

New attention to NTDs and availability of low-cost and effective interventions to control and even eliminate some NTDs, offer a unique opportunity to significantly reduce disease burden among the world’s poor. Still, many challenges remain, including: funding shortages despite recent increases, raising concerns about the ability to sustain and augment successes, particularly in light of the global economic crisis which affects not only donor resources, but exacerbates the underlying conditions of poverty so conducive to NTD spread; ongoing and significant unmet need for interventions among hard hit populations; and outstanding research challenges to identifying interventions for NTDs not yet "tool-ready."
Big Pharma as a Catalyst for Change

- February 13, 2009 Speech to Harvard Medical School – Andrew Witty, CEO

In a speech titled “Big Pharma a Catalyst for Change,” CEO Andrew Witty set out an ambitious new agenda to tackle the challenges of improving global public health. In summary, Witty said:

- The task before us is huge. Africa, for example, has 34 of the 50 poorest countries in the world and suffers 24% of the global disease burden.

- To tackle the problems before us we need to scale up our existing commitments. But that alone will not be enough. We need to develop new partnerships and new approaches. We need to adopt a new mindset, one which is more innovative, open-minded, flexible and willing to take risks.

- Today we are setting out four commitments:

  First, a more flexible approach to IP in the Least Developed Countries. IP’s primary objective is to incentivise and reward research. However, there are plenty of neglected tropical disease where there is a severe lack of research. We need to see if we can use IP to help address that gap. One idea we are proposing is a Least Developed Country (LDC) Patent Pool for medicines for neglected tropical diseases. We would put our relevant small molecule compounds or process patents for neglected tropical diseases into the pool, allowing others access to develop and produce new products. The pool would be voluntary so as to encourage others to participate and any benefits from the pool must go in full and solely to LDCs.

  Second, on pricing. Today we are setting out a new promise: we will reduce our prices for patented medicines in the LDCs so that they will be no higher than 25% of the developed world assuming we can cover our cost of goods. This will be a maximum price – where possible we will go further and reduce our prices more aggressively. In middle income countries we will also be more flexible, so that prices reflect more closely a country's ability to pay.

  Third, on greater collaboration in fighting Diseases of the Developing World. GSK is fully committed to research into DDW. We have a dedicated research centre into DDW in Tres Cantos, Spain which employs 100 scientists funded in part by our partners - including Medicines for Malaria Venture and the Global Alliance for TB drug Development. However, globally research into DDW is still too fragmented, which represents a sub-optimal approach. We need to have much greater critical mass and partnership between the public and private sectors. For our part we are willing to open up, allowing partners in to our facilities if that helps create a truly world-class, global centre of excellence, not owned just by GSK, but by all of its partners whether they are governments, foundations or other companies.

  Fourth, by looking at how we move from being a supplier of drugs to being a partner in delivering solutions. We need to stop saying “it’s not our fault there is no infrastructure to deliver healthcare” and start saying “who can we work with to ensure that the infrastructure does exist?” To start with today we are setting out a new commitment in which 20% of the profit we make selling medicines in LDCs will be reinvested in infrastructure projects in the LDCs, benefiting the poorest people in the poorest countries directly. We need to do more. We never want to be seen just as a “Western” company. We need to be a local company.
committed to addressing the specific healthcare needs of the country we operate in, building on our existing partnerships. An example of this is Brazil, where we are helping them build technical expertise so that in the long run they can produce vaccines themselves. We are setting ourselves the challenge of ensuring that we create partnerships in every country we operate in whether that is with a local company, public sector organisation or academic institution. These partnerships will tie us much more closely to the country we operate in, giving us a stake in its economic and social development. That is how it should be.

In conclusion, Witty said:

- The potential of what we can achieve by working in partnership is huge. Take malaria as an example. GSK has been working in partnership with PATH’s Malaria Vaccine Initiative on a malaria vaccine for over twenty years. The vaccine is poised to go into Phase III efficacy trials. If this vaccine works, we need to make sure nothing gets in the way of access, least of all price. The children who need this vaccine are among the poorest in the world; that is why price cannot be a barrier to access. So we need to get the price right and we need to work with the international community to mobilise the resources to pay for it and the infrastructure needed to deliver, not least to remote communities. We developed this vaccine in partnership; we need to deliver it in partnership.

- What this shows is that we can work together. We need more such partnerships and a new and greater willingness to work together. At GSK we are fully committed to doing just that; we will not shirk from difficult issues or the hard decisions. We will evolve our business practices and model. In doing so we aim to be a catalyst for change.
GlaxoSmithKline allows generic AIDS drugs

From PRI's The World

Pharmaceutical giant GlaxoSmithKline says it will allow manufacturers to produce generic versions of all its HIV and AIDS medicines.

A slum in the Kenyan capital, Nairobi, was the setting for a surprise announcement. The speaker was Andrew Witty, chief executive of pharmaceutical giant GlaxoSmithKline. The topic: the drugs made by the company for the treatment of HIV and AIDS.

"We’re now issuing voluntary licenses free of royalties, so with no charge, to generic companies who can now get on and manufacture their versions of our medicines, if you will, and make sure there is maximum volume available. So we’ve done this previously for what I call first-line HIV treatment, this is the first time it’s been applied to a second-line or more advanced treatment," said Witty.

What that means is that GlaxoSmithKline is waiving its patent rights on several key medicines, and that could mean cheaper drugs for millions of people living with HIV around the globe.

Katy Athersuch is coordinator for the Stop AIDS Campaign-UK. She thinks the announcement amounts to a publicity stunt, "It’s relatively good news, but this isn’t really such a breakthrough announcement. Lots of other companies have already done voluntary licenses that Andrew was referring to. But the devil in the detail of the GSK announcement -- it’s not only that the voluntary licenses are one company only, so weren’t necessarily lower priced -- but also that this announcement has come on the day that the UK government has called on pharmaceuticals to join the patent pool set up by UNITAID.

"And Witty, he explicitly said in the announcement that they would not be signing up to the HIV patent pool, which is for us very, very disappointing. I mean, to be honest, I definitely think it’s a PR stunt."

Athersuch explains the importance of the patent pool: "So, the international drug patent facility called UNITAID, which is based in Geneva, but headed up by France, the UK, Norway, Chile and Brazil; has set up a proposal to basically ask companies voluntarily to put their patents that they own on HIV drugs into a pool which would allow many generic manufacturers to make cheap copycat versions of those pills to sell in the developing world. And the other thing about the patent pool is that companies will then be paid a royalty fee from the generic manufacturers, so that they also get a benefit from joining in with the proposal."

She does think there’s something to be said about the GlaxoSmithKline announcement, but that the pharmaceutical company can go a lot further, "It will definitely save some lives, and it’s definitly welcome that they’re looking to do more, particularly in relation to children living with HIV.

"But it’s just a shame that, when there’s such a great proposal of the patent pool on the table -- that would really revolutionize access to treatment, and see many more people accessing these drugs at an affordable price -- that GSK has not come forward and endorsed the patent pool, is very disappointing. And they could go a lot further, and we call on them to go a lot further.

"There is, I’m, I rule it’s a PR exercise, some lives will be saved, which obviously is very, very welcomed, but more could be saved if they went a bit further."

PRI’s "The World" is a one-hour, weekday radio news magazine offering a mix of news, features, interviews, and music from around the globe. "The World" is a co-production of the BBC World Service, PRI and WGBH Boston.

More "The World."

© Copyright 2009 Public Radio International. All rights reserved.
GSK’s patent pool for neglected tropical diseases

Jon Pender, GlaxoSmithKline
20 May 2009
GSK’s Response – Facing the Challenge

Diseases of the Developing World (DDW) research & development

- Conducting R&D in vaccines and medicines for HIV, TB and malaria
- Dedicated research centre in Spain
- One-third of vaccine pipeline for DDW
- World’s leading malaria vaccine

Preferential pricing

- Not-for-profit prices on ARVs
- 75 – 90% of our vaccines go to developing countries
GSK’s Response – Facing the Challenge

Community investment
- 1 billion tablets donated to the LF elimination programme
- Programmes on HIV/AIDS, malaria and diarrhoea

Commitment to innovative partnerships
- Product development PPPs
- Disease strategy groups
- 8 voluntary licences.
- In 2008 our licencees shipped 280 million tablets – 4 times our own volumes

GSK Number One in the first Access to Medicines Index
“Pharma as a catalyst for change” – Andrew Witty – Harvard Medical School – 13 February 2009

- **Reduce prices for patented medicines in the LDCs to no more than 25% of developed world prices**
  - Price reductions effected on 7 products across LDCs - Average price reduction = 45%

- **Move from being a supplier of drugs to being a partner in delivering solutions**
  - 20% of the profit we make in LDCs to be reinvested in healthcare infrastructure projects

- **Build greater collaboration in R&D for DDW because research into DDW is still too fragmented globally**
  - GSK to expand and allow partners into Tres Cantos to create global centre of excellence
  - Co-ownership of projects by GSK and all of its partners - governments, foundations or other companies.
Objectives and scope of the patent pool

- To facilitate and encourage R&D into new and improved treatments for 16 NTDs for sale into LDCs
- NTDs as identified by FDA for their Priority Voucher Review scheme
- Subject matter
  - Relevant GSK patents
    - Those which have identified potential utility for the NTDs (80 families have been listed)
    - Those which haven’t but may be useful
    - Wherever in the world they exist
  - Know how
- Exclusions:
  - HIV/ARVs
  - Vaccines and Adjuvant Technology
  - Generic manufacturing of existing products
- On its own this initiative will not solve the problem. Additional resources and incentives are required.
Outstanding Issues

Issues to be considered include
- Availability of know how
- Terms of licence for LDCs
- Who has what rights and on what terms in developing countries
- Who has what rights to any IP generated from use of pooled assets

What information will applicants for licences need to provide?

To what extent will there be vetting of applications and on what basis?

Balancing simplicity of standard contracts against greater complexity of flexibility

Is a third party administrator necessary or desirable?
An idea under development

A partnership approach

Although GSK alone can contribute leadership and assets, ultimate success depends on many issues and stakeholders who might be involved in contributing assets, using assets and funding development

But if we all get it right, this could be an initiative which makes a tangible contribution to alleviating the lack of new treatments for NTDs
Neglected Diseases

**List of Target Neglected Diseases**

1. tuberculosis
2. malaria
3. blinding trachoma
4. buruli ulcer
5. cholera
6. dengue/dengue haemorrhagic fever
7. dracunculiasis
8. fascioliasis
9. human African trypanosomiasis
10. leishmaniasis
11. leprosy
12. lymphatic filariasis
13. onchocerciasis
14. schistosomiasis
15. soil transmitted helminthiasis
16. yaws
What is a patent pool?
A patent pool is a voluntary arrangement where a group or groups agree to licence identified classes of patents and/or classes of technology to third parties on predetermined standard conditions.

What would a successful pool look like for GSK?
Our hope is that the pool will engender a collaborative approach within industry and between industry and third parties (including academic researchers and, potentially, funding agencies) to deliver real benefits for patients in least developed countries.

Timings associated with product development are notoriously difficult to second-guess. However, however long it takes, success for GSK is the same as success for patients – the development of new products for the target neglected tropical diseases.

What is the therapeutic scope of your pool?
The pool is aimed at helping to bridge the gap in the severe lack of R&D and access to medicines for the treatment of the 16 neglected tropical diseases identified by the US Food and Drug Administration for its own neglected tropical diseases initiative.

These are tuberculosis, malaria, blinding trachoma, buruli ulcer, cholera, dengue/dengue haemorrhagic fever, racoculiasis, fascioliasis, human African trypanosomiasis, leishmaniasis, leprosy, lymphatic filariasis, onchocerciasis, schistosomiasis, soil transmitted helminthiasis and yaws.

What are the distinctions between a patent and a patent application?
Do the terms and conditions for licensing vary?
Unlike some intellectual property rights, patents are applied for at national or regional patent offices. They are usually examined by the respective offices to determine whether they meet the requirements of patentability (whether they are novel inventive and capable of industrial application) and, if they do, they are granted. It is generally not until they are granted that proceedings to prevent infringement can be taken.

Although it is possible that there will be ultimately be differences between the license terms for patents and applications, we do not currently anticipate that that will be the case.

What is the geographic focus of the pool?
GSK will provide licences for the development of medicines for the treatment of neglected tropical diseases in least developed countries. The patents families that we are contributing to the pool are not generally filed in least developed countries.

We believe that the contribution of patents and patent applications in outside of these least developed countries will encourage research and development of drugs for neglected tropical diseases for use within the identified target countries.

Are you only including patents in least developed countries?
No. The pool extends to patents anywhere in the world in order to allow third parties to conduct research into neglected diseases.
Working together - Collaborations ...

We are looking both for groups who wish to contribute IP to the pool and for applications from third parties who would be interested in carrying out research on one of the patent areas we have outlined in our own pool (PDF 152KB).

Ultimately as more groups join this initiative, we would anticipate that it is coordinated by an independent third party.

If you represent a company or group and would like to speak to us about contributing IP to the pool or have questions about how it will work, please contact us at the address below.

Research applications

If you are a research group wanting to work with us, we encourage you to send ideas to us by email.*

We will confirm receipt of the email and provide a request number. We will then evaluate the request and follow up the request in a timely manner.

Contact information

All requests for patent pool and know-how licences should be directed to us by email.*

* Please note that this email address should not be used for reporting side effects of medicines. If you want to report a side effect, please call the GSK Response Center in the US on 1-888-825-5249 or the Customer Contact Centre in the UK on 0800 221441. For other locations, please contact your local GSK office.

Back to top
Creating a pool of intellectual property to fight neglected tropical diseases

At GSK, we are committed to playing our part in addressing the global healthcare challenges of this century. We announced new steps on this path on 13 February 2009, and a key element of those commitments is our support for wider access to some intellectual property.

We would like to support the creation of a least developed country “Patent Pool” for medicines for Neglected Tropical Diseases. To have real impact, this pool needs to be a true collaboration made up of pharmaceutical companies, biotechs, patient groups, non-governmental organisations and universities.

We see this pool as a place where groups could donate relevant small molecule compounds or process patents for neglected tropical diseases, and allow others access to develop and produce new products and formulations for use in those least developed countries. If a new treatment is the results of such research, then we believe the full benefits should go solely to the least developed countries.

But it will take some time to create this model.

GSK donated IP

While this collaborative approach evolves, we have created our own pool of intellectual property containing over 800 granted or pending patent applications. We will donate this to the collaborative pool as it develops, but in the meantime, the intellectual property we have identified can now be sought immediately by researchers.

Want to take part?

We would also like to hear from others interested in contributing their own patents or knowledge to the pool to help achieve these goals. You can send ideas to us by email or if you need further information, you can check out our FAQ section.

*Please note that this email address should not be used for reporting side effects of medicines. If you want to report a side effect, please call the GSK Response Center in the US on 1-888-825-5249 or the Customer Contact Centre in the UK on 0800 221441. For other locations, please contact your local GSK office.

Back to top
Licence terms

We list the current GSK patents and patent applications that cover small molecules and their formulations, uses and processes for neglected tropical diseases on this site. The terms of the IP patent pool relate specifically to the development of medicines for the treatment of the identified diseases and only for use in least developed countries.

For pool licensees looking to sell outside the least developed countries, we may be willing to discuss different options. The preferred option would be chosen on mutually agreed terms, on a case by case basis.

We have also included in the patent list some patent filings that include some compounds and uses GSK is actively developing. Licences for these patent filings could be considered if it related to a different neglected tropical disease therapy area, or a different compound covered by the patent that we are not currently developing.

Where a third party or institution has a contractual right in a GSK patent filing or know-how, we will seek permission for transferred use under this initiative.

Within certain guidelines, GSK will offer licences to third parties on available technologies on favourable terms that will include geographical and therapeutic area restrictions and other terms relevant to the transaction.

While it is right that we explore new ways of stimulating research that might otherwise not happen – and a patent pool is one such model - GSK will defend our IP robustly outside of the patents in the pool.

All requests for patent pool and know-how licences should be directed to us by email.*

*Please note that this email address should not be used for reporting side effects of medicines. If you want to report a side effect, please call the GSK Response Center in the US on 1-888-825-5249 or the Customer Contact Centre in the UK on 0800 221441. For other locations, please contact your local GSK office.
Biotech Patent Pool Workshop

Alnylam joins GSK in donating intellectual property to patent pool for neglected tropical diseases

Issued: Wednesday 8 July 2009, Cambridge, Massachusetts and London UK
- First company to join the pool since creation in March 2009
- Contribution triples number of patents in the pool
- RNAi technology could lead to new targets and treatments

GlaxoSmithKline (GSK) and Alnylam Pharmaceuticals, Inc. (Nasdaq: ALNY) announced today that Alnylam will contribute more than 1500 issued or pending patents on its RNA interference (RNAi) technology patent estate to the patent pool established by GSK earlier this year.

Alnylam is the first company to add its patents to the approximately 800 patent filings GSK provided to populate the pool in March. The company’s RNAi platform provides an innovative approach to drug discovery and development through “gene silencing,” a technology that targets the cause of diseases by potently silencing specific messenger RNAs (mRNAs), thereby preventing disease-causing proteins from being made.

“We are delighted that Alnylam will join GSK in this important programme by adding their unique RNAi technology to the patent pool,” said Andrew Witty, Chief Executive Officer of GSK. “The key objective of the pool is to make it easier for researchers across the world to access intellectual property that may be useful in the search for new medicines to treat neglected tropical diseases. The more companies, academic institutions and foundations that join the pool, the more effective it will be. Alnylam’s announcement today is therefore a welcome and significant step forward.”

The patent pool was formed to aid in the discovery and development of new medicines for the treatment of 16 neglected tropical diseases (NTD), as defined by the U.S. Food and Drug Administration, in the world’s Least Developed Countries. By adopting a more flexible approach to intellectual property, the patent pool will facilitate access to compounds and technologies for organisations that want to conduct research on treatments for these neglected diseases.

“We are committed to the innovation of medicines for patients, so we cannot ignore the potential of our technology to make a difference in the discovery of important new medicines for neglected diseases that afflict millions of people each year,” said John Maraganore, Ph.D., Chief Executive Officer of Alnylam. “We are very proud to be joining GSK in this unique and bold vision of social responsibility for some of the world’s poorest nations.”

Through today’s contribution, Alnylam is providing RNAi intellectual property, technology and know-how on a royalty-free, non-profit basis in the Least Developed Countries via licensing agreements with qualified third parties. Such organisations will be engaged in research efforts focused on discovery of new medicines for NTD and their distribution to Least Developed Countries.

In the near term, Alnylam RNAi technology is expected to help validate novel drug targets for the discovery and development of treatments for the targeted NTD in least developed countries. For example, the technology has already helped to identify new targets for malaria treatments. [1], [2],[3] in the future, RNA therapeutics may themselves be developed and used directly in the treatment of more neglected tropical diseases.

About the patent pool

The diseases targeted by the pool are the 16 diseases identified by the FDA for its own Neglected Tropical Diseases initiative. These are tuberculosis, malaria, blinding trachoma, buruli ulcer, cholera, dengue/dengue haemorrhagic fever, racuculiasis, fascioliasis, human African trypanosomiasis, leishmaniasis, leprosy, lymphatic filariasis, onchocerciasis, schistosomiasis, soil transmitted helminthiasis and yaws. The geographic focus of the pool will be the world’s Least Developed Countries as identified by the United Nations and includes much of western and central Africa as well as several countries in Southeast Asia.

About RNA Interference (RNAi)

RNAi (RNA interference) is a revolution in biology, representing a breakthrough in understanding how genes are turned on and off in cells, and a completely new approach to drug discovery and development. Its discovery was awarded the 2006 Nobel Prize for Physiology or Medicine. RNAi is a natural process of gene silencing that occurs in organisms ranging from plants to mammals. By harnessing the natural biological process of RNAi occurring in cells, the creation of a major new class of medicines, known as RNAi therapeutics, is on the horizon. RNAi therapeutics target the cause of diseases by potently silencing specific messenger RNAs (mRNAs), thereby preventing disease-causing proteins from being made. RNAi therapeutics have the potential to treat disease and help patients in a fundamentally new way.

About Alnylam Pharmaceuticals

Alnylam is a biopharmaceutical company developing novel therapeutics based on RNA interference, or RNAi. The company is applying its therapeutic expertise in RNAi to address significant medical needs, many of which cannot effectively be addressed with
small molecules or antibodies, the current major classes of drugs. Alnylam is leading the translation of RNAi as a new class of innovative medicines with peer-reviewed research efforts published in the world’s top scientific journals including *Nature, Nature Medicine,* and *Cell.* The company is leveraging these capabilities to build a broad pipeline of RNAi therapeutics; its most advanced programme is in Phase II human clinical trials for the treatment of respiratory syncytial virus (RSV) infection and is partnered with Cubist and Kyowa Hakko Kirin. In addition, the company is developing RNAi therapeutics for the treatment of a wide range of disease areas, including liver cancers, hypercholesterolemia, Huntington’s disease, and TTR amyloidosis. The company’s leadership position in fundamental patents, technology, and know-how relating to RNAi has enabled it to form major alliances with leading companies including Medtronic, Novartis, Biogen Idec, Roche, Takeda, Kyowa Hakko Kirin, and Cubist. To reflect its outlook for key scientific, clinical, and business initiatives, Alnylam established “RNAi 2010” in January 2008 which includes the company’s plan to significantly expand the scope of delivery solutions for RNAi therapeutics, have four or more programmes in clinical development, and to form four or more new major business collaborations, all by the end of 2010. Alnylam and Isis are joint owners of Regulus Therapeutics Inc., a company focused on the discovery, development, and commercialisation of microRNA-based therapeutics. Founded in 2002, Alnylam maintains headquarters in Cambridge, Massachusetts. For more information, please visit www.alnylam.com.

**Alnylam forward-looking statement**

Various statements in this release concerning Alnylam’s future expectations, plans and prospects, constitute forward-looking statements for the purposes of the safe harbor provisions under The Private Securities Litigation Reform Act of 1995. Actual results may differ materially from those indicated by these forward-looking statements as a result of various important factors, including whether Alnylam technology will be utilised by third parties to develop drugs for neglected tropical diseases in the world’s poorest nations as well as those risks more fully discussed in the “Risk Factors” section of its most recent quarterly report on Form 10-Q on file with the Securities and Exchange Commission. In addition, any forward-looking statements represent Alnylam’s views only as of today and should not be relied upon as representing its views as of any subsequent date. Alnylam does not assume any obligation to update any forward-looking statements.

**About GlaxoSmithKline** – one of the world’s leading research-based pharmaceutical and healthcare companies – is committed to improving the quality of human life by enabling people to do more, feel better and live longer. For further information please visit www.gsk.com.

**GSK enquiries:**

**UK Media enquiries:**
Philip Thomson (020) 8047 5502
David Outhwaite (020) 8047 5502
Stephen Rea (020) 8047 5502
Alexandra Harrison (020) 8047 5502

**US Media enquiries:**
Nancy Pekarek (919) 483 2839
Mary Anne Rhyne (919) 483 2839
Kevin Colgan (919) 483 2839
Lisa Behrens (919) 483 2839

**European Analyst/Investor enquiries:**
David Mawdsley (020) 8047 5564
Sally Ferguson (020) 8047 5543
Gary Davies (020) 8047 5503

**US Analyst/Investor enquiries:**
Tom Curry (215) 751 5419
Jen Hill Baxter (215) 751 7002

**Alnylam Investor enquiries:**
Cynthia Clayton (617) 551-8207

**Alnylam Media enquiries:**
Tim Lynch (212) 355-4449

**References**

Patent Pool

Alnylam is contributing more than 1500 issued or pending patents on its RNA interference technology patent estate to the patent pool initiated by GSK earlier this year.

The patent pool was formed to aid in the discovery and development of new medicines for the treatment of 16 neglected tropical diseases (NTD), as defined by the U.S. Food and Drug Administration, in the world’s least developed countries. The geographic focus of the pool will be those the world’s least developed countries as identified by the United Nations and include much of western and central Africa as well as a numerous countries in Southeast Asia. By adopting a more flexible approach to intellectual property, the patent pool will facilitate access to compounds and technologies for organizations that want to conduct research on treatments for these neglected diseases.

Alnylam is the first company to add its patents to the approximately 800 patent filings GSK provided to populate the pool in March. Through its contribution, Alnylam is providing RNAi intellectual property, technology and know-how on a royalty-free, non-profit basis in the least developed countries via licensing agreements with qualified third parties. Such organizations will be engaged in research efforts focused on discovery of new medicines for NTD and their distribution to least developed countries.

Blinding trachoma

Trachoma is an infectious disease caused by an organism and usually occurs when the discharge from an infected person's eye is passed to another by way of hands, clothing, or flies. Children are the most susceptible to this disease because of their tendency to play and get dirty.

Trachoma is the leading cause of preventable blindness. It is estimated that 6 million people worldwide are blind due to trachoma and more than 150 million more are in need of treatment. Trachoma accounts for 15.5% of the global burden of blindness.

Trachoma occurs worldwide, most often in poor, rural communities within developing countries. The disease is easily preventable with the practice of good facial hygiene and environmental changes to produce cleaner living conditions. Although there is no vaccine, Trachoma is treatable with surgery to reverse the inward growth of the eyelashes and antibiotics.

Symptoms of trachoma include cloudy cornea, discharge from the eye, swelling of the lymph nodes just in front of the ears, swollen eyelids, and turned-in eyelashes.

Infection typically occurs during childhood and repeats over lifetime, eventually causing damage to the interior of the eyelid that forces the eyelashes to grow inward. The inward growth of the eyelashes results in rubbing on the front of the eye, damaging the cornea. The damage done to the cornea leads to severe vision loss and eventual blindness.

Buruli ulcer

Buruli ulcer (BU) is an infectious disease caused by bacteria from the same family of bacteria that cause tuberculosis and leprosy. The bacteria produce a destructive toxin which causes tissue damage and inhibits immune response to the infected area. Human-to-human transmission has rarely been reported.

BU affects mainly poor rural communities located near still bodies of water; cases have also
occurred following floods. Instances have been reported in 30 countries, mainly those with tropical and subtropical climates. Although BU has a low mortality rate, it is estimated that 7,000 people are infected with the disease annually.

It is one of the most common, and perhaps least understood major mycobacterial infection. Currently, there are six main research priorities that will lead to better understanding and prevention of BU. These research areas include mode of transmission, development of simple diagnostic tests, drug treatments and new treatment modalities, development of vaccines, social and economic studies, and studies to determine the incidence and prevalence.

Infection of BU leads to extensive destruction of the skin and soft tissue with the formation of large ulcers usually on the legs or arms. Ulcerations are generally painless unless complicated by a secondary infection. BU can destroy nerves, appendages, and blood vessels and can also invade bone tissue. The disease progresses without pain or fever, which may partially explain why infected persons often do not seek prompt treatment. Infected persons not treated early often suffer long-term functional disability, such as restriction of joint movements as well as the obvious cosmetic problems.

Cholera

Cholera is an infectious disease caused by bacterial infection of the intestines. Cholera outbreaks are linked to crowded living conditions, inadequate or unprotected water supply, and poor sanitation; making developing countries highly vulnerable to this disease. The most common sources of cholera infection include surface and well water, raw or undercooked seafood, raw fruits and veggies, and grains.

It is estimated that 120,000 people die of cholera each year, with as many as 100 times more cases than officially reported. Cholera can be simply and successfully treated by immediate replacement of fluid and salts lost through diarrhea. Although antibiotics can shorten the course and diminish the severity of the illness, they are not as important as rehydration.

A recently developed oral vaccine for cholera is also available; however, improvements in water supply and sanitation represent the most sustainable approach to protecting against cholera.

Symptoms of cholera include abdominal cramps, dry mucus membranes or mouth, dry skin, excessive thirst, glassy or sunken eyes, lack of tears, lethargy, low urine output, nausea, rapid dehydration, rapid pulse, sunken "soft spots" in infants, vomiting, and sudden, watery diarrhea. Other complications of cholera include low blood sugar, low potassium levels, and kidney failure.

Dengue fever

Dengue is the most common mosquito-borne viral disease, prominently transmitted by the female Aedes mosquito. Once a mosquito acquires the virus from an infected human, it is capable of transmitting the virus for the rest of its life-span.

Although dengue is rarely fatal, the deadly complication of dengue, dengue hemorrhagic fever (DHF), has a 6 to 30% death rate, with the most deaths occurring in children and young adults. It is estimated that DHF causes 22,000 deaths per year.

Dengue occurs in tropical and sub-tropical parts of the world. There are no specific antiviral medicines for dengue, but currently those infected are prescribed pain relievers to treat fever and pain.

Symptoms of dengue include severe flu-like symptoms ranging from a mild fever, to an incapacitating high fever with a severe headache, pain behind the eyes, muscles and joint
pain, and rash.

DHF causes fever, abdominal pain, vomiting, bleeding, enlargement of the liver, and circulatory failure. During DHF, hemorrhagic manifestations occur after two to seven days. Complications include the tendency to bruise easily and other types of skin hemorrhages, bleeding nose or gums, and possible internal bleeding. Capillaries can become extremely permeable, allowing for fluid to escape from the blood vessels. This may lead to failure of the circulatory system, followed by death if the circulatory system is not corrected.

**Dracunculiasis**

Dracunculiasis is a crippling infectious disease caused by a parasitic worm. The disease is transmitted exclusively by drinking contaminated water.

Although dracunculiasis is rarely fatal, death can occur through a secondary infection to the wound. To prevent a secondary infection, wounds are treated with tropical antibiotics.

Dracunculiasis affects people in rural, deprived, and isolated areas who depend on open water sources, like ponds, for drinking water. There is currently no vaccine or drugs available to prevent or heal the disease.

Drinking water becomes contaminated with the parasite when infected persons try to relieve the burning sensation by sticking the parasite infected part of the body in water. Once the female worm is submerged in water it releases hundreds of thousands of first-stage larvae into the body of water. The larvae are then ingested by tiny water fleas, which are then ingested by those who drink the contaminated water. The water fleas are digested by the stomach acids, leaving the parasite larvae to migrate through the intestinal wall. After 100 days, the male and female parasites mate. The male parasite dies and the female migrates down the muscle planes, and after nearly a year the female worm emerges, usually from the feet, with a uterus filled with larvae, repeating the cycle.

In dracunculiasis, as the parasite migrates through the infected person's subcutaneous tissues, it causes severe pain, especially in the joints. When the parasite emerges, from the feet in 90% of cases, it causes an intensely painful oedema, a blister and an ulcer accompanied by fever, nausea, and vomiting. A few days or even hours before the worm emerges the person may develop a fever, swelling, and pain in the area.

**Fascioliasis**

Fascioliasis is a parasitic infectious disease that can cause blockage of the bile ducts in the liver. Fascioliasis is a zoonosis, or a disease of animals that can be transmitted to humans. Susceptible hosts include main domestic animals like cattle, sheep, pigs, horses, donkeys, and others, and sylvatic animals such as hares, rabbits, and rodents. It is now also believed that human-to-human transmission can occur.

Fascioliasis cases are widespread throughout the world. It is estimated that between 2.4 and 17 million people are infected worldwide, and 180 million more are at risk.

The disease is transmitted through a fecal-oral route. Parasitic eggs are passed in feces of infected animals or humans and contaminate the water where they develop within snails. Snails then release mature larvae onto aquatic or semi-aquatic vegetation. Humans typically become infected by drinking contaminated water or using utensils or eating food washed with contaminated water. Fascioliasis can also be transmitted through the consumption of raw liver from infected sheep, goats, or cows.

The most common symptoms include fever, enlarged liver, malaise and weight loss, hives, cough, shortness of breath and/or chest pain, change in bowel habits, nausea, anorexia, vomiting, diarrhea, and/or jaundice, and abdominal pain. Human fascioliasis can be
distinguished by four phases. The incubation phase is from the time of the ingestion of parasites to the visibility of the first symptoms, and may last from days to months. During the acute phase immature worms migrate through the liver. Symptoms include hemorrhage and inflammation and are usually severe, including fever, abdominal pain, respiratory disturbances, and skin rashes. The latent phase can last from months to years and most cases are asymptomatic. The chronic phase starts when the worms reach the bile duct. Symptoms during this phase are non-specific and usually mild; however, progressive inflammation can lead to more serious health problems.

Human African trypanosomiasis

African trypanosomiasis is an infectious parasitic disease caused by protozoa parasites. The disease is transmitted to humans by infected tsetse flies, which acquire the infection through other infected humans or animals.

African trypanosomiasis currently affects more than 500,000 people, with more than 12,000 new cases developing every year. If left untreated, African trypanosomiasis is fatal, but the cure rate approaches 95 percent when those infected are treated with drugs that work inside the CNS.

There is no vaccine available for African trypanosomiasis. Most patients fully recover from African trypanosomiasis if treated during the first stage of the disease. However, the disease occurs mostly in remote rural areas where the health system is weak or nonexistent, making detection in the first stage difficult. Diagnosis is usually not made until the second, ultimately fatal stage when CNS manifestations develop.

There are two types of African trypanosomiasis. Trypanosoma brucei gambiense (TPG) is found in West and Central Africa, and represents 90% of African trypanosomiasis cases. This form of the disease is represented by chronic infection. Persons can be infected for months or years with no symptoms, but when symptoms do emerge the infected person is already in an advanced stage of the disease and the central nervous system (CNS) is already affected.

Trypanosoma brucei rhodesiense (TBR) is found in Eastern and Southern Africa and is represented by an acute infection. The first signs and symptoms of TBR appear after a few weeks or months. This form of the disease typically progresses rapidly and invades the CNS quickly.

There are also two phases of African trypanosomiasis. During the initial phase of the disease, the haemolymphatic phase, symptoms can include bouts of fever, headache, joint pain, and itching. Infected persons may also experience symptoms of extreme fatigue that can last for several years before the second phase of the disease, called the neurological phase, sets in. This longterm fatigue is why the disease is known as the "sleeping sickness".

The Neurological phase begins when the parasite crosses the blood/brain barrier and invades the CNS. This is generally when symptoms of the disease appear, including confusion, sensory disturbances, and poor coordination. Sleep cycle disturbance is also an important feature of African trypanosomiasis.

Leishmaniasis

Leishmaniasis is an infectious parasitic disease with wide range of clinical symptoms. The disease is transmitted by the bite of a sandfly. Some types of these parasites can be transmitted through blood transfusions or contaminated needles. Congenital transmission, spread from pregnant woman to baby, has also been reported.

There are no vaccines or drugs to prevent infection. The best ways to prevent the disease are to wear protective clothing, insect repellant, bed nets, and place screens on doors and windows. With early treatment, the disease cure-rate is higher than 90%. If left untreated,
death can occur in as quickly as three to 20 months. Approximately 80,000 people die from leishmaniasis each year.

Leishmaniasis occurs within the world's inter-tropical temperature regions, wherever the sandfly is found.

In leishmaniasis, a sandfly becomes infected with the parasite through biting an infected human. Then there is an incubation period of four to 25 days during which the parasite develops inside the sandfly. Once the sandfly feeds again, its painful sting infects the new victim with the parasite.

There are three forms of leishmaniasis. The cutaneous form of the disease normally produces skin ulcers on exposed parts of the body, such as the face, arms, and legs. The disease can produce a large number of lesions, sometimes up to 200, causing serious disability and leaving the patient permanently scarred. In the mucocutaneous form, lesions can lead to partial or full destruction of the mucous membranes of the nose, mouth, and throat cavities and surrounding tissues. The visceral form, also known as kala azar, is characterized by irregular bouts of fever, substantial weight loss, swelling of the spleen and liver, and anemia.

**Leprosy**

Leprosy is a chronic infection caused by bacteria. It affects the skin, nerves of the hands and feet, and can also cause problems in the eyes and nose. Leprosy is spread through long-term contact with an untreated person who has the disease, usually through coughing and sneezing. However, within two weeks of starting treatment an infected person is no longer contagious.

Currently, there is no vaccine for leprosy. The BCG (Bacille Calmette-Guerin) vaccine, used to prevent tuberculosis, provides some protection against leprosy, but is not often used to prevent the disease. Leprosy is a curable disease and treatment in early stages helps to avoid permanent disability. If left untreated, leprosy can cause progressive and permanent damage to skin, nerves, eyes, and limbs. People with long-term leprosy may lose use of hands and feet due to repeated traumatic injury because of lack of sensation due to nerve damage.

Multidrug therapy is recommended to treat leprosy; however medication cannot reverse any nerve damage that has already occurred. Leprosy is rarely fatal, but people with leprosy often suffer psychological and social problems due to the disfigurement and significant disability the disease can cause. It is estimated that 2.4 million people suffer from disabilities from leprosy and need ongoing care, with 300,000 new cases developing each year.

There are two variations of the disease, tuberculoid leprosy and lepromatous leprosy. Tuberculoid is milder than lepromatous and is characterized by skin discoloration. In this variation, fewer skin areas are affected and the disease is less contagious. A rash can develop that can eventually cause bacterial nerve damage.

The lepromatous variation is more common than the tuberculoid form. It is characterized by symmetric skin lesions, nodules, plagues, a thickened dermis, and nasal mucosa complications resulting in congestion and nose bleeds. In the lepromatous variation more skin areas are affected and the disease is more severe and contagious. People can also develop borderline leprosy, when they have features from both the Tuberculoid and Lepromatous variations.

**Lymphatic filariasis**

Lymphatic filariasis, or Elephantiasis, is a parasitic and infectious tropical disease caused by one of three types of thread-like parasitic worms. The disease is transmitted through
mosquito bites.

Lymphatic filariasis affects an estimated 120 million people in 80 countries throughout the tropics and subtropics, and approximately another 1.3 billion, 20% of the world's population, are at risk of acquiring the disease.

There is no vaccine for lymphatic filariasis. The best treatment for the disease is a combination of drugs to kill the parasite, skin care to prevent secondary infections, and elevation, exercises, and in some cases pressure bandages to reduce swelling.

Most people infected with lymphatic filariasis are asymptomatic and will never develop clinical symptoms. A small percentage of people will develop lymphedema, which is caused by irregular functioning of the lymph system. Lymphedema leads to fluid collection and swelling of the legs, arms, breast, and genitalia. Lymphedema can then lead to elephantiasis. Elephantiasis occurs in about 5% of cases and is characterized by the hardening and thickening of the skin caused by bacterial infections within the skin and lymph system. It leads to severe disfigurement, decreased mobility, and long-term disability.

In addition to these symptoms, there can also be internal damage to the kidneys and lymphatic system caused by the parasite. Although rarely fatal, the disease can also cause recurring infections, fever, severe inflammation of the lymph system, and a lung condition called tropical pulmonary eosinophilia.

Malaria

Malaria is a parasitic infectious disease that is transmitted to people through the bites of infected mosquitoes. Malaria can also be transmitted through blood transfusions, organ transplants, or the shared use of contaminated needles or syringes. It can also be transmitted from mother to unborn baby before or during delivery. Malaria is not contagious and cannot be sexually transmitted.

Malaria is considered one of humanity's most serious parasitic infections. Each year, 350-500 million cases of malaria occur worldwide. If malaria is not treated promptly with effective medicines it can cause severe illness and is often fatal. Each year, more than 1 million people die of malaria, and a child dies of malaria every 30 seconds.

Malaria is found in tropical and subtropical regions. Approximately half the world's population is at risk for malaria, particularly those living in lower income areas.

There is no vaccine for malaria. Prevention measures focus on controlling the disease-carrying mosquito with the use of mosquito nets treated with long-term insecticides and indoor residual spraying of insecticides.

Initial symptoms of Malaria usually appear 10 to 15 days after the infected bite, and include fever, headache, chills, and vomiting. Other symptoms can include flu-like symptoms, muscle aches, lethargy, anemia, and jaundice. If not promptly treated, the falciparum variation can potentially cause kidney failure, seizures, mental confusion, coma, and death. In certain types of malaria some parasites can lay dormant in the liver for months to four years, causing the disease to eventually recur (recurring malaria).

Onchocerciasis

Onchocerciasis, or River Blindness, is a parasitic disease that is transmitted through the bites of black flies.

There is no vaccine or recommended drug to help prevent onchocerciasis. It is estimated that 17.7 million people are infected with the disease worldwide, and 99% of all cases are found in Africa. Approximately 270,000 of those infected suffer from blindness and another
500,000 have visual impairment.

In onchocerciasis, the parasites are transferred from an infected human to the female black fly through a bite. Over the course of one to three weeks the transferred parasite develops inside the black fly to form infective larvae. The larvae are then passed to another human through another bite. Once in a human, the larvae migrate to the subcutaneous tissue and slowly form into adult worms, completing the disease cycle.

An adult worm can live for 15 years in the human body. After mating, the female worm releases around 100 parasitic larvae a day in the surrounding subcutaneous skin tissue. The parasites can live in the human body for one to two years, and when they die they cause an inflammatory response that leads to skin rashes, lesions, intense itching, and skin depigmentation.

Over several years, severe dermatitis can occur. The skin can waste away and lose elasticity, giving the appearance of early aging. The parasites can also migrate to the eye where they cause inflammation and other complications. Over time the area becomes opaque, leading to impaired vision and eventually blindness. This is what gives the disease its common name, "River Blindness".

**Schistosomiasis**

Schistosomiasis, or Bilharzias, is a parasitic infectious disease caused by parasitic worms. The disease is transmitted through contaminated freshwater where snails that carry the parasites live. Schistosomiasis can also be transmitted when the parasites penetrate the skin of persons who are wading, swimming, or bathing in the contaminated water. The freshwater becomes contaminated when infected people urinate or defecate in the water source.

There is no vaccine available for schistosomiasis. Next to malaria, schistosomiasis is considered humanity's most serious parasitic infection. Although schistosomiasis is rarely fatal, it can become a chronic illness that damages internal organs and causes cognitive deficiencies in children. The disease is most prevalent in rural areas in which standards of hygiene are low. More than 200 million people are infected worldwide.

Once the parasite penetrates human skin it matures in the lungs or liver and then migrates to the bladder, rectum, intestines, liver, portal venous system, spleen, or lungs causing inflammation or scarring. Parasitic eggs can become embedded in the tissues of the body, leading to the formation of granuloma. Once the disease progresses to the granuloma stage the damage is irreversible; it is possible to kill the parasite but not to repair the damage already done. Rarely, eggs are found in the brain or spinal cord and can cause seizures, paralysis, or spinal cord inflammation.

There are several variations of schistosomiasis, eastern, intestinal, and urinary. The type the infected has depends on the specific parasite that infects the individual and where it migrates to.

Within one to two months symptoms can include fever, chills, cough, and muscle aches, but most people have no symptoms at the early phase of the infection. Children who are repeatedly infected can develop anemia, malnutrition, and learning difficulties.

Complications of this disease can include bladder cancer, chronic kidney failure, chronic liver damage, an enlarged spleen, colon inflammation with bloody diarrhea, kidney and bladder obstruction, pulmonary hypertension, repeated blood infections can occur, right-sided heart failure, and seizures.

**Soil transmitted helminthiasis**

Soil-transmitted helminthiasis, or intestinal worms, is a parasitic infectious disease caused by alnylam.com/.../index.php
the ingestion of parasite eggs from contaminated soil or by penetration of the skin by larvae in the soil.

Soil-transmitted helminthiasis is associated with poverty, lack of sanitation, impaired hygiene, and overpopulation. It is estimated that 2 billion people worldwide are infected with this disease. It can become fatal due to anemia, vitamin A deficiency, and loss of appetite.

Soil-transmitted helminthiasis can be transmitted to humans through the ingestion of vegetables grown in the infected soil or by drinking water from sources near the infected soil. And most often young children contract the infection from lack of hand washing. For hookworms, the eggs also hatch into larvae which rest in the soil. If a person walks on the contaminated soil, the larvae can penetrate the skin, usually between the toes.

There are a wide range of symptoms including diarrhea, abdominal pain, and general malaise and weakness that may affect working and learning capacities, as well as impair physical growth.

**Tuberculosis**

Tuberculosis (TB) is a contagious disease that spreads through the air. When people cough, sneeze, talk, or spit they release TB germs, known as bacilli, into the air. A person only needs to inhale a small amount of bacilli to become infected. Left untreated, each person with active TB disease will infect on average between 10-15 people per year.

Approximately one-third of the world's population is currently infected with TB bacillus. Each year there are more than 8 million new cases of TB reported and almost 2 million TB related deaths. TB is a leading killer of people who are HIV infected due to their weakened immune defenses.

Bacille Calmette Guerin (BCG) is a vaccine for TB given throughout many parts of the world. BCG is especially effective in infants and children, but when administered the vaccine as a child people can still contract TB as an adult. There are currently several drugs to treat TB infections; however there are multiple strands of the disease that are drug-resistant.

TB most commonly affects the lungs, but can also involve almost any organ of the body. People infected with TB bacilli may not immediately become sick with the disease because the immune system blocks the TB bacilli, leaving the disease to lie dormant for years. When the immune system is weakened a person's chance of becoming sick increased.

When TB bacteria are inhaled they can multiply and cause a local lung infection, pneumonia, and then can spread to other parts of the body. The body's immune system stops the infection from spreading by forming scar tissue around the TB bacteria and isolating it from the rest of the body. Once the infection is contained, the disease is in an inactive state, latent TB, unless the body's immune system weakens and the bacteria can break through the scar tissue and become active again.

Symptoms of active TB are generally tiredness or weakness, weight loss, fever, and night sweats. If the infection in the lung worsens, further symptoms can include coughing, chest pain, coughing up of material from the lung, sputum and/or blood, and shortness of breath. If the infection spreads beyond the lungs the symptoms will depend on the organs involved.

**Yaws**

Yaws is a chronic infection that affects mainly the skin, bone, and cartilage. It is transmitted primarily through direct skin contact with an infected person. Overcrowding, poor personal hygiene, and poor sanitation facilitate the spread of the disease.

The disease occurs mainly in poor communities in warm, humid, tropical areas of Africa, Asia
and Latin America. Currently there is no global coordination to fight the disease.

Yaws can be completely eradicated from an area by giving penicillin or another appropriate antibiotic to everyone in the population, yet this may cost more than an impoverished country can afford. In the 1990's it was estimated that the global prevalence of yaws stood at 2.5 million, with 460,000 new cases each year.

There are four stages of Yaws. In the primary stage the appearance of the first, painless lesion occurs. This initial lesion usually heals without treatment after three to six months.

In the secondary stage, more lesions develop and the lymph nodes swell. These secondary lesions may be painless, or they may be filled with pus, burst, and ulcerate. The secondary stage may last for more than six months.

After the secondary stage comes the latent stage. During the latent stage the disease symptoms abate, although an occasional lesion may appear. Skin lesions may relapse for as long as five years after infection.

The fourth stage of Yaws is the tertiary stage. In this stage the disease can destroy areas of the skin, bones, and joints, and also deform them. The palms of the hands and soles of the feet tend to become thickened and painful. This late stage of yaws develops in 10% of cases, usually five to 10 years after the disease onset. Without treatment, multiple lesions will appear all over the body and can lead to chronic deformities of the legs, nose, palate, and upper jaw.

Image © NASA Visible Earth
Alnylam Joins GSK in Donating Intellectual Property to Patent Pool for Neglected Tropical Diseases

First company to join the pool since creation in March 2009 -- Contribution triples number of patents in the pool -- RNAi technology could lead to new targets and treatments

CAMBRIDGE, Mass. & LONDON, Jul 08, 2009 (BUSINESS WIRE) -- GlaxoSmithKline (GSK) and Alnylam Pharmaceuticals, Inc. (Nasdaq: ALNY) announced today that Alnylam will contribute more than 1500 issued or pending patents on its RNA interference (RNAi) technology patent estate to the patent pool established by GSK earlier this year.

Alnylam is the first company to add its patents to the approximately 800 patent filings GSK provided to populate the pool in March. The company’s RNAi platform provides an innovative approach to drug discovery and development through "gene silencing," a technology that targets the cause of diseases by potently silencing specific messenger RNAs (mRNAs), thereby preventing disease-causing proteins from being made.

"We are delighted that Alnylam will join GSK in this important programme by adding their unique RNAi technology to the patent pool," said Andrew Witty, Chief Executive Officer of GSK. "The key objective of the pool is to make it easier for researchers across the world to access intellectual property that may be useful in the search for new medicines to treat neglected tropical diseases. The more companies, academic institutions and foundations that join the pool, the more effective it will be. Alnylam’s announcement today is therefore a welcome and significant step forward."

The patent pool was formed to aid in the discovery and development of new medicines for the treatment of 16 neglected tropical diseases (NTD), as defined by the U.S. Food and Drug Administration, in the world’s Least Developed Countries. By adopting a more flexible approach to intellectual property, the patent pool will facilitate access to compounds and technologies for organisations that want to conduct research on treatments for these neglected diseases.

"We are committed to the innovation of medicines for patients, so we cannot ignore the potential of our technology to make a difference in the discovery of important new medicines for neglected diseases that afflict millions of people each year," said John Maraganore, Ph.D., Chief Executive Officer of Alnylam. "We are very proud to be joining GSK in this unique and bold vision of social responsibility for some of the world’s poorest nations."

Through today’s contribution, Alnylam is providing RNAi intellectual property, technology and know-how on a royalty-free, non-profit basis in the Least Developed Countries via licensing agreements with qualified third parties. Such organisations will be engaged in research efforts focused on discovery of new medicines for NTD and their distribution to Least Developed Countries.

In the near term, Alnylam RNAi technology is expected to help validate novel drug targets for the discovery and development of treatments for the targeted NTD in least developed countries. For example, the technology has already helped to identify new targets for malaria treatments. In the future, RNAi therapeutics may themselves be developed and used directly in the treatment of more neglected tropical diseases.

About the patent pool

The diseases targeted by the pool are the 16 diseases identified by the FDA for its own Neglected Tropical Diseases initiative. These are tuberculosis, malaria, blinding trachoma, buruli ulcer, cholera, dengue/dengue haemorrhagic fever, rickets, fascioli, human African trypanosomiasis, leishmaniasis, leprosy, lymphatic filariasis, onchocerciasis, schistosomiasis, soil transmitted helminthiasis and yaws. The geographic focus of the pool will be the world’s Least Developed Countries as identified by the United Nations and includes much of western and central Africa as well as several countries in Southeast Asia.

About RNA Interference (RNAi)

RNAi (RNA interference) is a revolution in biology, representing a breakthrough in understanding how
genes are turned on and off in cells, and a completely new approach to drug discovery and development. Its discovery was awarded the 2006 Nobel Prize for Physiology or Medicine. RNAi is a natural process of gene silencing that occurs in organisms ranging from plants to mammals. By harnessing the natural biological process of RNAi occurring in cells, the creation of a major new class of medicines, known as RNAi therapeutics, is on the horizon. RNAi therapeutics target the cause of diseases by potently silencing specific messenger RNAs (mRNAs), thereby preventing disease-causing proteins from being made. RNAi therapeutics have the potential to treat disease and help patients in a fundamentally new way.

About Alnylam Pharmaceuticals

Alnylam is a biopharmaceutical company developing novel therapeutics based on RNA interference, or RNAi. The company is applying its therapeutic expertise in RNAi to address significant medical needs, many of which cannot be addressed with small molecules or antibodies, the current major classes of drugs. Alnylam is leading the translation of RNAi as a new class of innovative medicines with peer-reviewed research efforts published in the world’s top scientific journals including Nature, Nature Medicine, and Cell. The company is leveraging these capabilities to build a broad pipeline of RNAi therapeutics; its most advanced programme is in Phase II human clinical trials for the treatment of respiratory syncytial virus (RSV) infection and is partnered with Cubist and Kyowa Hakko Kirin. In addition, the company is developing RNAi therapeutics for the treatment of a wide range of disease areas, including liver cancers, hypercholesterolemia, Huntington’s disease, and TTR amyloidosis. The company’s leadership position in fundamental patents, technology, and know-how relating to RNAi has enabled it to form major alliances with leading companies including Medtronic, Novartis, Biogen Idec, Roche, Takeda, Kyowa Hakko Kirin, and Cubist. To reflect its outlook for key scientific, clinical, and business initiatives, Alnylam established “RNAi 2010” in January 2008 which includes the company’s plan to significantly expand the scope of delivery solutions for RNAi therapeutics, have four or more programmes in clinical development, and to form four or more new major business collaborations, all by the end of 2010. Alnylam and Isis are joint owners of Regulus Therapeutics Inc., a company focused on the discovery, development, and commercialisation of microRNA-based therapeutics. Founded in 2002, Alnylam maintains headquarters in Cambridge, Massachusetts. For more information, please visit www.alnylam.com.

Alnylam Forward-Looking Statement

Various statements in this release concerning Alnylam’s future expectations, plans and prospects, constitute forward-looking statements for the purposes of the safe harbor provisions under The Private Securities Litigation Reform Act of 1995. Actual results may differ materially from those indicated by these forward-looking statements as a result of various important factors, including whether Alnylam technology will be utilised by third parties to develop drugs for neglected tropical diseases in the world’s poorest nations as well as those risks more fully discussed in the "Risk Factors" section of its most recent quarterly report on Form 10-Q on file with the Securities and Exchange Commission. In addition, any forward-looking statements represent Alnylam’s views only as of today and should not be relied upon as representing its views as of any subsequent date. Alnylam does not assume any obligation to update any forward-looking statements.

About GlaxoSmithKline - one of the world’s leading research-based pharmaceutical and healthcare companies - is committed to improving the quality of human life by enabling people to do more, feel better and live longer. For further information please visit www.gsk.com.

Cautionary statement regarding forward-looking statements

Under the safe harbor provisions of the U.S. Private Securities Litigation Reform Act of 1995, GSK cautions investors that any forward-looking statements or projections made by GSK, including those made in this announcement, are subject to risks and uncertainties that may cause actual results to differ materially from those projected. Factors that may affect GSK’s operations are described under 'Risk Factors' in the 'Business Review' in the company’s Annual Report on Form 20-F for 2008.

Registered in England & Wales:
No. 3888792

Registered Office:
980 Great West Road
Brentford, Middlesex
TW8 9GS

References


2 Rodrigues et al. (2008) Host Scavenger Receptor SR-BI Plays a Dual Role in the Establishment of Malaria Parasite Liver Infection, Cell Host & Microbe 4, 271-282;

3 Epiphanio et al. (2008) Heme Oxygenase-1 Is an Anti-Inflammatory Host Factor that Promotes Murine Plasmodium Liver Infection, Cell Host & Microbe, 3: 331-338)
OneWorld Health, Amyris Biotechnologies and Sanofi-aventis Announce Development Agreement for Semisynthetic Artemisinin

- Partnership could help boost Artemisinin supply and treat up to 200 million malaria patients each year -

San Francisco, CA, Emeryville, CA & Paris, France, March 3, 2008 – The Institute for OneWorld Health (iOWH), the US-based nonprofit pharmaceutical company, together with synthetic biology innovator Amyris Biotechnologies, and leading pharmaceutical company sanofi-aventis today announced they have entered into an agreement for the development of semisynthetic artemisinin, a key ingredient in first-line malaria treatments. This partnership will build on technology originated by Professor Jay Keasling at the University of California, Berkeley.

This collaboration aims to create a complementary source of non-seasonal, high-quality and affordable artemisinin to supplement the current botanical supply, thereby enabling millions of people infected with malaria to gain consistent access to lower-cost, life-saving artemisinin-based combination therapies (ACTs). Under the terms of the agreement, OneWorld Health, Amyris and sanofi-aventis will work jointly to develop and design pilot and commercial scale manufacturing processes, with the goal of introducing low-cost, semisynthetic artemisinin into the supply chain and ACTs in 2010.

“We are delighted to expand this partnership to build on the ground-breaking innovations of the University of California, Berkeley and Amyris Biotechnologies,” said Nina E. Grove, OneWorld Health's Vice President for Commercial Planning & Strategy. “Sanofi-aventis' historic commitment to the fight against malaria, its technical capabilities and the track record of its Access to Medicines program make them an ideal partner for this next phase of product development.”

OneWorld Health, UC Berkeley, and Amyris have been working together as the Artemisinin Project since late 2004 to develop a new, low-cost technology platform to produce artemisinin – a project funded by the Bill & Melinda Gates Foundation. UC Berkeley professor Jay Keasling, the originator of the technology, initially identified the genetic pathway and developed a microbial system that produces artemisinin via fermentation. After successfully completing its scientific responsibilities in the Artemisinin Project, U.C. Berkeley continues to license the technology to OneWorld Health and Amyris for further product development and ultimate use in ACTs for the treatment of malaria. Sanofi-aventis, which has extensive experience in the field of malaria drugs, will be the newest partner in this collaboration to increase global access to ACTs.

“Sanofi-aventis and Amyris are among the most advanced companies in synthetic biology,” said Paul Baduel, Director, Process Development Biotechnology of sanofi-aventis. “Sanofi-aventis Process Development teams in biotechnology and chemistry are proud to be involved in the design of an industrial process for the production of artemisinin.”

Amyris will provide strain engineering expertise using the novel tools of synthetic biology. Sanofi-aventis will provide fermentation and chemistry process development expertise, and OneWorld Health will focus on the achievement of public policy and global access goals. If technical benchmarks are achieved, sanofi-aventis will commercialize the semisynthetic artemisinin.
“This collaboration enables us to reach a goal that some scientists only dream of,” said Jack Newman, founder and Senior Vice President of Amyris. “What started as breakthrough in the lab can now evolve into a real solution that will truly make a difference in the world.”

If it reaches commercial-scale, this alternative source of artemisinin would supplement the supply that is currently extracted from the botanical source Sweet Wormwood plant (Artemisia annua) and produce enough artemisinin for ACTs to treat up to 200 million of the more than 500 million estimated individuals who contract malaria each year. This complementary source of supply would improve the availability of high-quality artemisinin derivatives to drug manufacturers and contribute to stabilizing the price of artemisinin-containing antimalarials to benefit patients and payers.

The World Health Organization recommends using ACTs as a first-line treatment for malaria in regions where the usual first-line treatments for malaria are no longer effective because of increasing drug resistance. Malaria is responsible for more than one million deaths annually.

The Bill & Melinda Gates Foundation awarded OneWorld Health a five-year grant of $42.6 million in December 2004 to manage a research and development collaboration with Amyris and Dr. Jay Keasling of UC Berkeley to utilize the techniques of synthetic biology to develop a new technology platform for producing artemisinin and its derivatives.

*****

About the Institute for OneWorld Health
The Institute for OneWorld Health, the first US nonprofit pharmaceutical company, develops safe, effective and affordable new medicines for people with infectious diseases in the developing world. The Institute for OneWorld Health, headquartered in San Francisco, California, USA, is a tax-exempt 501 (c) (3) US corporation. (http://www.oneworldhealth.org/).
Media resources are available at http://www.oneworldhealth.org/media/index.php/

About Amyris Biotechnologies
Amyris (www.amyris.com) is applying its proprietary, breakthrough technology to address major global health and energy challenges. Amyris’ technology is used to produce high-value compounds to enable the production of lower cost artemisinin-based anti-malarial drugs and a slate of renewable hydrocarbon biofuels which are expected to be cost-effective and compatible with existing engines and distribution infrastructure. Based in Emeryville, CA, Amyris is a privately-held venture backed company whose investors include DAG Ventures, Khosla Ventures, Kleiner Perkins Caufield & Byers and TPG Ventures.

About the University of California, Berkeley
The University of California, Berkeley, is the nation's number one public university and is home to more top-ranked departments than any academic institution, public or private. The flagship of the 10-campus University of California system, UC Berkeley enrolls more nearly 25,000 undergraduates and more than 10,000 graduate students each year. The university's research budget exceeds half a billion dollars annually, one of the highest of any university without a medical school. Currently on the faculty are seven Nobel Prize winners, 131 members of the National Academy of Sciences and 84 members of the National Academy of Engineering.

About sanofi-aventis
Sanofi-aventis, a leading global pharmaceutical company, discovers, develops and distributes therapeutic solutions to improve the lives of everyone. Sanofi-aventis is listed in Paris (EURONEXT PARIS: SAN) and in New York (NYSE: SNY).