



Ferghana Partners Group

*Founded in 1992, **Ferghana Partners Group** is a Life Sciences investment banking group with companies based in London and New York.*

We specialize in initiating and executing value-enhancing strategic transactions for pharmaceutical, chemical, diagnostic and biotech companies.

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“The Challenge of Infectious Diseases”

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What is an “Infectious Disease?”

Simple Definition of “Infectious Disease”:

A disease resulting from the presence and activity of a microbial agent

Basic Categories of Infectious Disease Agent:

- Bacterial
- Viral
- Fungal
- Parasitic
- Collectively, “Microbial”

Categories of Therapeutic Agent:

- Preventatives – antiviral vaccines, anti-toxins
- Curatives (Drugs) – antibiotics, antivirals, germicides, anti-fungals



Main Infectious Diseases

Major Life Threatening Infectious Diseases

Disease	Class	Infectious Agent	Number of People Infected Worldwide	Worldwide Death Toll Per Year
AIDS	Viral	HIV1, HIV2	40 million	3,000,000
Tuberculosis	Bacterial	<i>M. tuberculosis</i>	1,800 million	2,500,000
Hepatitis B	Viral	Hepatitis B virus	350 million	1,500,000
Malaria	Parasitic	<i>Plasmodium falciparum</i> ; <i>P. vivax</i> ; <i>P. ovale</i> ; <i>P. malariae</i>	400 million	1,000,000
Influenza (Pneumonia)	Viral	Influenza A, B and C Viruses	Many millions of cases per year	1,000,000 (USA 36,000)
Measles	Viral	Measles Virus (<i>Rubeola</i>)	40 million cases per year	1,000,000
Hepatitis C	Viral	Hepatitis C virus	300 million	???



Exotic Large Scale Infectious Diseases

- Lymphatic filariasis (120 million cases)
- Schistosomiasis (120 million cases)
- Dengue Fever (50 million cases)
- Onchocerciasis – “River Blindness” (18 million cases)
- Chagas disease (12 million cases)
- Leishmaniasis (10 million cases)
- Leprosy (10 million)



Overview of Current (and Future) Challenges:

- Emerging Diseases - More than 30 new (or newly recognised) infectious disorders have been identified over the last 30 years....Many are Life Threatening (Ebola, HIV, *Legionella*) !
- Re-emerging Diseases - The global emergence of resistance to antibacterial agents (TB, *Gonorrhoeae*, malaria, *Staphylococcus aureus*) is increasingly limiting the effectiveness of current drugs....And perhaps new families of anti-infective agents will have equally short life cycles.
- Stubborn Diseases - Many common infectious diseases (common cold, influenza, hepatitis B and C) are still inadequately prevented and treated.
- Deliberately Caused Diseases - The threat of Bio-terrorism has raised the spectra of new outbreaks of deadly infectious diseases (anthrax, plague and smallpox....the latter being the only infectious disease ever to have been eradicated worldwide in the wild!).



Some of the Major, New Pathogens Identified in Just the Past 30 Years:

Year	Infectious Agent	Disease
1973	Rotaviruses	Infantile Diarrhoea
1976	Ebola Virus	Ebola Fever
1977	<i>Legionella Pneumophila</i> Hepatitis D Virus Hantaan Virus	Legionnaire's Disease Hepatitis D Haemorrhagic Fever with Renal Syndrome
1982	<i>Borrelia Burgdorferi</i>	Lyme Disease
1983	HIV1, HIV2	AIDS
1989	Hepatitis C Virus	Hepatitis C
1990	Hepatitis E Virus	Hepatitis E
1993	Sin Nombre Virus	Hantavirus Pulmonary Syndrome
1994	Human Herpes Virus 8	Kaposi's Sarcoma
1995	Hendravirus	Meningoencephalitis
1996	BSE Prion	New Variant CJD
1998	Nipah Virus	Meningoencephalitis
2001	Metapneumovirus	Bronchiolitis



Some Examples of the Emergence of Anti-microbial Resistance:

- The resistance to methicillin of *Staphylococcus aureus* has increased to over 40% in the last 15-years.
- Evidence suggests that over 70% of HIV infected patients in the USA carry virus that is resistant to at least one current HIV-agent.
- Nearly 10% of *M. tuberculosis* from previously untreated patients are resistant to 1 of the 4 main anti-TB drugs....and 0.2% are resistant to all 4!
- Penicillin-resistant *N. Gonorrhoeae* is now endemic in regions of the world, and resistance to fluoroquinolones is increasing.
- In parts of East Africa, chloroquine is no longer used as first-line treatment for malaria, because of increasing resistance.



Are All Diseases Infectious in Nature?....Some Thought-Provoking Examples:

- The causal role played by *Helicobacter pylori* in peptic ulcer disease
- The causal role played by Human Papilloma virus in cervical cancer
- The association of *Chlamydia pneumoniae* with atherosclerosis
- The possibility that Borna disease virus (a pathogen in horses) has a role in neuropsychiatric disorders
- The possible link between retroviral infection and schizophrenia



What is the Infectious Disease Market Worth?

Current Worldwide Human Anti-Infectives Market:

Category	Market Value	Current Annual Growth Rate
Anti-bacterial drugs	\$14 Billion	15%+
Anti-viral drugs	\$8 Billion	15%+
Anti-fungal drugs	\$4 Billion	10%+
Vaccines	\$7 Billion	15%+

Big Markets....But Highly Diverse and Short-lived!



Who are the Key Players?

Important Companies with a Substantial Business/R&D Interest in Infectious Diseases:

Abbott Laboratories	Fournier	Nabi Biopharmaceuticals
Arrow	Fujisawa	Novartis
AstraZeneca	Gilead	Pfizer
Aventis	GSK	Quorex
Basilea	H. Hoffmann-La Roche	Recordati
Bayer	ICN Pharmaceuticals	Ribapharm
Boehringer Ingelheim	InterCell	Schering-Plough
Bristol-Myers Squibb	InterMune	Taisho
Elan	Isis Pharmaceuticals	Tanabe
Chiron	Johnson & Johnson	Vicuron
Daiichi	Medimmune	Wyeth
Diversa	Menarini	Zambon
Eli Lilly	Merck & Co.	



How are the Relentless Challenges Being Met?

Some Promising Areas of R&D:

- New understanding: e.g. the sequencing of many (>150) microbial whole-genomes, and the on-going sequencing of many more is generating new knowledge on infectious disease
- New targets: e.g. TRIM5 – alpha (a recently discovered novel monkey protein that prevents shedding of the HIV coat)
- New drug classes: e.g. the Discovery of new classes of antibiotic such as the ketolides, glycylicyclines, glycopeptides, oxazolidinones, streptogramins, lantibiotics
- New paradigms: e.g. DNA Vaccines, Signal Transduction Firewall, Predatory Bacterium (“Living Antibiotics”)



Ketek: A Troubled Case for a Promising New Drug Class!!!

Drug Name:	Ketek Antibiotic (Aventis)
Chemical Class:	Ketolides
Mode of Action:	Disruption of protein production in bacteria
Indication:	General-purpose antibiotic for broad bacterial respiratory Infections

Key Events

2000	Ketek Submitted for US FDA Approval
2001	Ketek approved and available in Europe
“	FDA requested additional evidence against drug resistance and rare complications
“	Aventis launched the largest ever comparative antibiotic trial (24,000 patient comparing Ketek against Augmentin)
2003	Ketek Approved and available in Japan
2004 (Jan)	Expert panel advised the FDA that Ketek be approved (but urged close monitoring of the drug once on the market!)
2004 (Jan-Mar)	5 million more patients (outside the US) treated with Ketek without any serious side effects
Present day	Still awaiting FDA approval

The Route to Market Can Be Tortuous and Very Expensive!!!



Recent Financings for Infectious Disease Companies

Some Recent Private Equity Financings:

Date	Company	Company Focus	Funds Raised	Total Raised
Nov 03	Peninsula	Exclusively infectious diseases	\$58m (Series C)	\$96m
Oct 03	Arrow	Exclusively infectious diseases	\$35m (Series B)	\$65m
Oct 03	BioVex	Infectious disease and Cancer vaccines	\$28m (Series C)	\$42m+
Sep 03	Therion	Infectious disease and cancer vaccines	\$39m (Series-C)	\$100m+
Aug 03	ActivBiotics	Exclusively infectious diseases	\$26m (Series B)	\$48m
Jul 03	Intercell	Infectious disease and Cancer vaccines	\$50m (Series C)	\$100m
Jun 03	GlobelImmune	Infectious disease vaccines	\$8m (Series A)	\$8m+
Jun 03	BioMedicines	Infectious diseases and cancer	\$43m (Series C)	\$70m+
Apr 03	Oxxon	Infectious disease and cancer vaccines	\$23m (Series B)	\$31m
Mar 03	Corvus	infectious and respiratory diseases	\$40m (Series B)	\$60m
Jan 03	Iomai	Vaccine delivery (via skin patch)	\$56m (Series C)	\$80m+
Jan 03	Aglon	Anti-microbial medical devices	\$11m (Series B)	N/A
Dec 03	NatImmune	Innate immunity to infectious diseases	\$6m (Series B)	\$13m
Nov 02	Biosyn	Infectious disease and reproductive health	\$10m (Series B)	\$34m
Apr 02	Apovia	Infectious disease vaccines	\$17m (Series C)	N/A
Apr 02	Inhibitex	Anti-bacterial and anti-fungal antibodies	\$45m (Series D)	\$65m



Global Anxiety and Infectious Disease

***“The Great Influenza Pandemic of 1918 Killed
50 million People Worldwide!!!”***

***“If a New, Similar Flu Pandemic Were to Hit America
1.8 Million Americans Would Die!!!”***

***“SARS, Avian Flu, Drug Resistant TB, the HCV Time
Bomb.....Which Infectious Disease(s) Will Be
Responsible for the Next Human Global Catastrophe?”***

**How is the Pharma/Biotech Industry Mobilizing
Itself to Meet the Still Enormous
Unmet Needs of Infectious Disease?**