



SABIN VACCINE REPORT

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Dedicated to Disease Prevention

SABIN COLLOQUIUM ADVANCES NEGLECTED VACCINE DEVELOPMENT

Leaders Move Toward Consensus On Fundamental Issues

by John M. Clymer

Leaders of the vaccine industry, academia, government, law, finance, nongovernment organizations and philanthropy gained greater understanding of vaccine research and development at the 7th Annual Sabin Vaccine Colloquium. The colloquium was sponsored by the Sabin Vaccine Institute with financial support from the Bill and Melinda Gates Foundation and held October 10-12 2000 at Cold Spring Harbor Laboratory on Long Island, New York. "This colloquium is important because it is not discussing sci-



Photo by V. Koen

7th Vaccine Colloquium Co-Chairs from left, Regina Rabinovich, M.D. and Philip K. Russell, M.D. far right. Pictured center, colloquium organizer Melinda Moree, Ph.D.

ence – it is about how to get vaccine development to happen," said Regina M. Rabinovich, M.D., colloquium Co-Chair and Director of the Malaria Vaccine Initiative.

Philip K. Russell, M.D., Sabin Institute founding President, gave the colloquium its charge: "The successful development of a vaccine for the developing world requires the interaction of a large number of players. We need alliances that have multiple partners from academia, government, industry and philanthropy. There are barriers to

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GAVI GATHERS IMMUNIZATION PARTNERS IN THE NETHERLANDS

Realizing the Full Potential of Childhood Immunization

by V. V. Manda, MBChB, MMed

The idyllic small town of Noordijk in The Netherlands was thrown into a frenzy when 300 participants from all corners of the globe added a new vibrancy to its normally sedate pace of life. World vaccine experts met there on November 20 and 21 this year at the first Global Alliance for Vaccines and Immunization (GAVI) meeting to assess progress in childhood immunization for developing nations and to design strategy for various facets of the most cost effective public health tool: vaccines.

Vaccines, as a means of advanc-

ing health equity have been in the forefront of international health efforts for many years, perhaps from the times of Pasteur and Jenner. Yet their use and distribution in developing countries remains a problem for reasons that GAVI and its partners hope to solve. "GAVI was initiated to fight stagnating global immunization rates, and widening North-South disparity in new vaccine access. GAVI, launched ceremoniously on January 31, 2000 at the World Economic Forum in Davos, Switzerland, is

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Please direct inquiries to:

SABIN VACCINE REPORT

58 Pine Street
New Canaan, CT 06840
phone: 203.972.7907
facsimile: 203.966.4763
email: john.carnright@sabin.org

EDITOR

Veronica Korn

CONTRIBUTORS

Michael T. Osterholm, Ph.D., M.P.H.

W. Clark McFadden, Esq

Heribert Warzecha, Ph.D.

Amy Wishner, Ph.D.

Kathy Pettiford

Charles Van der Horst, M.D.

Gregory Poland, M.D.

SABIN INSTITUTE STAFF/Writers

H. R. Shepherd, Chairman

Philip K. Russell, M.D.,

Senior Advisor to the Chairman

Fran G. Sonkin,

Executive Vice-President

Peter J. Hotez, M.D. Ph.D.,

Chair, Scientific Advisory Board

John M. Clymer,

Director, External Relations

Paul Vilc RPH, RAC,

Director, Program Management/
Regulatory Affairs,

Hookworm Vaccine Initiative

John Carnright,

Information Coordinator

Veronica Korn, Research Associate

Gboku Lumbila, Executive Assistant

V.V. Manda, MBChB, MMed

Postdoctoral Research Fellow

Cara Murray, Research Assistant

Vanessa Santiago, Research Assistant

Serge Valcourt, Accountant

The First Great Terror of the 21st Century

"It's not a matter of if, but when... and how bad it will be."

Michael T. Osterholm, Ph.D., M.P.H.

by H. R. Shepherd and Peter J. Hotez, M.D., Ph.D.

We just completed a century that saw more than 65 million people die in two great world wars. This staggering toll pales, however, compared to the carnage caused by the smallpox virus. Best estimates indicate that 300-500 million people died from smallpox in the 20th century – several times the numbers of deaths from all wars combined.

Humankind's greatest single accomplishment of the last century arguably was the eradication of smallpox. Thanks to the smallpox vaccine and a global immunization campaign, the World Health Organization certified the world smallpox-free in 1980. So vanished a virus that caused disfiguring pustular rash, internal hemorrhage and excruciating death.

Smallpox is back.

Since the fall of the Soviet Union in 1991, many of its military secrets have been divulged. One disturbing revelation is that a Soviet biological warfare program produced millions of infectious doses of smallpox virus that still exist today. Through black markets, the virus is believed to be in the hands of terrorist and rebel groups and possibly even individuals. It would be a simple exercise for them to mount a devastating terrorist attack with smallpox.

If it is important to prevent an attack with nuclear weapons, it is just as crucial to prevent an attack with bioweapons such as smallpox virus. Militaries, including the U.S., spend billions of dollars to develop and maintain "stealth" technologies, such as aircraft invisible to radar, capable of striking with little or

no warning. Smallpox may be the ultimate stealth weapon. Tens of millions of smallpox virus particles will easily fit into a hand-held container. Using store-bought materials assembled into a primitive device, the virus particles can be aerosolized into a public building. The microbe would be invisible and odorless, and could be unleashed without being noticed.

The consequences of an attack are starkly illustrated in a forthcoming book by bioterrorism expert Michael T. Osterholm entitled *Living Terrors*. Without an explosion or any sound whatsoever, a terrorist attack using smallpox would go completely unnoticed by either security personnel or its victims. Only 8 – 16 days later when victims show up in emergency rooms will the enormity of the attack become apparent. By then, it will be too late. Highly contagious, the smallpox virus from a single assault could strike hundreds of thousands of people. More than 30% would die. Survivors would suffer a permanent and disfiguring facial rash.

Beyond the dreadful human consequences of a smallpox bioterrorism attack are momentous social, political and economic consequences. Hospitals are unprepared to deal with such an onslaught. The ranks of front line health care workers would be decimated by the contagion. Confidence in public institutions and elected officials would erode. We would fear going outside our homes, never knowing when and where the next invisible, lethal attack would

happen. The workforce and productivity would dwindle.

Call to Action

The US is dangerously under prepared to combat a bioterrorist attack using smallpox. Few individuals have been vaccinated against smallpox since 1972 when eradication allowed immunization to be discontinued. Protective immunity is also thought to have worn off for all but 10%-20% of those who were vaccinated. Thus, approximately 90% of the U.S. population are susceptible to smallpox. Our stores of currently available vaccine are extremely inadequate to handle an outbreak.

The government has taken the first

steps to prepare for and prevent such an attack. The CDC received funds in 1999 to develop coordinated federal, state and local plans, educate health care and public health professionals about handling such an attack, and developing and strengthening surveillance systems for early detection of outbreaks. Last week, the government ordered 40 million doses of smallpox vaccine for a stockpile. These initial steps are positive but much more needs to be done. The smallpox vaccine stockpile should have at least 100 million doses. The estimated cost for this expansion of the stockpile is under \$100 million – cheap compared to nuclear

preparedness. Serious consideration should be given to accelerating vaccine research and development for other potential bioterrorism agents.

The U.S. – indeed, the world – is vulnerable to a catastrophic bioterrorist attack. Production of economical and effective vaccines to prevent the calamity is feasible and would be an easily attainable countermeasure. ♦

H. R. Shepherd is Chairman of the Sabin Vaccine Institute. Peter Hotez, M.D., Ph.D. is an institute advisor and Chair of the Department of Microbiology and Tropical Medicine at The George Washington University Medical Center, Washington, DC.

SABIN AWARDS HOOKWORM VACCINE INITIATIVE TO GWU

Research Grant Located at Washington, D.C. University

by John M. Clymer

The Albert B. Sabin Vaccine Institute awarded a multi-million dollar research contract to The George Washington University Medical Center for development of a hookworm vaccine. Peter J. Hotez, M.D., Ph.D., lead scientist for the Hookworm Vaccine Initiative, joined the GW faculty as Professor and Chair of the Department of Microbiology and Tropical Medicine.

These moves set the stage for

progress toward developing a vaccine to prevent hookworm infection, which afflicts about 22 percent of the world's population. Hookworm is a leading cause of malnutrition and stunts intellectual and physical development.

Dr. Hotez has identified a class of antigens – proteins that stimulate the immune system – from the infective stage of the hookworm that offers promise in eliciting immunity. Sabin's grant will help Hotez and his multinational laboratory staff conduct more research. It is part of his department's emphasis on developing vaccines and therapies for "neglected" diseases not found in industrialized countries but prevalent in developing countries. Examples include hookworm, dengue fever, yellow fever and malaria.

Dr. Hotez is pleased with his new resources. "The Sabin-GW partnership offers an unprecedented



Photo Courtesy of GWU

Microbiology and Tropical Medicine Department members who work on the Hookworm Vaccine Initiative are front, from left: Kashinath Ghosh, PhD, Peter Hotez, MD, PhD, professor and chair; Yan Wang. Second row: Jianjan Feng, MD, Bin Zhan, MD, Ivania Rizo. Back row, John Hawdon, PhD, Ben Datu, Ray Loomis, and James Ashcom, PhD.

opportunity to tackle a major health problem – one that destroys the quality of life in developing countries," he said.

The Hookworm Vaccine Initiative is funded by an \$18 million grant from the Bill and Melinda Gates Foundation to the Sabin Vaccine Institute.

GW President Stephen Joel Trachtenberg welcomed Hotez and the Sabin Institute to the University. "We

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Photo Courtesy of GWU

From left, Frederick Rickles, M.D., Associate Vice President for Health Research, Compliance, and Technology Transfer; John F. Williams, M.D., MPH, EdD, Vice President for Health Affairs, and Dean, Heloisa Sabin, widow of Albert B. Sabin; Peter Hotez, M.D., Ph.D., Professor and Chair, Microbiology and Tropical Medicine; H.R. Shepherd, Chairman, Sabin Vaccine Institute; Stephen Joel Trachtenberg, M.D., President of The George Washington University.

Intergenerational Program Strives to Improve Childhood Immunization Rates

One generation familiar with common childhood illnesses of days past and one generation who may never know about them unite in Texas to continue the battle.

by Kathy Pettiford

The Seniors and Volunteers for Childhood Immunization program originated in 1993 funded by a grant from the Administration on Aging. The focus of the program was to link two generations, older adults and young children, in an effort to improve and sustain preschool childhood immunization rates. During the initial 17-month demonstration phase, volunteers were recruited from two senior volunteer agencies in Denton and Dallas. Based on positive results achieved during this period, the Texas Department of Health elected to fund the dissemination of the SVCI project beyond the initial sites. The program currently operates in 13 sites across Texas, encompassing both rural and larger metropolitan areas. Funding has also been obtained to expand the SVCI model dissemination beyond Texas. The model has been shared with public health officials and RSVP personnel in areas such as Oklahoma, New Mexico, Louisiana, Arkansas, South Carolina, South Dakota, Indiana and Nevada.

Senior volunteers interact with new mothers in the hospital prior to discharge in an effort to educate them about the importance of and need for timely childhood immunizations, as well as to solicit their enrollment in a reminder system. Upon the enrollment of the mother/infant pair, volunteers send reminder cards and/or place reminder calls prior to the expected receipt of the 2-, 4-, 6-, and 12- month immunizations. Addition-

ally, once enrollment in the reminder system exceeds 13 months, sufficient for the infant to have received the first four groups of immunizations, follow-up is conducted to determine if all vaccinations had been received and in a timely manner. Volunteers determine the immunization status of enrolled infants by checking their immunization record and documenting the dates of received vaccinations. Any missed inoculations prompt the volunteer to place another reminder call and/or send a reminder card.

The SVCI program utilizes the unique talents of older adults who are especially suited to complete the tasks involved in the program. They have seen the devastation and impact that the now preventable childhood diseases can impose. They are willing

ambassadors in the fight against these diseases and promote education about the long-range implications. Personal experience, via a friend, family member, or even themselves, who suffered through any of these diseases, has motivated many volunteers to serve in this program. Approximately 250 volunteers across Texas are involved in the SVCI program. ❖

To learn more about the SVCI program, or about implementing the SVCI model in your area, call (940) 565-3450 or E-mail at KathyP@scs.cmm.unt.edu.

Kathy Pettiford is the Program Specialist for the SVCI Program at the Texas Institute for Research and Education on Aging at the University of North Texas.

SOME ADVANTAGES OF THE SVCI MODEL

- Volunteers are committed seniors, many with childhood disease experiences
- The SVCI model educates mothers before they leave the hospital
- The reminder system operates throughout the child's first year of life
- The SVCI model allows for corrections to its reminder data base to:
 - help stay in touch with the child's family
 - disenroll any parent at any time at their request
 - protect and delete all information and reminder system files after a child has reached two years of age.
- Evaluation is built into the model because it:
 - links hospitals with "immunization homes"
 - includes scanning of official immunization records for timeliness and completion of children's preschool immunizations.

News You Can Use From Pennsylvania's Immunization Education Program

The primary goal of the IEP is to decrease the incidence of vaccine-preventable disease by improving the immunization levels of preschool children in Pennsylvania.

by Amy Wishner, M.S.N., R.N.

The U.S. Department of Health and Human Services set a Year 2000 goal that at least 90% of all two year olds complete the basic series of vaccines. The goal of the IEP is to meet that goal for the Commonwealth of Pennsylvania.

The measles epidemic of 1991 clearly demonstrated the tragic effects of low immunization levels for the preschool children of Pennsylvania. Five years later, even with a significant commitment of time, energy and dollars, many of the preschool children are still not fully immunized. National Immunization Survey data for Pennsylvania from April 1994-March 1995 show that only 78% of 2 year olds had completed the basic series of immunizations. For Philadelphia as a whole, 71% of two year olds had completed the basic series. However, there are neighborhoods where rates of immunization are as low as 40%. While immunization levels vary by geographic location, socioeconomic class and source of primary

care, there is growing evidence that all primary care providers, including those in private practice, have lower than anticipated immunization levels.

Pennsylvania's Immunization Education Program, in conjunction with many public and private efforts, has succeeded in raising Pennsylvania's rank in childhood immunizations from 23rd in 1994 to 4th in 1999. In addition, New Jersey and Georgia have adopted the IEP program and materials and the Centers for Disease Control and Prevention are promoting it nation-wide.

Funded by the Pennsylvania Department of Health, the IEP is a public-private partnership between the Pennsylvania Department of Health and the Pennsylvania Chapter of the American Academy of Pediatrics. The program is based upon the Educating Physicians In their Communities model of in-office education for the entire practice staff.

Teams, consisting of a physician or nurse practitioner, a practice manager and an immunization nurse visit

provider offices and present the IEP. Teams conducted 402 presentations for 6,904 providers.

The IEP offers free, in-office, interactive CME/CEU immunization updates, Clinic Assessment Software Application (CASA) assessments, and intervention strategies. The interactive programs are tailored to each audience. Topics include: vaccine-preventable diseases, updates on new vaccines, current immunization schedules, true and false contraindications to immunizations, reasons for missed opportunities to immunize, rates, insurance and reimbursement issues and reminder/recall systems. Teleconferences are sometimes used for remote areas and periodic updates. The IEP web site also promotes immunization. ❖

For complete information visit the IEP web site: paaap.org/immunize or call: 610-527-0970.

Amy Wishner, MSN, RN is the IEP Program Director at the Pennsylvania Chapter of the American Academy of Pediatrics.

RESULTS OF A THREE-YEAR EVALUATION OF THE IEP INDICATE:

Immunizations increase significantly for IEP participants not for controls.

IEP decreases missed opportunities for some antigens.

IEP participants increase screening for immunizations more than controls.

IEP participants seem to be "early adopters" of new vaccines.

95% of IEP participants report that the presentations are very useful.

Incredible Edible Veggie Vaccines

*Transgenic plants show promise in vaccine delivery and accessibility...
and the developing world keeps its fingers crossed.*

by Heribert Warzecha, Ph.D.

Progress in biotechnology over the last 20 years has introduced a wide range of new techniques and new approaches for vaccine production. Until recently, vaccines were usually based on adapted or killed pathogen. Now chimeric, subunit or peptide vaccines broaden the spectrum of immunization. Research also shows alternative ways of administration, using intranasal or oral application to avoid needles and syringes.

Transgenic plants are an exciting approach of combining an innovative production method with an oral delivery system. Ideally it would be like this: once transformed with a gene for an immunogenic subunit, the crop plant produces the vaccine in its edible parts. Eating a "dose" of fruit or a processed preparation would cause

Candidates include Norwalk and Rotavirus, ... causative agents of sexually transmittable diseases like human papillomavirus are also potential targets. For those pathogens, subunits have been shown efficient in inducing immune response.

an immune response and vaccination. Because plants grow almost anywhere in the world at low cost, developing countries would benefit greatly from this system. There would also be no need for cold-chain or medicinal equipment.

In the early 1990's Charles

Arntzen (see bio, page 7) started to follow this idea. Despite some difficulties in the utilization of plants, first human clinical trials are promising.

By developing an edible vaccine, researchers focus on pathogens which invade the host via the mucosal surfaces, such as the gastrointestinal and respiratory tracts. Candidates include the Norwalk and Rotavirus, which cause severe diarrhea. The causative agents of sexually transmittable diseases like hepatitis B or human papillomavirus are also potential targets. For all pathogens, subunits have been shown efficient in inducing immune response. Virus-like particles (VLP's) mimic the virus without carrying DNA or RNA and therefore are not infectious. Since the genomes of all those organisms are sequenced, their genes can be cloned and expressed in heterologous systems.

The second choice is the "right" plant for the job. The plant material should be eaten raw to avoid degradation of its antigen by cooking. Bananas would be an ideal fruit, loved by young and old, and harboring a fairly high protein content. For a plant molecular biologist who tries to evaluate a new idea, other plants are also favorable because a banana takes almost two years from transformation until fruit development, and therefore trial-and-error would take a whole lifetime. For a "proof of principle", the tomato and potato are better systems because they could be trans-

Eating a "dose" of fruit or a processed preparation would cause therefore an immune response vaccination. Because plants grow almost anywhere in the world at low cost, developing countries would benefit greatly from this system.

formed routinely and grow faster. And, important for primary testing, laboratory mice do not disdain raw tubers or fruits.

To generate a plant which produces a viral or bacterial antigen, the genetic information must be brought into a "plant-readable" context. Today, many different plant promoters and regulating sequences are known, enabling targeted or inducible expression of the foreign gene. For introduction of the DNA into the plant, most commonly *Agrobacterium*-mediated transformation or biolistic delivery with the gene-gun is applied. In both cases the DNA is integrated into the plant genome on a random basis, which results in a different expression level for each independent line. Screening for the best expressed line is necessary for the maximum level of antigen production. Other modifications, like the use of synthetic, plant-optimized genes or targeting of the protein to specific compartments of the plant cell might increase protein levels.

Plants obtained after transformation are, in general, heterozygous for an inserted gene.

...researchers focus on pathogens, which invade the host via the mucosal surfaces like the gastrointestinal and respiratory tracts.

To obtain homozygous lines the plants need to be self-pollinated or crossed with other lines. This feature is another advantage of plants over other production systems. By crossing two plant lines harboring different antigens, multicomponent vaccines could be obtained. Or, putative adjuvants could be co-expressed along with the antigen in the same plant.

For some of the antigens the assembly into certain structures is essential before antigenicity is present. Viral capsid proteins for example have to self-assemble into VLP's

from their monomers or even from several components. Therefore, each single antigen expressed in plants must be tested for its proper assembly.

As mentioned, there are several ongoing studies to produce subunit vaccines in plants. Two antigens of pathogens causing severe diarrhea have demonstrated their potential as plant-expressed oral vaccines: the LT-B subunit of the enterotoxigenic *E. coli* (ETEC) and the Norwalk virus capsid protein. Both passed phase one trials. Together with a third agent, the hepatitis B surface antigen (HBsAg), examples prove that edible plant tissue is sufficient to protect the antigen against digestion. The antigens also have induced systemic and mucosal immune responses without aid of adjuvants and

no adverse effects of genetically modified materials have been demonstrated.

In the near future it may be possible to add new plants to the set of medicinal plants already used by humans for centuries: tailor-made vaccine plants which are capable to prevent diseases. ❖

Heribert Warzecha is a researcher at the Boyce Thompson Institute for Plant Research at Cornell University in Ithaca, NY. He earned his degree from Johannes Gutenberg University, Mainz, Germany.

For related information visit http://www.celera.com/celera/science/news/articles/07_00/vaccines_trees.cfm

CHARLES J. ARNTZEN, PH.D: EDIBLE VACCINE PIONEER

Charles J. Arntzen is the Florence Ely Nelson Presidential Chair in Plant Biology, Arizona State University, and *President/CEO Emeritus* of the Boyce Thompson Institute for Plant Research, Inc., a not-for-profit corporation affiliated with Cornell University. He is currently a Distinguished Advisor on the Council for Biotechnology.

Dr. Arntzen received his bachelor's and master's degrees from the University of Minnesota and his Ph.D. from Purdue University. His research interests are in plant molecular biology and protein engineering, and the utilization of plant bio-

technology for enhancement of food quality and value, for expression of pharmacologically active products in



Photo Courtesy of Cornell University

transgenic plants, and for overcoming health and agricultural constraints in the developing world.

He has been recognized as a pioneer in the development of "edible vaccines" which are particularly targeted for health improvement in developing countries.

Dr. Arntzen held faculty positions at the University of Illinois and Michigan State University. He served as a research scientist with the USDA and as the Director of the Michigan State University-Plant Research Laboratory funded by the Department of Energy.

Ebola and Hemorrhagic Fever Viruses: Orphan or *l'enfant terrible*?

New outbreaks revisit old problems in Africa and call orphan vaccines into the spotlight.

by V.V. Manda, MBChB, MMed

The Ebola outbreak in the Gulu district of Uganda has killed Dr. Matthew Lukwiya, the physician in charge of outbreak control measures. According to the World Health Organization, the recent epidemic has tallied 354 cases and 140 deaths to date. Dr. Lukwiya's death shook local and international health care workers alike who have been on the scene of the epidemic in a country well known for its successful prevention policies against HIV/AIDS. Despite full body protective suits, the medical superintendent of St. Mary's Hospital must have been exposed to infected bodily fluids, allowing the virus entry to ravage his body with fever, headache, conjunctivitis, vomiting and diarrhea, chest and abdominal pains and bleeding from the lining of body surfaces. Despite around-the-clock efforts to save his life, the Ebola virus killed the well-known Lukwiya in less than six days.

This deadly *filovirus* hit international headlines by sweeping through the densely forested area of Kikwit, Zaire (now the Democratic Republic of Congo) in 1995 killing hundreds of

Ebola belongs to a group known as orphan diseases, diseases that occur commonly in remote places in the developing world, and that tend to be bypassed in most research and development efforts.

vulnerable people. The nidus of the Ebola virus, its natural reservoir, remains unknown. Researchers believe that the virus is zoonotic, or

animal-borne. In addition to the epidemic in Zaire, previous outbreaks of Ebola have been recorded in Sudan, Ivory Coast, and now, Uganda.

Recently some answers have been found. Scientists at the Scripps Research Institute successfully elicited a protective response against Ebola in cynomolgous macaque monkeys. Adopting this *orphan* disease, the researchers used pieces of Ebola DNA, carried in a modified adenovirus, to introduce antigens into the monkey model. The loss of Dr. Matthew Lukwiya, working to contain the Ebola outbreak, exemplifies the critical need for a successful human vaccine.

The DNA vaccine, developed at Scripps, contains a mixture of genes that encode surface glycoproteins found on each of the three Ebola virus strains. Following the success of further studies, broad vaccinations would be difficult, according to Gary J. Nabel, Director of the Vaccine Research Center at the National Institutes of Health.

The disease strikes unexpectedly and its source in the wild remains unknown. Microbiologists at the University of Pennsylvania and the University of Texas recently announced a possible treatment candidate, and have published their finding in the *Proceedings of the National Academy of Sciences*. They showed that if they created mutations in the VP40 protein, a surface projection of Ebola virus, they could significantly reduce the ability of the protein to bud, thereby reducing replication of the virus within

the infected person and giving the immune system time to respond.

Ebola belongs to a group known as orphan diseases, diseases that occur commonly in remote places in the developing world, and that tend to be bypassed in most research and development efforts. Special consideration is often required in creating vaccines for these diseases because the target market cannot pay top dollar for either treatment or vaccines.

Dr. Jan ter Muelen of Germany shared his work during a visit at the Sabin Vaccine Institute. He discussed his experience at the only

B S L 4

laboratory in West Africa, a lab that meets the highest standards

for bio-safety in protection of contagious agents. Almost half a million people are afflicted yearly with a form of hemorrhagic fever called Lassa fever, from which 30% die. Dr. ter Muelen's attempts to vaccinate non-human primates against Lassa fever revealed partial efficacy. His work in the Republic of Guinea and at the Marburg Institute in Germany focuses on creating a Lassa fever virus vaccine—an *orphan* vaccine. "Vaccination is the only answer to this deadly virus," said Dr. ter Muelen while speaking at the Institute.

An *orphan* vaccine of this nature calls for very involved 'partnering'

between the various sectors of the vaccine industry. This message echoed throughout the 7th Annual Cold Spring Harbor Laboratory Colloquium, "Social Venture Capital: Creating Successful Alliances", held October 10-12, 2000. Aiming to nurture orphan vaccine attempts, the Sabin Vaccine Institute regularly holds colloquia that address vaccine issues for developing countries. Representatives from bio-technical and pharmaceutical companies, and global aid agencies, along with scientists, health economists, public health researchers and intellectual property researchers discussed novel partnerships in creating vaccines for the developing community. Participants at this colloquium recognized the interdependent relationships between the public and the private sectors in creating vaccines, that intellectual

property rights need serious evaluation, and that financial incentives drive production in the private sector. Vaccines must be valued as a tool to achieve global health through adequate vaccine coverage.

By facilitating discourse at the colloquium, the Sabin Institute served as a diplomatic mediator. Effective orphan vaccines hover on the horizon, as do solutions for responsible partnerships that will enable vaccine production and delivery for the demand regardless of capital. Firm solutions are in progress, and the creation of such orphan vaccines is a step closer to success. ❖

CLASSIFICATION OF HEMORRHAGIC FEVER VIRUSES (HFV)

FAMILIES:

Arena Virus

- Lassa Fever Virus
- Lymphocytic Choriomeningitis Virus
- South American Hemorrhagic Fever Virus

Bunyavirus

- Rift Valley Fever Virus

- Hanta Virus Pulmonary Syndrome

Filovirus

- Ebola Hemorrhagic Fever Virus
- Marburg Hemorrhagic Fever Virus

Flavivirus

- Tick Borne Hemorrhagic Fever Virus

SOURCE: CDC

V.V.Manda is the Institute's Postdoctoral Research Fellow. Dr. Manda is from South Africa and recently joined the Institute's New Canaan, CT office.

GAVIMEETS NEAR AMSTERDAM

[Continued from page 1](#)

the culmination of efforts that started many years ago," said founding President of Sabin Vaccine Institute, Dr. Philip K. Russell, renowned vaccine "end-to-end" scientist as he recalled international vaccine programs.

This first assembly defines ground covered in the record-breaking time of one year, a year that has required enormous inter-country communication and interorganizational diplomacy. It all started when Bill and Melinda Gates, threw their weight behind the efforts of vaccine advocates, leading the crusade against infectious diseases in developing countries by laying the foundation of GAVI with a much needed \$750 million. The Gates have led the way in enlightened philanthropy, through what has been described as the

"most richly endowed philanthropic organization on earth" with a spending power of \$1 billion per year. The Bill and Melinda Gates Foundation's global health initiative is focused mainly on developing vaccines and cures and in improving the availability of treatment to those who need them most in developing countries. Promoting the efforts of scientists who are often taken aback by elaborate and costly 'product development', will help alleviate the frustration that inadvertently has discouraged scientific research in diseases affecting developing countries. The Sabin Vaccine Institute is among such beneficiaries of Gates' grants and will develop a Hookworm vaccine, a vaccine that has taken years of industrious

effort after proof of principle stage to reach product development, by Professor Peter Hotez and team, now at The George Washington University Medical Center.

"The elaborate production of vaccines, often taking place in low-income countries could benefit from increased safety and quality control" said Dr. Mrtchyan, Minister of Health, Armenia at the meeting. "In addition to safe vaccines, the initiative is considered vital to its beneficiaries because it will support and increase infrastructure capacities at all levels, and offer opportunity to introduce new vaccines to the national immunization schedules." he added. Advances in molecular biology, recombinant DNA techniques,

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BETRAYAL OF TRUST

The Collapse of Global Public Health

By Laurie Garrett

by Charles van Der Horst, M.D.

Laurie Garrett, a health reporter for *Newsday* and contributor to *The Washington Post*, writes a meticulously documented treatise on global public health. Nothing escapes her: plague, pollution and prostitution are all examined. She illustrates the collapse of this system by focusing on outbreaks of plague in India and of Ebola hemorrhagic fever in the Congo, the disintegration of the Soviet public health system with its attendant rise in pollution, tuberculosis, drug addiction and HIV, the failing U.S. public health system and bioterrorism.

The first thread she weaves in this story is that our greatest health advances have always been in the arena of public health. For example, tuberculosis deaths dropped 87 percent from 1838 to 1949, prior to the development of any anti-tuberculous medications. Another key motif here is that disease knows no boundaries, affecting rich and poor alike. Expanding on this theme, Ms. Garrett points out that disease knows no boundaries

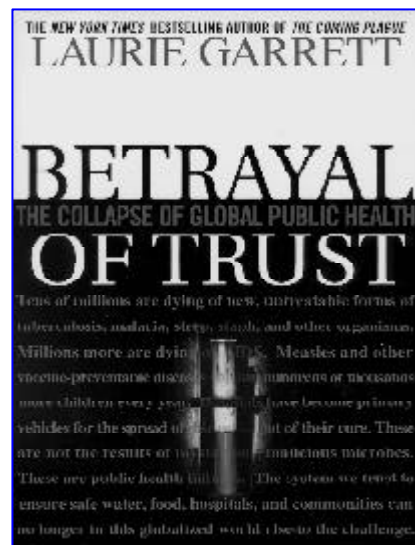
Over the last 20 years, ... trust has frayed and our global public health system ... systematically destroyed. The impact has been felt by average citizens, as a blow to both their personal health and their pocket books.

in a broader sense or, as goes the world, so goes the United States. She sums up: "Globalization did in-

volve shared risk . . . as escalating drug markets had ways of spilling over into other nations; prostitute slave markets became sources of exported sexually transmitted diseases; new mutant strains of bacteria that could defy modern medical options swiftly spread beyond country or regional borders; tuberculosis was an airborne transmitter; disease-ravaged regions often spurred mass human migrations to other regions of the planet; and instability in any strategic part of the planet could reverberate with geopolitical impact across the globe."

Finally, Ms. Garrett points out in every chapter that public health is not free. "Public health is a bond—a trust—between a government and its people. Society at large entrusts its government to oversee and protect the collective good health. In return individuals agree to cooperate by providing tax monies, accepting vaccines, and abiding by the rules and guidelines laid out by government public health leaders. If either side betrays that trust the system collapses like a house of cards."

Over the last 20 years, this trust has frayed and our global public health system has been systematically destroyed. The impact has been felt by average citizens, as a blow to both their personal health and their pocketbooks. During the twelve Reagan and Bush years, tax revenues were cut by more than \$787 billion, leading to skyrocketing numbers of uninsured citizens, emerging and dangerous infectious diseases and a heightened



sense of individual, as opposed to community, responsibility for disease.

Perhaps the most controversial section of the book concerns bioterrorism. In 1979, an anthrax leak from a Soviet plant in Yekatarinaburg killed up to 1,000 people downwind with an estimated one gram of anthrax spores. In 1992 Iraq admitted that it had 75 SCUD missiles loaded with chemical and biological weapons and claimed to have destroyed 45, but to date Saddam Hussein has blocked independent verification of this.

As we embark on a new century, it is important to remember that public health and preventive medicine are often not glamorous. Anonymous people operating in plain buildings make sure that our food is safe, and our water and air clean. Is it more important to promise a tax cut or promise that we shall live to a ripe old age without threat of ancient scourges such as plague or tuberculosis? The future as outlined by Laurie Garrett is grim, unless all of us and our political leaders take heed of her lessons. ❖

Charles van der Horst is a Professor of Medicine and Infectious Diseases at the University of North Carolina, Chapel Hill.

GAVI (cont.)

Continued from page 9

constituting the 'biotechnology revolution' are harnessed as successful new vaccines, but do not reach the world's poor in developing countries. Typically it has taken 15-20 years for newer vaccines to reach the poorest people, the people who invariably need vaccines the most.

"When you consider what immunizing the children we miss would mean for global health, it is a scandal that we aren't doing it already!" pronounced Mr. Jacques-Francois Martin, President of the GAVI fund. The Gates' concern has "taken away excuses for not doing it" Mr. Martin said at the First Meeting of the GAVI Partners.

GAVI aims to strengthen immunization systems in the poorest countries, procure vaccines and accelerate research and development of new vaccines against HIV, tuberculosis and malaria. Six childhood vaccines (polio, diphtheria, pertussis, measles, tetanus and BCG) are brought to most children through a World Health

President Clinton championed...GAVI by pledging \$50 million in support of GAVI efforts.

Organization (WHO) program called the Expanded Program on Immunization (EPI) at a total cost of delivery estimated at about \$20 per child (WHO 1999).

In his opening address in Noordwijk, the Deputy Prime Minister and Minister of Health, Welfare and Sports of the Netherlands, Dr. Els Borst-Eilers, declared that his country would add \$100 million to the start-up funds, adding to the millions of dollars in support given by Norwegian British and American governments. In his address, he reiterated his governments pledge to the mis-

sion of saving the lives of all children, by ensuring that every child in the world received immunization against vaccine preventable diseases. President Clinton of the United States championed the importance of GAVI at the meeting in Noordwijk by pledging \$50 million in support of GAVI efforts. He stated that "GAVI is the kind of innovative partnership needed to bring vaccines to children who need them most, and to demonstrate that if they develop vaccines



Photo Courtesy of GAVI

for the poorest countries, we will help pay for them."

Governments, industry, scientists, economists and international agencies, tried to solve the puzzle of vaccine access by active networking in this very young organizational structure; all participants recognized the fact that it will need committed nurturing throughout its infancy. Industry supplies vaccines to developing countries by considerably lowering their prices to just cents a dose, saving three million children annually. Three million children, however, still die of vaccine preventable diseases. Existing vaccines still do not reach all children of the world through routine immunization schemes and current infrastructure. According to GAVI, thirty million children are still left behind in immunizations as a result of inaccessible basic immunization services.

By creating new networks and promoting inter-country communication, countries will gain from each other's experiences. "Eligible

countries are called to design improved immunization programs based on local needs and conditions, a call that is resonating well to developing countries" said Carol Bellamy, Head of UNICEF.

An estimate of 74 eligible countries, all with annual per capita GNP under \$1,000 are eligible to apply for assistance. Thirteen countries have been approved, and are initial recipients of GAVI vaccine money, a total of \$15 million. An increase in government expenditure towards immunization and health care infrastructure, capacity building, and technical support, is planned through a 5-year plan that becomes implementable with received GAVI resources.

Sabin Chairman H.R. Shepherd, said in his debriefing session upon his return that: "Providing safe high quality vaccines to all children of the world, sharing scientific research and field experiences by experts in the vaccine field, is critical for worldwide health." He pledged the weight of the Sabin Institute towards realizing the precious goal that children of the world are protected and saved from deadly diseases.

Further discussions on progress towards strategic goals, GAVI partners' activities, improvement of immunization services will take place at the next GAVI meeting in 2002. ❖

An estimate of 74 eligible countries, all with per capita GNP under \$1,000 are eligible to apply for assistance.

SABIN HOLDS 7TH ANNUAL VACCINE COLLOQUIUM

[Continued from page 1](#)

creating these alliances: lack of understanding of the partners' needs, cultural differences and behaviors, intellectual property issues." The goal of the meeting was to reduce barriers.

Spurring investment in development of vaccines for neglected diseases is a priority in preventing millions of deaths each year.

"...only one in 20 potential vaccines that enter pre-clinical research ever reach market."

Hannah Kettler of the [Office of Health Economics](#) in London reported that of \$55.8 billion invested in drug research and development in 1992, just 4% went to diseases that predominantly occur in less developed countries.

One way to increase interest in development of such vaccines is to help leaders see it in a new light, suggested R. P. Eddy, Senior Advisor to the US Ambassador to the [United Nations](#) Richard C. Holbrooke. For example, the Clinton Administration has officially recognized AIDS as a threat to global security. "As soon as something is labeled a national security threat, it gets

more resources and a whole new set of people thinking about it expands the knowledge base," Eddy added.

Solution: Market Clarification

Peter Young, CEO of [AlphaVax](#), said companies could make better judgments about investing R&D if the size of the market for a vaccine was clear. He called on the public sector to clarify market size. One way to do this would be to guarantee that a specified amount of a vaccine would be purchased.

Social Venture Capital

Developing vaccines requires major, up-front outlays for research and development, a high risk enterprise. Luis Barreto, M.D., Vice President of Public Policy, [Aventis Pasteur](#), noted that only one in 20 potential vaccines entering pre-clinical research ever reach market.

Recognizing that companies cannot risk large amounts of capital on such vaccines that have very limited payback potential, MVI brings philanthropic dollars to malaria vaccine research and development. But instead of making outright grants, MVI applies an industrial management model to the

partnerships it forms.

Differing Perspectives on Other Barriers

Some industry executives said the high royalty rates sought by the NIH are a barrier to commercial development of vaccines developed by NIH. NIH also prefers to grant rights to its intellectual property on a non-exclusive basis, meaning competing companies could license the same technology. For small market vaccines with limited potential payback, exclusive manufacturing rights are

very important, said *...companies, philanthropists and governments are reluctant to invest heavily to create a vaccine if it cannot become widely used.*

Lance Gordon, Executive Vice President of [OraVax](#), a small vaccine

company. But Steven M. Ferguson of the NIH Office of Technology Transfer said NIH is under pressure from Congress to seek high royalty rates and to stipulate the prices companies can charge for vaccines licensed from NIH.

Jacques-François Martin, president of the [Global Fund for Children's Vac-](#)

[Continued on page 13](#)

FIFTY PEOPLE COULD IMMUNIZE THE WORLD

When Sabin Vaccine Colloquium participants lamented how difficult it was to persuade governments to appropriate sufficient funding for the vaccines necessary for global immunization, venture capitalist Ted Elliot offered a novel solution: enable *individuals* to underwrite the effort.

Elliot proposes getting 50 billionaires to put \$50 million each into a global vaccine charitable trust established by a nonprofit entity such as the Sabin

Vaccine Institute. Each billionaire would make a 30 year gift to the trust; after 30 years, the principal would revert to his heirs. "The IRS says the residual value of a 30 year gift is zero, so each donor gets a \$50 million write-off today because it's a charitable contribution," explained Elliot, a principal of Prime Capital Management in Darien, Connecticut.

The trust manager would invest in 30 year government bonds, protect-

ing the principal and generating income to buy vaccines. If the bond yield was 6%, the trust would have \$1.5 billion in annual interest income for vaccines.

The bottom line of Elliot's plan? Vaccines would be made available to the poorest throughout the world, fifty individuals would receive up-front tax relief and their heirs would receive the full nominal principal loaned to the global vaccine trust.

A VACCINE CONSORTIUM COULD SPEED DEVELOPMENT, CREATE EFFICIENCIES

by Clark McFadden, J.D.

Clark McFadden, a partner with the law firm of Dewey Ballentine in Washington, DC, described several areas of vaccine development that could benefit from collaborative activity.

For vaccines the greatest challenge and potentially the greatest pay-off is in collaboration for research and development. Many areas of high technology have generated successful collaboration in research and development – e.g. optoelectronics, flat panel displays and semiconductors. Experience in these areas may be instructive for assessing the potential for collaboration in vaccine research and development.

Several elements have characterized successful industrial research and development consortium. Some of these elements are obvious and generic to any joint activity:

- **Catalyst for Action** – A common threat or opportunity facing potential participants.

- **Determined Leadership**

- Because joint activity is not normal in a market environment, high level leadership is important to get it started.

- **Leverage** – Whether tech-

nological or financial, leverage is a major attraction for collaborative activity.

- **Effective Technology Transfer**

- Since broad based collaboration generally requires that the participants must be able to exploit the benefit achieved, the transfer mechanism must be clear and effective.

In general, these elements should be readily achievable for collaboration in vaccine research and development.

Other elements that have characterized successful industrial research and development consortia will be more difficult to achieve in vaccine research and development collaboration. These elements include:

- **Industry Driven Activity** - To achieve the benefits of competition in the market, industry must participate on a profit-making basis, that is, with the intention of commercially exploiting the research results.

- **No Secrets** – The collaborative activity works best when there

is full and open access by participants to the work of the consortium. This requires carefully circumscribed boundaries for the activity and the background research upon which it is based.

- **Avoid Areas of Core Competition** – Industrial consortia have worked best where they have focused on supporting an ancillary technology development, e.g. manufacturing processes or design tools.

The implications of these elements for collaboration in vaccine research and development are to be **(i) less ambitious in scale and (ii) focused on particular aspects of vaccine development rather than comprehensive development of the vaccine itself.** Such collaboration is a major challenge both in its difficulty and its constraints. Nevertheless, it may constitute the most effective way to gain the benefits of industrial collaboration for vaccine development.

cines, cited additional factors as barriers to neglected vaccine development. For example, companies, philanthropists and governments are reluctant to invest heavily to create a vaccine if it cannot become widely used. The Global Fund is working with countries to establish and improve vaccine delivery infrastructure.

Vaccine purchase funds (such as the GFCV) break down multiple barriers, said Tony Lakavage, Senior Director of Global Public Affairs at

SmithKline Beecham. Not only do purchase funds represent a way for companies to get a return on investment, they also represent access to new vaccines for developing countries.

Ingredients of Successful Alliances

There was strong consensus among participants that for an alliance to be successful, its partners must understand each other's perspectives and cultures. Carol Nacy, Ph.D., CEO of Sequella, a biotechnology company, outlined the dif-

ferent perceptions of risk held by government agencies, nonprofit organizations, foundations and companies. Still, she said, “we each have a role to play in vaccine development. Above all, we must respect our partners' roles in the process.” Any companies or organization considering joining a partnership should have at least one person who “speaks the other parties' language,” advised Mr. Lakavage. This person can translate the other partners' positions and

[Continued on page 16](#)

NEWS FROM THE INSTITUTE

SVI is proud to announce six additional staff and board members now bringing their professional experience to the Institute.

by Fran G. Sonkin

New Board Members

The Sabin Vaccine Institute welcomed four new members at its September 26, 2000 meeting at The Lotos Club in New York City. The new members are:

Allan L. Goldstein, Ph.D.

Allan L. Goldstein is Professor and Chairman of the Department of Biochemistry and Molecular Biology at the George Washington University School of Medicine and Health Sciences. Previously, he served as President and Science Director at the Institute for Advanced Studies in Immunology and Aging. He also acted as Founder and Chairman of the Board and as Chief Scientific Advisor at Alpha Biomedicals, Inc., a public biotechnology company.

Dr. Goldstein is the co-discoverer of the Thymosins, the family of polypeptide hormones of the thymus gland. He has been issued eleven patents in connection with this discovery.

Michael T. Osterholm, Ph.D, M.P.H

Michael T. Osterholm is the Chairman and CEO of ican, Inc., a decision-support resource for health professionals. He is the former State Epidemiologist for the Minnesota Department of Health. Dr. Osterholm is internationally recognized as a leader in infectious diseases. Dr. Osterholm served as a personal advisor to the late King

Hussein of Jordan on bioterrorism. Dr. Osterholm's latest publication, *Living Terrors: What America Needs to Know to Survive the Coming Bioterrorist Catastrophe*, addresses the risk factors for biological terrorism and possible solutions.

Michael E. Whitham, Esq.

Michael E. Whitham is a Partner at McGuireWoods, LLP. He has worked with several universities, non-profit research institutions and charitable foundations on patent, trademark, licensing, and contract matters over the last fifteen years.

Mr. Whitham has previously served as Chief Financial Officer and Partner at Whitham, Curtis & Whitham, PLC, where both the size of the firm and its earnings each quadrupled during his time there. Mr. Whitham is a member of the Association of University Technology Managers, the American Bar Association, the American Intellectual Property Law Association, the American Trial Lawyers Association, the Licensing Executives Society, and the American Chemical Society.

Lawrence J. Wilker, Ph.D.

Lawrence J. Wilker is President and CEO of ShowOnDemand.com, Inc. This new theatrical production and media company produces high quality, live popular entertainment titles including pop concerts, musicals, plays, children's entertainment, and comedy.

Dr. Wilker was previously President of The John F. Kennedy Center for the Performing Arts for ten years. He created and presented more than 3,000 performances annually and extended performances and education programs to all 50 states. Within five years, Dr. Wilker more than doubled attendance and nearly tripled fundraising at the Center. He also created the PBS series, "Kennedy Center Presents." Additionally, Dr. Wilker produced three Tony Award-winning musicals and was nominated for an Emmy.

The Albert B. Sabin Vaccine Institute is pleased to highlight news about three new staff members.

Postdoctoral Research Fellow

Valerie Manda, MBChB, MMed of South Africa has been named Postdoctoral Research Fellow by The Albert B. Sabin Vaccine Institute, and The George Washington University Medical Center's Department of Biochemistry and Molecular Biology and Department of Microbiology and Tropical Medicine.

Dr. Manda will work with Dr. Peter J. Hotez and Dr. Philip K. Russell. Dr. Hotez is Chairman of the Institute's Scientific Advisory Board, Principal Scientific Investigator of the Hookworm Vaccine Initiative and Chair and Professor of the GWU Department of Microbiology and Tropical Medicine. Dr. Russell is a

Founding President of the Sabin Vaccine Institute and Senior Advisor to the Chairman.

Dr. Manda will provide research, observation, and consultation for the Hookworm Vaccine Initiative Program which is being funded by an \$18 million grant from the Bill and Melinda Gates Foundation.

Prior to her appointment at the Sabin Vaccine Institute, Dr Manda was specialist/lecturer in the Department of Microbiology at the Medical University of Southern Africa (MEDUNSA), one of the few universities in South Africa that actively readdressed racial inequalities in health care provision and training.

Director of Program Management and Regulatory Affairs for the Hookworm Vaccine Initiative (HVI)

Paul Vilks, RPh, RAC, has joined the Institute as its new Director responsible for the supervision and coordination of biologic contractors and vaccine developmental partners.

Additionally, he is the Institute's liaison with the Food and Drug Administration, The National Institutes of Health and the World Health Organization. He maintains the HVI strategic plan and budget, and coordinates research team meetings with collaborators and consultants.

Dr. Vilks brings product development experience in the fields of oncology and metabolic and infectious diseases. Throughout his professional career, he has been involved with project management and regulatory affairs activities for drugs and biological products for non-profit, for-profit and government organizations. A graduate of Columbia University, he majored in pharmaceutical sciences and completed graduate study in business administration at the George Washington University. He is a retired Captain/Colonel of the US Public Health Service Commissioned Corp, a licensed pharmacist in New York and Maryland and is Regulatory Affairs Certified. Dr. Vilks is based at the Institute's satellite office in Rockville, Maryland.

Information Coordinator/ Librarian

John Carnright will assist the Institute's efforts in organization of information retrieval and internal library/information services including web-based research. Mr. Carnright's previous experience as an information librarian involved extensive news, patent, trademark, corporate and art research in New York, Denver and Los Angeles. He was Library Director for Gaston, Snow and Ely Bartlett and for Fitzpatrick, Cella, Harper and Scinto law firms. He has also done research and advising on art and art reference tools having been an Arts Advisory Associate for MacMillan Publishing Company in New York, and Library Director for the Industrial Movement Art and Photo Complex in Los Angeles. He writes television treatments, film synopses, screenplays, novella and novel length works. Other writing assignments have included copywriting, journalism and concept writing. ❖

Fran G. Sonkin is the Executive Vice-President of the Albert B. Sabin Vaccine Institute.

SABIN JOINS HANDS WITH GWU

Continued from page 3

are proud to have Peter join our faculty and begin a collaborative relationship with the Sabin Vaccine Institute from which we expect great things to emerge," Trachtenberg said.

"Peter Hotez is engaged in novel research with global impact," noted John F. "Skip" Williams, M.D., GW Vice President for Health Affairs and Dean of the School of Medicine.

Dr. Hotez earned his M.D. from Cornell University College of Medicine and his Ph.D. from Rockefeller University. He was a pediatric resident

at Massachusetts General Hospital and did a fellowship in pediatric infectious diseases at Yale University School of Medicine, on whose faculty he served until this past summer. He is recognized as one of the world's leading authorities on tropical diseases and medical parasitology.

Hotez can gaze out the window of his seventh floor office and see the Pan American Health Organization, World Health Organization and several US government buildings. He is just a few blocks from the World Bank. He wants

to use this proximity to focus more attention on "vaccine diplomacy."

"Vaccine research can be a force for conflict resolution," Hotez explained. "It can draw together scientists, advocates and health officials from countries with political hostilities to one another. Vaccines themselves democratize health care by making disease prevention possible for all people, not just those in established market economies." ❖

John M. Clymer is the Sabin Institute's Director of External Affairs. He is located in the Institute's Rockville, MD office.

COLLOQUIUM (CONT.)*Continued from page 13*

culture to people within his organization.

Are Vaccines Undervalued?

In recent years, international health leaders have argued that vaccine prices are too high and, if they were lowered, immunization rates in poorer countries would skyrocket. This has created a tension between industry and those in the government and nonprofit sectors. But this meeting saw a breakthrough on this subject, with participants moving toward shared recognition that prices are not the only barrier to immunization in many countries, and that if prices fall below a certain level it becomes unfeasible to develop and manufacture vaccines.

Participants agreed that the public and its leaders tend to undervalue vaccines. Peter Young hypothesized that one could sell an effective treatment for AIDS for many times the maximum selling price of a vaccine to prevent AIDS. The market currently bears this out. Therapies for a liver cancer that kills approximately 5,000 Americans a year sell for large multiples of the cost of the hepatitis B vaccine which also prevents liver cancer.

Carole Heilman, Ph.D., Director of the Division of Microbiology and Infectious Diseases at the [National Institute of Allergy and Infectious Diseases](#) observed that President Clinton has changed perceptions of vaccines within government. He made development of an AIDS vaccine a national priority. His Administration has put vaccines on the national security and global development agendas. The colloquium was sponsored by the Sabin Institute with financial support from the [Bill and Melinda Gates Foundation](#). ❖

sabin calendar

The Institute is not responsible for non-Institute events listed below.

March 7-11 2001*Walkers Cay, Abaco, Bahamas*

Sabin Vaccine's Institute's

**THIRD ANNUAL WALKER'S CAY
COLLOQUIUM ON CANCER VACCINES
AND IMMUNOTHERAPY**

April 23, 2001*Arlington, Virginia*

Hyatt Regency Crystal City

**ALBERT B. SABIN GOLD MEDAL
AWARD CEREMONY**

APRIL 23-25, 2001*Arlington, Virginia*

Hyatt Regency Crystal City

**FOURTH ANNUAL CONFERENCE ON
VACCINE RESEARCH**

FOR MORE INFORMATION VISIT:WWW.NFID.ORG**MAY 31, 2001***New York, NY*

Pierre Hotel

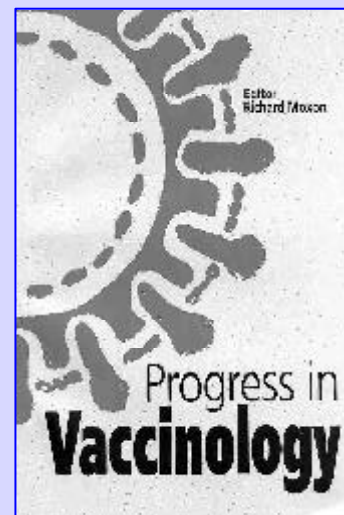
**2001 SABIN AWARDS CELEBRATION
HONORING:**

DR. JOHN W. ROWEChairman and CEO,
AETNA US Healthcare

**LIFETIME ACHIEVEMENT AWARD
&**

JEAN-JACQUES BERTRANDChief Executive Officer,
Aventis-Pasteur**ALBERT B. SABIN****HUMANITARIAN AWARD****FOR MORE INFORMATION VISIT:**WWW.SABIN.ORG**PROGRESS IN VACCINOLOGY***Editor: Richard Moxon*

Presenting selected works originally published in *The Lancet*, this book introduces the reader to eight key vaccinology issues in a concise and thorough manner, complete with questions and provocative discussions at the end of each chapter. Pertinent topics are presented covering molecular biology applications to vaccine discovery, futuristic vaccines, immunobiology, public health and design, evaluation and use of vaccines. This book is excellent for students at all levels wishing to understand the principles, progress and potential of vaccines.



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