



# NICED LIBRARY NEWSLETTER

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## Using the One Health Approach for Containment of Antimicrobial Resistance in India

### *Changing Public Health Challenges*

A quick study of the public health priorities in India over the past seven decades provides some interesting snapshots. Certain areas, for example, water supply and sanitation, which were of concern as early as the first five-year plan (1951-1956), still remain on our radar; some programs, like the National Smallpox Eradication Program (launched in 1962), have been successfully wrapped up; still others, like the Family Planning efforts, have undergone multiple metamorphoses over the ages; and some issues, like the retinue of non-communicable diseases like diabetes, hypertension, cardiovascular diseases and stroke, have only started to garner attention over the last decade or so. Whilst India has progressed as a sovereign nation, and emerged as an economic powerhouse, it has also started to suffer from the ailments of the developed world. Today, the nation stands at crossroads where a double-edged dagger – reflecting the dual risks of communicable diseases as well as non-communicable diseases – has emerged. Added to this is the burden of zoonotic and other novel, emerging diseases which have affected multiple countries of this age.

With these conditions in mind, it becomes unfeasible to launch vertical programs addressing individual diseases or risk-profiles. What was a successful strategy in the first few five-year plan periods, have lately appeared to generate too much

redundancy. The move to unify many of the stand-alone, vertical programs under the banner of the National Health Mission was a step in the direction of reducing the redundancy. Yet, there remains a lot of room to further break the sectoral barriers, which create difficulties in providing holistic approaches to existing problems. The One Health approach provides us with a set of tools that can be reliably deployed to combat these issues by considering a cross-sectoral, transdisciplinary framework from which to consider the existing public health challenges.

### *What is One Health?*

One Health is an integrative effort powered by multiple disciplines working together at the local, national and global level to ensure the attainment of optimal health for man, animal and the environment. The One Health approach recognizes that the health of people is linked to the health of animals and well-being of the environment, including artificial healthscapes created by man.

The concept of One Health is inextricably linked with that of transdisciplinarity or cross-sectorality. The United States Centers for Disease Control and Prevention (US CDC) contend that for successful One Health interventions to work, it requires the collaboration of human, animal and environmental health communities. The CDC has also outlined multiple emerging infectious challenges that can be adequately dealt with using this approach (figure 1 below).

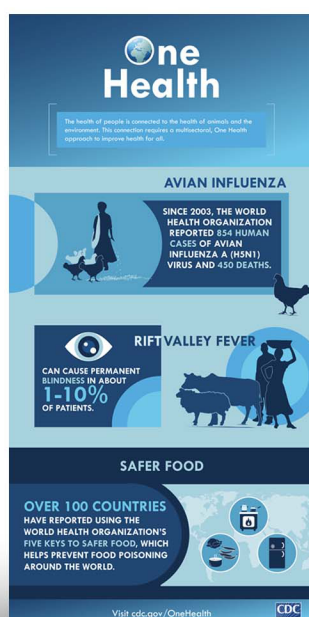


Figure 1: One Health – Connecting the health of people, animals and environment

The World Health Organization's (WHO) vision for One Health has even more far reaching implications. The WHO cites that it is "an approach to designing and implementing programs, policies, legislation and research in which multiple sectors communicate and work together to achieve better public health outcomes". Perhaps the best example of institutionalized One Health initiatives come through the work done with the tripartite coalition of the WHO, the Food

and Agriculture Organization of the United Nations (FAO) and the World Organization for Animal Health (OIE). The One Health Initiative, a collaborative, multidisciplinary, cross-sectoral platform, has elucidated a wider vision for One Health as a key concept in amelioration of health in the truest sense of the word, as summarized in Figure 2 below.

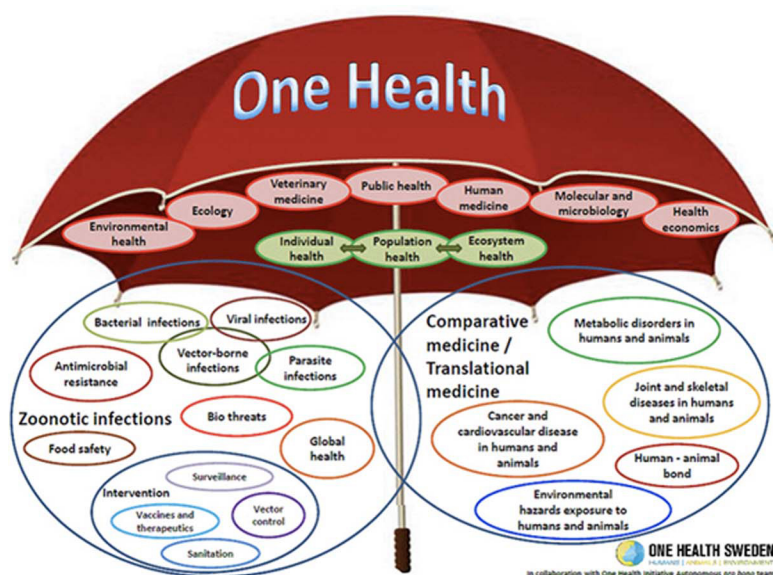


Figure 2: The One Health Umbrella

Source: <http://www.onehealthinitiative.com/gfx/umbrella.jpg>

#### *A Brief History of the One Health Concept*

The concept behind One Health is nothing radically new – in fact, some advocates believe that the One Health concept was first aired by none other than Hippocrates in his tome *Airs, Waters and Places*, which was written around 2500 years ago. In this discourse, he argues the role that the climate, local geology, flora and fauna play on the health and temperament of the natives.

In more recent, recorded history, Rudolph Virchow, while studying the roundworm *Trichinella spiralis*, and its infestation in swines, postulated the link between human and animal diseases – this was around the 1860s. He

stated: “Between animal and human medicine there are no dividing lines—nor should there be. The object is different but the experience obtained constitutes the basis of all medicine.”

Sir William Osler, widely considered to be the Father of Clinical Medicine, also had a deep and lasting interest in the connection between human and animal diseases. In fact, one of his first publications was a treatise on the very same topic: *The relations of animals to man*. Osler, ever the consummate teacher, was widely sought after to not only lecture the medical students at the McGill University, the faculty of which he served, but also the veterinary students at the nearby Montreal Veterinary College.

However, one has to admit that the quantum leap towards the One Health revolution of today probably germinated much later – in the works of Calvin Schwabe, a veterinary epidemiologist, who directed the World Health Organization’s program on parasitic diseases. In the 1964 edition of his veritable masterpiece

*Veterinary Medicine and Human Health*, Dr. Schwabe coined the term “One Medicine” to emphasize the fact that human and animal health were not all that distant and that the well-being of one depended verily on that of the other.


The core principles of the One Health approach were institutionalized when the Wildlife Conservation Society published the Manhattan principles in 2004. These twelve principles are self explanatory and outline the aspirations of the One Health approach for approaching diseases, especially the challenges of the modern era, like emerging infectious diseases (both epidemics and epizootics), antimicrobial resistance in clinically significant microbes, and nurturing and safeguarding of the environment. These principles define the role One Health would come to play in the next decade. (The principles have been added in the section on reading points below for your perusal.)

With the threat of emerging infectious diseases becoming real, especially at the human-animal-environment interface, the One Health approach was officially endorsed by several public health agencies as the way forward. Further, it became a critical component of the effort to contain the emergence of antimicrobial resistance (AMR). The Global Action Plan on the containment of AMR, which was adopted by the 68th World Health Assembly in New York in 2015, outlined the need to utilize the One Health approach as a strategy to counter the emergence of AMR, both in the context of developing and developed countries.

*One Health in Action: The Case of Antimicrobial Resistance in the Indian Context*

The natural question that arises at this point is how this translates into a sustainable solution for the public health problems in India. Although the One Health approach can be potentially applied to any complex health problem it is not a stereotypical, one-size-fits-all solution. In fact, by ensuring the dissolution of sectoral borders, and ensuring the adoption of a malleable approach towards solving multi-disciplinary problems, it becomes a flexible tool to deal with several problems of public health concern. The One Health approach has found multiple successful deployments in different socioeconomic settings across the world.

A successful One Health effort was launched in India in the wake of the emergent threats of H5N1 influenza. “The emergence of the H5N1 influenza, and the resulting policy and public panic, led to the conceptualisation of multisectoral linkages in India, with human health, animal health, and wildlife sectors coming together to combat the problem. The collaboration was institutionalised in the form of an Inter-Ministerial Task Force and Joint Monitoring Group at the national level, with coordination




mechanisms established all the way down till the district level. Written standard operating procedures (SOPs), in the form of avian influenza contingency plans, were developed and followed in subsequent outbreaks. The protocols ensured successful stamping out of the virus from most locations, though some of the north eastern states are now endemic, with porous international borders playing an important role in the continued transmission.”

However, the tentativeness around the adoption of the One Health approach with respect to other critical infectious disease issues has persisted. The global consensus on employing the One Health Approach for dealing with the emergent crisis of antimicrobial resistance, and its institutionalization in the form of the Global Action Plan on antimicrobial resistance, could go a long way in breaching some of this hesitancy. Some aspects of why this approach could be a game changer from the public health perspectives in India is highlighted in this section.

#### *Why AMR needs a One Health Approach*

As we obtain a more complete understanding of the emergent issue of antimicrobial resistance, it becomes clearer that overuse in the human clinical settings is only part of the picture – one that is immensely more complex. The consumption of antibiotics in livestock sector remains a major problem, especially when consumed in sub-therapeutic doses for metaphylactic purposes – securing animals residing in an infection-prone environment from suffering with infections through the administration of anti-infective agents. The issue of release of antibiotics and antibiotic/antimicrobial resistance genes in the environment is another cause for concern, especially since studies have shown that river water downstream from pharmaceutical industries may contain a high concentration of antibiotics that could encourage the selection of resistant strains of bacteria in the nature, which could then be passed off to man and/or animals, to cause drug resistant infections.

As Figure 2 below illustrates, the complex web of antimicrobial residue and antimicrobial resistance transmission is indeed a good target for the cross-sectoral principles endorsed by the One Health approach.



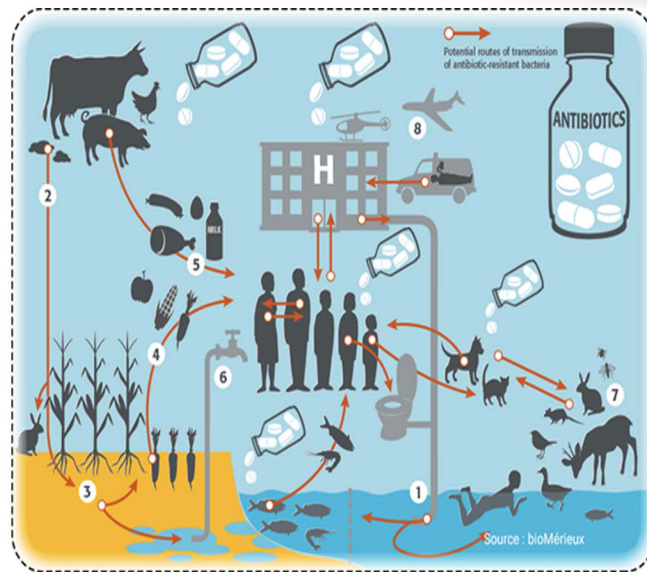


Figure 3: Transmission of Antimicrobial Resistance – From Farm to Food to People

Source: [http://www.antimicrobial-resistance.biomerieux.com/wp-content/uploads/2015/10/Illustration\\_Chap1-1e.png](http://www.antimicrobial-resistance.biomerieux.com/wp-content/uploads/2015/10/Illustration_Chap1-1e.png)

Researchers have worked to address the complex nature of the transmission of antimicrobial resistance by designing a policy framework for an integrated, One Health-based surveillance. In one approach, the problem of antimicrobial resistance was centralized and integrated to the surveillance of both antimicrobial consumption for humans as well as animals, along with data from resistant agents from humans, animals, food and the environment. The process, summarized in figure 3 below, highlights the critical processes for the same:

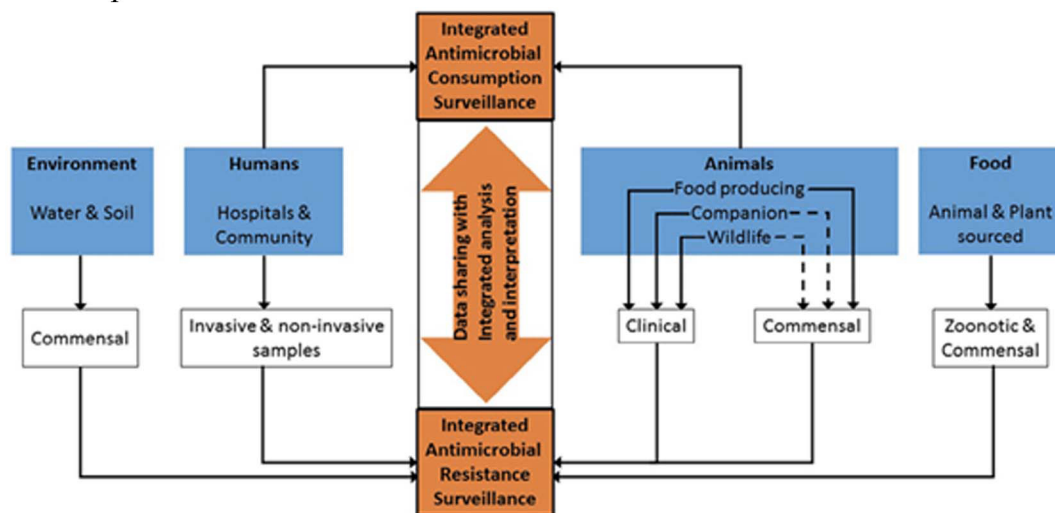
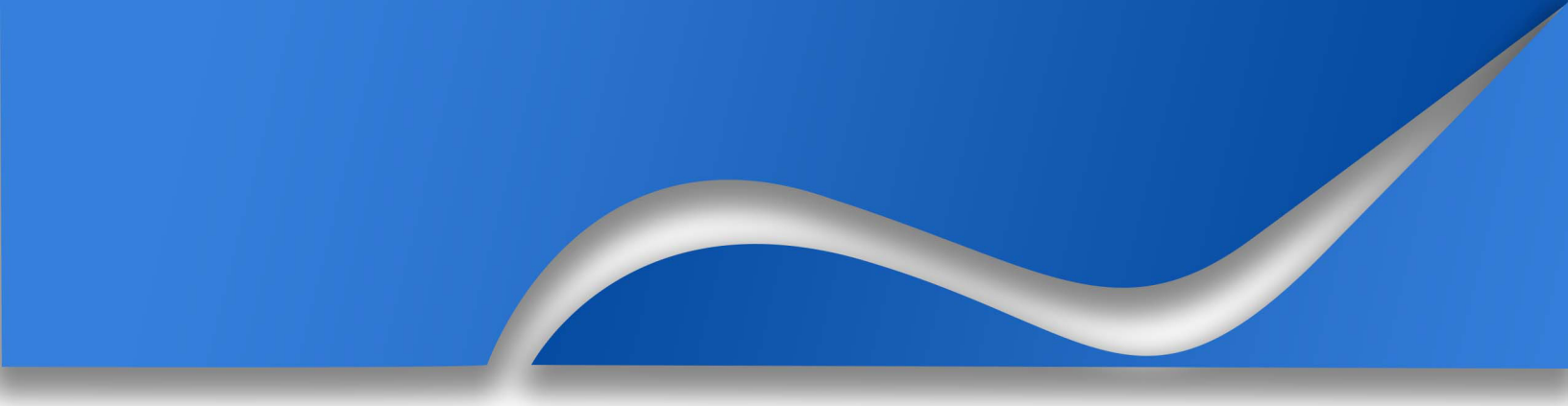


Figure 4: An interconnected and integrated One Health surveillance framework that puts at its centre antimicrobial resistance and antimicrobial consumption

Source: DOI: 10.1016/j.ijantimicag.2016.06.014



### *One Health for AMR in India*

India has recently outlined the National Action Plan for containment of the menace of antimicrobial resistance. Although the implementation of the principles outlined in the document are still ongoing, it has put a strong emphasis on the need to adopt the One Health approach for the containment of AMR in India. The action plan censures the existing efforts for the lack of an overarching, unifying One Health theme:

*“The AMRSN also incorporates in-depth understanding of clonality of drug resistant pathogens and the transmission dynamics to enable better understanding of AMR in Indian context and devise suitable interventions. The AMRSN, although currently limited to the human health side, plans to scale up on a national scale and expand its ambit to include samples from a wider spectrum of sources, including animal, environmental and food samples, to reflect the principles of a One Health approach based surveillance system. Currently the laboratory network has been expanded to include ten centres.*

*Aside from the absence of a One Health approach to surveillance, another weakness of the existing surveillance systems for AMR in India is that it does not account for antibiotic use. The existence of a surveillance system that can establish the relationship between the antibiotic consumption patterns and emergence of AMR is vital to producing evidence that may help in the designing and evaluation of effective interventions.”*


Further, the action plan has centered the principles outlined in it based on the One Health approach; the main objective of the plan states:

*“Define the strategic priorities, key actions, outputs, responsibilities, and indicative timeline and budget to slow the emergence of AMR in India and strengthen the organizational & management structures to ensure intra- & inter-sectoral coordination with a One Health approach;”*

Given this commitment to adopt the One Health approach for solving the antimicrobial resistance puzzle in India, it is encouraging to see the deeply integrated adoption of the principles of transdisciplinarity and silo-breaking cooperation between participating agencies in the plan.

### *In conclusion: The Way Forward*

The role played by the One Health approach in handling complex issues is beyond debate. In essence, it is the complex and complete solution that the complex emerging problems of this era demand. Going forward, India needs to ensure seamless adoption of the One Health approach for the containment and control of its health problems – not just antimicrobial resistance, but other issues with similar complex determinants underneath, like, child malnourishment, zoonotic diseases, neglected tropical diseases, emerging infectious diseases (especially those infections emerging at the human-animal and domes-



tic-wildlife interfaces), and urban epidemics of reemerging infectious diseases like dengue and chikungunya and other vector borne diseases. To make this vision of an integrated response come through, it is essential that the policy push is provided on certain fronts to ensure the smooth adoption and implementation of the One Health approach. Some central areas that need this attention include:

1. *Capacity building*: The limited healthcare capacity in the nation notwithstanding, it is essential to provide One Health skills to a cadre of program managers and public health officers, including researchers and policymakers, to enable them to guide the smooth enactment and implementation of One Health strategies on the ground. Further, adding this sub-specialty training could improve and expand the skill sets of the current crop of public health students who are likely to engage as policy-makers, program managers, researchers and teachers of tomorrow.
2. *Research Investment*: It is essential to identify the critical components that need to be targeted through One Health interventions. This is especially challenging in healthcare issues which have multiple moving parts, like antimicrobial resistance or emerging and reemerging infectious diseases. It is particularly vital to understand the critical paths – the pathways and networks of spread of a disease or a resistant pathogen – so that these can be targeted specifically, using “silver bullet” policy strategies. For this to happen, it is critical to provide support to mid-term studies that unearth the epidemiologic complexities of diseases.
3. *One Health as Surveillance Strategies*: While this has yet to be tested out in the developing world context, the adoption of One Health strategies for surveillance of health and disease conditions is a rapidly emerging field of study. This is of particular interest in the field of antimicrobial resistance, which remains a medusoid problem whose multiple tentacles are seldom adequately addressed.
4. *Institutionalization of One Health Approaches*: If sustainable One Health policies and evidence-to-policy translation needs to happen, its principles need to be ingrained within the public health establishments involved in solving the problems of the day. Whilst the creation of new, vertical facilities defeats the purpose of disseminating a horizontal, integrative principle, the need to identify an avenue of incorporating the One Health approach in everyday research and policy work remains vital. To this end, it follows that in addition to strategic capacity building, as outlined above, there needs to be a directed deployment as well, ensuring equitable distribution of skills.
5. *Monitoring and Course Correction*: While the principles of One Health do incorporate the need to translate knowledge into action, and use the experiential evidence from such transformation into advising future research/knowledge-generating activities, there still remains the need to police the development around the One Health interventions. Not only monitoring the successes and failures of deployed interventions, but also ensuring feedback loops to allow course corrections is an essential part of any such monitoring framework.

Louis Pasteur famously said: “Messieurs, c’est les microbes qui auront le dernier mot.” (Gentlemen, it is the microbes who will have the last word.) Whilst this apocalyptic statement seems to be coming true, with WHO recently stating that the world is running out of antibiotics (in its report titled: Antibacterial agents in clinical development – an analysis of the antibacterial clinical development pipeline, including tuberculosis), the One Health paradigm provides us with a fighting chance. The Nobel

Laurate biologist, Joshua Lederberg, characterized this epic struggle for existence when he stated: “The future of humanity and microbes will likely unfold as episodes of a suspense thriller that could be titled: Our wits versus their genes”. It is time for us to mount an offensive against the rapidly evolving threats posed by our microbial cohabitants and initiate a new chapter in this struggle for existence.

It is time for adopting the One Health principles in public health and policy.

**Reading Points:**

*The Manhattan Principles:*

1. Recognizing the link between human, domestic animal, and wildlife health, and the threat disease poses to people, their food supplies and economies, and the biodiversity essential to maintaining the healthy environments and functioning ecosystems we all require.
2. Recognizing that decisions regarding land and water use have real implications for health. Alterations in the resilience of ecosystems and shifts in patterns of disease emergence and spread manifest themselves when we fail to recognize this relationship.
3. Including wildlife health science as an essential component of global disease prevention, surveillance, monitoring, control, and mitigation.
4. Recognizing that human health programs can greatly contribute to conservation efforts.
5. Devising adaptive, holistic, and forward-looking approaches to the prevention, surveillance, monitoring, control, and mitigation of emerging and resurging diseases that fully account for the complex interconnections among species.
6. Seeking opportunities to fully integrate biodiversity conservation perspectives and human needs (including those related to domestic animal health) when developing solutions to infectious disease threats.
7. Reducing demand for and better regulating the international live wildlife and bushmeat trade, not only to protect wildlife populations but to lessen the risks of disease movement, cross-species transmission, and the development of novel pathogen-host relationships. The costs of this worldwide trade in terms of impacts on public health, agriculture, and conservation are enormous, and the global community must address this trade as the real threat it is to global socioeconomic security.
8. Restricting the mass culling of free-ranging wildlife species for disease control to situations where there is a multidisciplinary, international scientific consensus that a wildlife population poses an urgent, significant threat to human health, food security, or wildlife health more broadly.
9. Increasing investment in the global human and animal health infrastructure commensurate with the serious nature of emerging and resurging disease threats to people, domestic animals and wildlife. Enhanced capacity for global human and animal health surveillance and for clear, timely information-sharing (that takes language barriers into account) can only help improve coordination of responses among governmental and nongovernmental agencies, public and animal health institutions, vaccine / pharmaceutical manufacturers, and other stakeholders.
10. Forming collaborative relationships among governments, local people, and the private and public (i.e. non-profit) sectors to meet the challenges of global health and biodiversity conservation.

11. Providing adequate resources and support for global wildlife health surveillance networks that exchange disease information with the public health and agricultural animal health communities as part of early warning systems for the emergence and resurgence of disease threats.

12. Investing in educating and raising awareness among the world's people and in influencing the policy process to increase recognition that we must better understand the relationships between health and ecosystem integrity to succeed in improving prospects for a healthier planet.

*Links:*

1. One Health Global Network: <http://www.onehealthglobal.net/>

2. The WHO on One Health: <http://www.who.int/features/qa/one-health/en/>

3. One Health Initiative: <http://www.onehealthinitiative.com/>

4. One Health Commission: <https://www.onehealthcommission.org/>

5. CDC's One Health Site: <https://www.cdc.gov/onehealth/>

6. Students for One Health:

[https://www.onehealthcommission.org/en/leadership\\_\\_board\\_of\\_directors/students\\_for\\_one\\_health\\_soh\\_news/](https://www.onehealthcommission.org/en/leadership__board_of_directors/students_for_one_health_soh_news/)

7. The United Nations and One Health: the International Health Regulations (2005) and global health security: <https://www.oie.int/doc/ged/D14097.PDF>

8. The WHO's library of National Action Plans on AMR: <http://www.who.int/antimicrobial-resistance/national-action-plans/library/en/>

9. WHO's report titled Antibacterial agents in clinical development – an analysis of the antibacterial clinical development pipeline, including tuberculosis: [http://www.who.int/medicines/areas/rational\\_use/antibacterial\\_agents\\_clinical\\_development/en/](http://www.who.int/medicines/areas/rational_use/antibacterial_agents_clinical_development/en/)

10. Joshua Lederberg. Infectious History: <http://science.sciencemag.org/content/288/5464/287>

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## **Library News:**

### **Resources of the ICMR-NICED Library:**

NICED Library has a rich collection of books. In 2015-16 and 2016-17 NICED has added 127 books in its collection. The books are of subjects catering to the research interest of the scientists of the Institute. The Library has books on the following subjects: Bacteriology, Biochemistry, Clinical Medicine, Electron Microscopy, Gastroenterology, HIV , Immunology, Infectious Diseases, Molecular and Medical Microbiology, Environmental Microbiology, Epidemiology, , Parasitology, Pathophysiology, Virology. Apart from the above subjects there are books on Research Methodology, Bioinformatics also.

- The Total Books in the library: 10,757 including bound volumes of journals
- Online journals subscribed in 2016-17: 33
- Online books: 2
- Database: Web of Science and Cochrane Library (provided by ICMR, HQ)
- Consortia: ICMR-e consortia Includes J gate Plus

### **Publication:**

NICED Library Newsletter