frontiers in Virology

FIELD GRAND CHALLENGE
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Frontiers in Virology: An Innovative Platform for Integrative Virus Research

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Since the first discovery of a plant virus in 19th century, numerous viruses have been found and identified as admirably unique genetic agents in virtually all unicellular and multicellular living creatures (1–3) (**Figure 1**). They are parasitic entities that replicate in a remarkably different manner in their specific hosts. Owing to extensive and enthusiastic efforts to date by numbers of scientists in diverse research fields, viruses are now recognized to be the most abundant replicating species in nature. However, naturally occurring viruses are found to be beyond the scope of our expectations. Each viral species has its own unique strategy to interact with its host species for survival and frequently gives unexpected results upon its infection, representing a wide variety of scientifically important biological issues to be addressed and solved (1, 4–26). Furthermore, new dreadful pathogenic viruses with distinct characteristics keep emerging or reemerging in various parts of the world, generating significant menaces to humans (4, 10, 27–34). It is thus increasingly important to systemically explore viruses in detail particularly in this challenging time (29, 32, 34–36) (**Figure 1**). Viral infectious diseases are certainly one of the most critical issues in medical, environmental, ecological, and health sciences. Extensive efforts need to be made against these pathogenic viruses. Today's virology, at a global level, aims at understanding practical aspects of viruses as well as elucidating relevant biological basic matters (**Figure 1**).

Virology has gradually developed to the present multidisciplinary status from the initial stage 130 years ago. During the period, virology clearly has been acting as strong driving forces to make paradigm shifts for basic biology and molecular biology (1–3), and also for applied sciences of various fields including nanotechnology, virus vectors, and medical therapies (37–39). Viruses are the smallest and most simple organic molecules with highly ordered structures that can replicate as a population under some specific conditions. On one hand, viruses are sometimes pathogenic/fatal for their hosts and sometimes transmittable among different host species. Targeting and taking the advantage of these characteristic viruses, a number of highly memorable investigations on biology and medicine, Nobel prize and Nobel prize-worthy studies, have been performed as well-known. Invaluable studies on various viruses are currently in progress all over the world. Needless to mention, the development and success of current virology have been critically supported by the innovative next-generation methodologies/technologies recently available. These include the forefront systems, such as bioinformatics, modellings, and sequencings, to sensitively and precisely analyze the concerned issues (3, 18, 40–56) (**Figure 1**). Given the multi-faceted perspective and inherent thoroughness, results obtained by these methods would readily point out the next projects to be done. We virologists can now predict, albeit to a certain degree, how viruses behave in response to environmental changes and are able to verify the predicted outcomes in an open and demonstrative way by well-designed experiments (1–3). Virology should spread its wings to be more scientifically general and inspirational, and should also continue to be a major academic discipline of the biology.

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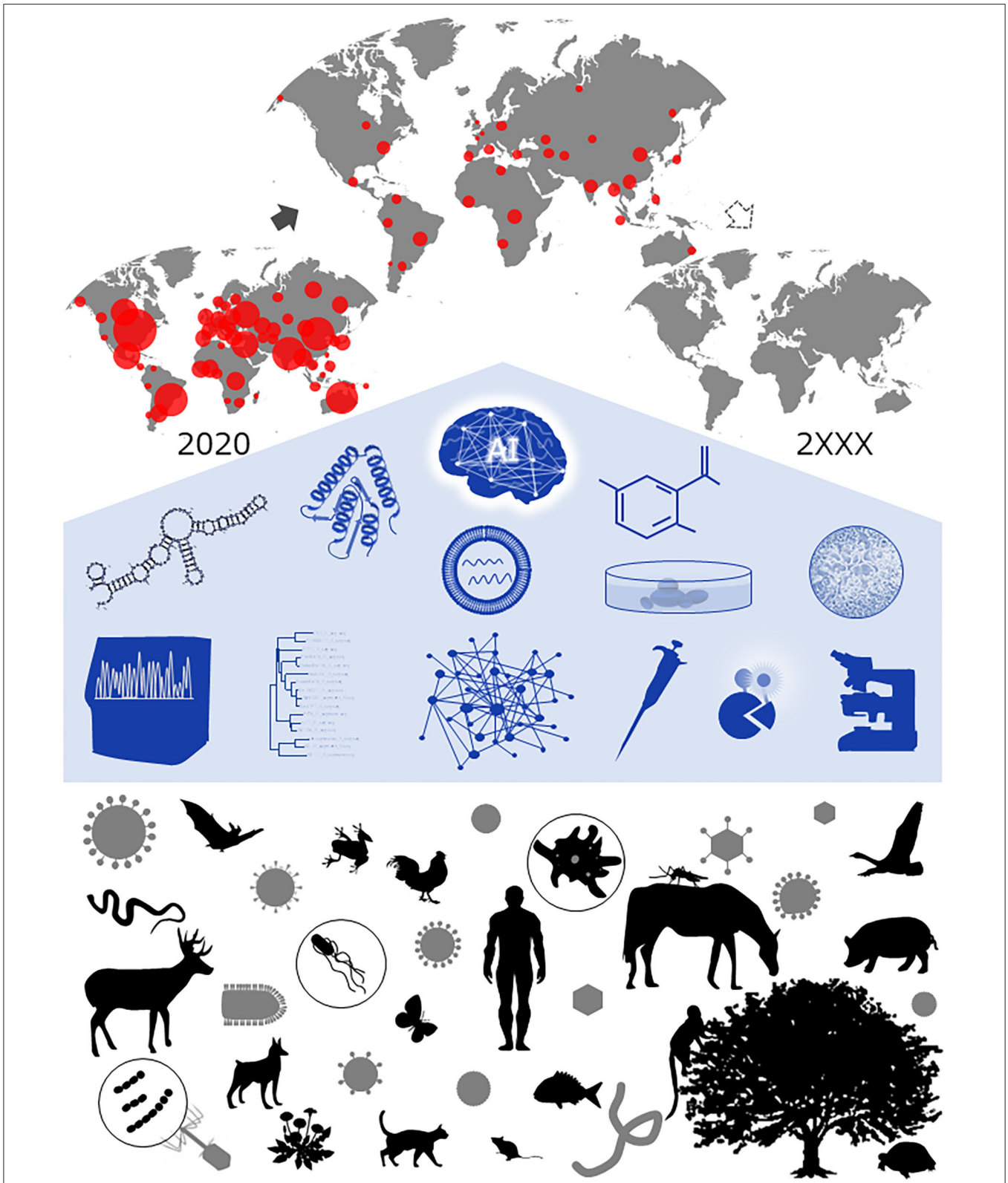

FIGURE 1 | Concept of contemporary virology. A wide variety of viruses/virus hosts (bottom) and numbers of scientific materials/methodologies/technologies for studies on viruses (middle) are depicted. At the top, an imaginary and desirable time course of viral disease distribution (pandemic) is illustrated. One clear and definitive goal of integrative virology in the era of recurringly emerging viruses is certainly to overcome the threat they pose to our world. Courtesy of Drs. Takaaki Koma and Masako Nomaguchi of Tokushima University, Tokushima, Japan.

Frontiers in Virology actively reports all the scientifically critical investigations/efforts relevant to all kinds of viruses in nature (**Figure 1**). It publishes high-quality studies on all species and topics of viruses in one journal in an integrative manner. It surely impacts both academic and public communities by eminent methodologies/technologies used for studies as well as crucial scientific contents reported. On one hand, as repeatedly emphasized and stated above, viruses are beyond the scope of our expectations. We virologists must keep exploring the nature of viruses by in-depth analytical studies. We do not understand the viruses themselves as yet to a sufficient extent for various biological and molecular biological points. In contrast, unfortunately, we certainly know that there are highly invasive and pathogenic viruses in our environments. It is becoming more likely that humans may experience new viral diseases caused by some emerging zoonotic viruses (an awful pandemic in the worst case), if we think about the world's environmental situation today. Also in this regards, it is pivotal for us virologists to stare at these mysterious viruses from diversified standpoints to really grasp their essentials. Toward this end, we have constructed a united cooperative platform for scientific information and interaction in the rapidly growing virology field. In order to effectively share, explore, and discuss about new findings, Frontiers in Virology consists of 10 distinct unique specialties, that is, "Fundamental virology," "Bioinformatic and predictive virology," "Virus and host immunity," "Antivirals and vaccines," "Emerging and reemerging viruses," "Viral diversification and evolution," "Translational virology," "Viral disease investigation," "Systems virology," and "Modeling of viral replication and pathogenesis." Summaries, keywords, and focuses for each section are as follows.

FUNDAMENTAL VIROLOGY

All basic issues related to various viruses, biology and molecular biology, virus replication, structural and functional virology, viral genetics, chemistry, classification.

BIOINFORMATIC AND PREDICTIVE VIROLOGY

Experimental and computational sciences, informatics, *in silico* studies, homology modeling, MD simulation, theoretical virology, predictive virology.

VIRUS AND HOST IMMUNITY

Host immunity against viruses, recognition of viruses by hosts, interaction between host and virus, viral escape mutations from host immunity, viral pathogenesis.

ANTIVIRALS AND VACCINES

Study and development of effective anti-viral drugs and vaccines, effects of the drugs and vaccines on individuals and the populations, anti-viral treatments.

EMERGING AND REEMERGING VIRUSES

All issues (basic and applied) related to emerging and re-emerging viruses, adaptation and evolution of the viruses, description of new viruses in detail.

VIRAL DIVERSIFICATION AND EVOLUTION

Viral mutation, viral adaptation, viral evolution, viral diversity with respect to replication property and biological properties such as pathogenicity, population genetics.

TRANSLATIONAL VIROLOGY

Applied medical sciences based on significant results/findings of basic virology, future perspective, description of (new) systems for the translational research in detail.

VIRAL DISEASE INVESTIGATION

All issues related to various viral diseases, pandemics, medical studies, pre-clinical and clinical studies, pathophysiology of viral diseases, persistent infection.

SYSTEMS VIROLOGY

Innovative research systems, novel technologies/methodologies, experimental/demonstrative studies based on innovative research systems/technologies/methodologies.

MODELING OF VIRAL REPLICATION AND PATHOGENESIS

In vitro model studies, animal models for viral replication and pathogenicity, organoid models for virus infections, any model systems for viral replication and viral diseases.

Finally, we encourage all active researchers, who are experts in virology and also who are not experts in virology but are specially or specifically interested in the research area or the particular theme, to submit the best works to the most fitted section in Frontiers in Virology. We are sincerely looking forward to receiving field-moving scientific articles. Please join us contributing to the promotion and development of scientific interplay in virology and to the successful fight against viral diseases.

AUTHOR CONTRIBUTIONS

AA is a sole contributor to this manuscript and approved its submission.

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