



Remembering Dr. Shinichi Kondo (15 June 1928–8 October 2022)

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Dr. Shinichi Kondo, an Emeritus Member of the Journal of Antibiotics, died on October 8, 2022 at his age of 94. He served this journal as an editorial member for more than 50 years. We all want to thank him for his contributions.

Dr. Kondo, together with Professor Hamao Umezawa, is credited with leading and developing practical scientific research on aminoglycoside antibiotics. Dr. Kondo practically played a very important role, during his research life, at the two organizations, the Institute of Microbial Chemistry (IMC) of the Microbial Chemistry Research Foundation (MCRF), and Meiji Seika Pharma Co., Ltd. (formerly Meiji Seika Kaisha Ltd.; Meiji Seika) in the field of exploratory research and chemical studies on aminoglycoside antibiotics and various kinds of biologically active natural products.

The greatest accomplishments in Dr. Kondo's life were, however, made in 1957 at the Department of Antibiotics,

the National Institute of Health (NIH), Japan (now renamed the National Institute of Infectious Diseases, Japan), under the direction of Prof. H. Umezawa, purification and crystallization of newly discovered aminoglycoside antibiotic, kanamycin, in its mono-sulfate form. These experimental results have greatly prompted further research on aminoglycoside antibiotics in Japan.

Dr. Kondo in 1951, after graduation from Prof. Sumio Umezawa's Laboratory of the Faculty of Science and Technology, Keio University, joined Meiji Seika. He was dispatched, four years later, to the NIH in order to learn technologies on production of streptomycin. Beside the streptomycin project, he worked on discovery and chemical studies of novel antibiotics in microbial resources including kanamycin.

On the other hand, the MCRF was established in 1958 with the patent royalties of kanamycin as an endowment, and the IMC was built in 1962 under the appointment of Prof. H. Umezawa as the director. Dr. Kondo joined the IMC at its beginning of research and had worked for 27 years until his return to Meiji Seika as the director of the Central Research Laboratory.

Dr. Kondo published 199 articles until 1988 and a total of 244 articles by 1994 according to SciFinder (There are 22 more articles between 1999 and 2010 according to ResearchGate). Their contents are 89 articles of aminoglycoside antibiotics, 42 of antitumor agents, 25 of enzyme inhibitors of microbial origin including "siastatin B", 65 of other antibacterial and antifungal antibiotics including "beta-lactam antibiotics" and "benanomicins", one article of reaction and 22 reviews. Dr. Kondo isolated 47 new antibiotics and other microbial products (68 natural molecules including related products were practically reported) until 1988 and 6 more natural products until 1992. Dr. Kondo was a thoughtful and encouraging mentor for more than 20 researchers for their PhD during his career at IMC and Meiji Seika.

One of most important discoveries of Dr. Kondo under supervision by Prof. H. Umezawa was not only the discovery of kanamycin (KM), but also elucidation of resistance

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mechanisms for aminoglycoside antibiotics. Namely, Dr. Kondo thoroughly investigated the chemistry and structures of kanamycins A, B and C. Moreover, Dr. Kondo isolated and structurally elucidated several kinds of important inactivated kanamycin metabolites, during research of resistance mechanisms of aminoglycoside antibiotics. In conclusion, Dr. Kondo isolated 3-*N*-acetylated KM, 3'-*O*-phosphorylated KM, 4'-*O*-adenylyrated KM, 6'-*N*-acetylated KM, 2''-*O*-phosphorylated KM and 2''-*O*-adenylyrated KM as metabolically inactivated KMs. These research results contributed not only to clarify inactivation mechanisms against antibiotics but also to design novel aminoglycoside antibiotics which are active against resistant bacteria.

At the beginning of the 1970's, very important aminoglycosides, dibekacin (3',4'-dideoxykanamycin B) and amikacin (1-*N*-[(2*S*)-4-amino-2-hydroxybutanoyl]kanamycin A) were successively launched and they were effective against clinically important resistant bacteria. Dr. Kondo analyzed information on resistant mechanism of aminoglycoside antibiotics and SAR of these novel aminoglycoside antibiotics in an integrated manner, and finally generated a super aminoglycoside antibiotic, arbekacin [1], 1-*N*-[(2*S*)-4-amino-2-hydroxybutanoyl]-3',4'-dideoxykanamycin B with Prof. H. Umezawa in 1973 (launched in 1990 in Japan). Arbekacin was effective against clinically important resistant bacteria as expected and the following clinical research made it clear that arbekacin was effective enough against MRSA also. Arbekacin is still important antibacterial agent for MRSA infections nowadays in Japan. Recent research results of effectiveness of arbekacin especially against MRSA focusing activities against metabolically double modified resistant bacteria were reviewed with Dr. Kunimoto Hotta in 2018 with 58 references.

Other than aminoglycoside antibiotics, Dr. Kondo has been interested in sistatin B (a neuraminidase inhibitor), benanomicins (antifungal antibiotics), podophyllotoxin (an antitumor agent) and cephalosporins/oxacephalosporins. Apart from human medicines, Dr. Kondo found destomycin A in 1966 and it was launched as a veterinary deworming agent in 1969 in Japan.

Dr. Kondo's contribution to academic societies were beyond description especially to the Journal of Antibiotics (JA). Dr. Kondo contributed as a reviewer to JA in addition to being the corresponding author. Dr. Kondo was at times the most prolific reviewer of articles according to Dr. Morimasa Yagisawa, a former Managing Editor of JA. Dr. Kondo was the councilor (1973-2004) of Japan Antibiotic Research Association.

Dr. Kondo was interested in scientific services to relationships between China and Japan. Dr. Kondo visited China with Prof. H. Umezawa in the middle of the 1970's, which prompted Chinese researchers at Shanghai Institute of Pharmaceutical Industry to start working in the Dr. Kondo's laboratories.

As other activities related to China, Dr. Kondo and Dr. K. Hotta visited Antibiotic Research Institute, Chengdu, Sichuan Province, China in 1986, in order to inspect the fermentation tank, when China had requested 100 million JP Yen in aid for the fermentation tank renewal from the Japanese government *via* the UN.

Dr. Kondo left many important scientific research results about antibiotics and bioactive natural products by tireless efforts in IMC and Meiji Seika. Additionally, Dr. Kondo has produced numerous distinguished researchers including Dr. Daishiro Ikeda and Dr. Yoshio Nishimura in the field of bioactive natural products and antibiotics, especially aminoglycoside antibiotics. Research of science and chemistry of antibiotics in Japan were clearly accelerated by his discoveries, invention, and education.

Compliance with ethical standards

Conflict of interest The author declares no competing interests.

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Reference

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