

Professor Roger David KORNBERG

Citation

Since the establishment of the Nobel Prize in 1895, only six families have achieved the extraordinary distinction of nurturing more than one laureate. Among this elite group stands the family of Professor Roger David KORNBERG. In 2006, Prof. Kornberg was awarded the Nobel Prize in Chemistry for his pioneering work on gene transcription, securing his family's second Nobel prize after his father, Professor Arthur KORNBERG, garnered the Nobel Prize in Physiology or Medicine in 1959 for his discovery of DNA polymerase.

Born in St. Louis, Missouri, Prof. Roger Kornberg was well positioned from an early age to embark on a career in molecular biology—the study of how genetic information is stored, replicated, and expressed. With both parents being biochemists, he was immersed in this rich intellectual home environment and developed a deep fascination with the molecular workings of life, which eventually led to a career defined by transformative discoveries about how genes are read and interpreted.

This journey of discovery began at Harvard University, where Prof. Kornberg earned his bachelor's degree in chemistry in 1967. He then pursued his doctoral studies at Stanford University, obtaining a PhD in chemical physics in 1972. Over the next three years, he undertook postdoctoral research at the Medical Research

Council Laboratory of Molecular Biology in Cambridge, the United Kingdom, a globally-renowned center for structural biology.

In his research in Cambridge he discovered the nucleosome, the fundamental particle of the chromosome. DNA coils around clusters of proteins known as histones in the nucleosome. Later, with Prof. Yahli LORCH, his wife and closest collaborator, Prof. Kornberg showed that the nucleosome is a general gene repressor. It prevents the expression of all genes except those required in a particular cell type. The nucleosome thus enables the development of complex multicellular organisms, including humans.

In 1978, Prof. Kornberg returned to Stanford University as Professor of Structural Biology, and later also the Mrs. George A. Winzer Professor in Medicine. There he and his collaborators discovered the machinery for gene expression, whereby genetic information is copied from DNA into RNA, from which proteins, the basis of all life, are derived. Prof. Kornberg and collaborators discovered a molecular computer that receives and processes information from everywhere in the body and in the environment to determine which genes are copied into RNA when, where, and in what amount in the body. They produced an actual image of the gene-reading process in atomic detail. It was for all these discoveries,

starting from the nucleosome and culminating in molecular imaging that Prof. Kornberg was awarded the Nobel Prize.

It was Prof. Kornberg's later groundbreaking work on RNA polymerase II, the enzyme that copies DNA into RNA, that earned him this supreme accolade. Before a cell can make proteins or respond to its surroundings, it must first create temporary working copies of its genetic instructions. Prof. Kornberg showed, in highly refined detail, how this copying process, called transcription, actually works. Using high-resolution images of RNA polymerase II in action, his team mapped the exact path DNA takes through the enzyme, identified where the growing RNA strand emerges, and showed how each chemical step unfolds. As a result, a once invisible and abstract process became a clear, visible model, shedding light on one of life's most essential mechanisms.

Prof. Kornberg's research has revealed the targets of mutations in DNA that cause cancer and other diseases. His findings guide work around the world to understand and prevent or treat disease and developmental syndromes. His remarkable achievements have placed Prof. Kornberg among the most respected figures in structural biology and biochemistry. In addition to his Nobel Prize, he has been recognized with numerous prestigious awards, including the Eli Lilly Award, the Gairdner

International Award, and the Welch Prize. He is a member of the US National Academy of Sciences, the American Academy of Arts and Sciences, and a Foreign Member of the Royal Society.

HKUST has also benefited greatly from Prof. Kornberg's expertise. Serving as a Senior Visiting Fellow at the HKUST Jockey Club Institute for Advanced Study, he is also a Member of the Council Advisory Group, offering invaluable advice to the Council on HKUST's Medical School proposal which hopes to shape the framework for medical education and research in the future. His reputation as a leading molecular biologist also lends international prestige to the University and supports its strategic ambitions in life sciences and medicine.

Prof. Kornberg's work has not only illuminated the molecular machinery of life and guided the development of new therapies but also inspired countless researchers throughout the world. With an intellectual legacy that spans generations, it can be truly said that scientific excellence is deeply embedded in the Kornberg family's own DNA.

Pro-Chancellor, on behalf of the Council of The Hong Kong University of Science and Technology, I have the high honor of presenting to you, Prof. Roger David Kornberg, Nobel laureate in Chemistry, for the award of Doctor of Science *honoris causa*.

羅傑·科恩伯格教授

讚辭

自1895年諾貝爾獎設立以來，僅有六個家族孕育出多於一位得獎者，而羅傑·科恩伯格教授的家族正是其中翹楚。2006年，科恩伯格教授憑藉開創性的基因轉錄研究，獲頒諾貝爾化學獎，成為家族中第二位摘下諾貝爾桂冠的科學家，成就斐然。早於1959年，其父阿瑟·科恩伯格教授便因發現脫氧核糖核酸 (DNA) 聚合酶，獲頒諾貝爾生理學或醫學獎。

科恩伯格教授出生於美國密蘇里州聖路易斯市，成長環境的優渥為他日後投身分子生物學研究奠定了良好基礎，並使其專注鑽研基因訊息儲存、複製及表達機制。他的雙親皆為生物化學家，自小受到濃厚的學術氛圍薰陶，使他對生命基體的分子運作深感著迷，最終成就其輝煌的科研事業，尤在基因讀取及表達領域方面，科恩伯格教授貢獻了許多劃時代的研究突破。

科恩伯格教授的科研生涯始於哈佛大學，在1967年獲得化學學士學位後，他轉往史丹福大學攻讀博士課程，並於1972年完成化學物理學博士學位。其後三年，他負笈英國劍橋，在享譽全球的醫學研究理事會分子生物學實驗室從事博士後研究，該實驗室乃結構生物學領域的頂尖研究機構。

在劍橋研究期間，他發現了構成染色體的基本粒

子單位——核小體。在核小體內，DNA像線一般纏繞於被稱為組蛋白的蛋白質簇上，形成盤狀結構。隨後，他與其夫人兼研究伙伴亞赫麗·洛赫教授共同發現，核小體具有抑制普遍基因的功能，除特定細胞類型所需的基因外，核小體能夠抑制其他所有基因的表達，這一機制對包括人類在內的複雜多細胞生物的生長發育至關重要。

1978年，科恩伯格教授重返史丹福大學，出任結構生物學教授及以Mrs. George A. Winzer冠名的醫學教授。在此期間，他與研究團隊發現了基因表達的關鍵機制，透過此機制，DNA的基因遺傳訊息被轉錄至核糖核酸 (RNA)，此乃蛋白質合成的重要步驟，亦即所有生命的基礎所在。科恩伯格教授與其研究團隊發現一種分子計算機制，能夠接收和處理來自身體各部位及外在環境中的訊息，從而精確決定特定基因在何時、何處及以何種程度轉錄成RNA，並製作出基因讀取過程的原子解析度精密影像。科恩伯格教授正是憑藉這一系列發現，從核小體開始到最終的分子影像技術突破，贏得諾貝爾獎殊榮。

最終為科恩伯格教授贏得這項殊榮的，是他對RNA聚合酶II的革命性研究，這種酶負責將DNA的訊息轉錄成RNA。在細胞合成蛋白質或回應其周邊環境變化前，細胞必須先將DNA中的遺傳指令轉錄成多個臨時副本，科恩伯格教授的研究鉅

把這個被稱為「基因轉錄」的抄寫過程徹底呈現。研究團隊利用RNA聚合酶II的動態高解析度成像，精確描繪DNA在酶內的傳遞路徑，以及辨識出RNA鏈的生成點，逐步展示每個化學反應的具體進程。此項創舉將昔日神秘莫測的基因轉錄過程轉化為清晰可解的模型，闡明了生命科學的其中一個最核心的運作原理。

科恩伯格教授的研究揭示導致癌症及其他疾病的DNA突變靶點，協助世界各地進行預防或治療疾病與發展障礙的研究。這些卓越的科學成就奠定了他在結構生物學及生物化學的崇高地位。除了諾貝爾獎外，他還榮獲許多國際殊榮，包括美國禮來獎、加拿大蓋爾德納國際獎，以及韋爾奇化學獎。此外，他還分別獲美國國家科學院及美國藝術與科學研究院頒發院士名銜，並獲選為英國皇家學會外籍院士。

科恩伯格教授的專業知識亦讓香港科技大學獲益匪淺。作為科大賽馬會高等研究學院資深訪問學人，以及校董會顧問小組的成員，就科大擬籌辦醫學院的方案提供寶貴意見，助力規劃大學在醫學教育與研究方面的未來藍圖。作為傑出分子生物學家的聲望，他也為科大提升了國際聲望，並支持其在生命科學及醫學領域的策略發展。

科恩伯格教授的科研貢獻揭開了生命分子機制的

奧秘，引領醫學治療邁向嶄新境界，更啟迪世界各地無數的科研人員。其家族的學術成就綿延兩代，可見優秀的科研精神深深植根於科恩伯格家族的基因傳承之中。

大學副監督，本人謹代表香港科技大學校董會，恭請閣下頒授理學榮譽博士予諾貝爾化學獎得主羅傑·科恩伯格教授。