

PREFACE

The QBIC (quantum bio-informatic center) of Tokyo University of Science, supported from Monnka-Shou (minister of education and sciences), is founded in 2006 towards new stage making interdisciplinary bridges in mathematics, physics, information and life sciences, in particular, research for new paradigm for information science and life science on the basis of quantum theory.

The purpose of our research center QBIC is firstly to return to the starting point of bio-informatics and quantum information, fields that are growing rapidly at present, and to seriously attempt mutual interaction between the two, with a view to enumerating and solving many fundamental problems they entail. Therefore we called our research center "quantum bio-informatic center (QBIC)". In our view, there is no similar research center in the world to return to the basis of bio-information and quantum information and to focus on the correlation between the two with a view to new development of each.

The immensely long DNA, sequence of four bases in the genome, contains information on life, and decoding or changing this sequence is involved in the expression and control of life. In quantum information, meanwhile, we produce various "information" by sequences of two quantum states, and think of ways of processing, communicating and controlling them.

It is thought that the problems we can process in time " T " using a conventional computer can be processed in time nearly " $\log T$ " using a quantum computer. However, the transmission and processing of information in living body might be much faster than those of quantum information. Seen from this very basic viewpoint, developing the mathematical principles that have been found in quantum information should be useful in constructing mathematical principles for life sciences, which have not been established yet. The mechanism of processing information in life is also expected to be useful for the further growth of quantum information.

To bring this project to fruition, we plan to bring together Japanese and overseas researchers from various fields including quantum information, quantum probability, bio-informatics, structural biology, stochastic

analysis, and solid-state physics, and to hold frequent exchanges between them (visits, invitations, conferences). Moreover, we will have international conference at the end of every academic year, continuously for at least five years.

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