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Proposal for Prevention and Treatment of Cancer Based on Recent Progress of Cancer Research

During the 1960's, basic research on cancer started to change from classical style to recent molecular approaches. Among various progress, three most important findings are

- Mutagenic substances were demonstrated to cause cancer in experimental animals,
- Highly oncogenic sarcoma virus proved to possess a gene responsible for its oncogenesis, presently called viral oncogene, and
- Normal cells fused with cancer cells suppressed tumor forming ability of cancer cells suggesting presence of the tumor suppressor genes.

In the 1970's reverse transcriptase of retroviruses was found and restriction endonucleases were also in hand. Thus, there have been great strides in molecular biology. In the middle of 1970's, by using molecular biological technique, D. Stehelin, M. Bishop, H. Varmus and P. Vogt found cellular counter part of vial oncogene src, which lead the cancer research to molecular analysis of the cause of cancer in the 1980's.

Thus, we gained very much on understanding of molecular mechanisms of cancer during the last quarter of the 20th century. That is:

- Cancers are caused by multistep-mutations of the genes by mutagenes in various environment including food, air pollutions etc.
- The primary targets of mutagenesis are proto-oncogenes and tumor suppressor genes which control cellular growth and differentiation in normal states,
- Hereditary mutation on one of tumor suppressor genes, or on a proto-oncogene, in special cases, arise cancer prone family. In addition, mutation of genes responsible for genome repair mechanisms results in high incidence of cancers.
- Mechanisms of resistance of cancer cells to drugs and radiations as well as molecular mechanisms of cancer metastasis are also explained step by step as the changes of cell functions. Although there are still many steps to be resolved, we now realize that cancer is caused by accumulation of mutations and thus recent higher incidence of cancer in developed country is reasonably explained by longer exposure to mutagenesis according to longer human life time.

Our experience of the society with advanced age showed us that both pains and troubles caused by cancer are less in aged persons compared to younger generations. Thus, we recognize importance of cancer prevention. In spite of the effort of cancer prevention, the effect may not become apparent soon. So that improvement of diagnosis and treatment is also very important. Progress in early cancer diagnosis allows us treatment by smaller

surgical regions. In addition, development of targeting method of anti-cancer drugs gives us tools for treatment with smaller pain. Specific and non-specific cancer immunotherapy as well as cancer gene therapy are the point of issue for development of cancer treatment in near future.