There is now generally accepted that the program for development and normal gene expression and repression during life are under epigenetic control. Epigenetic modifications are very important and critical for gene regulation processes. Several distinct syndromes, numerous complex diseases such degenerative and age-related diseases and cancers are caused by local epigenetic alterations of the chromatin structure. Understanding of the process of epigenetic reprogramming in development is important for studies of therapeutic cloning and the clinical application of stem cells. Mechanisms that regulate genomic plasticity and the state of totipotency are being unravelled and the gained knowledge will enhance our ability to manipulate stem cells for therapeutic purposes in many human diseases. Similarities between embryonal and cancer cells suggest new potential therapies for the treatment of cancer based on epigenetic strategies. In the future, personalized medicine provided as the result of epigenetic profiling of critical genes may be a more effective method of treating patients than the current generic approach. The methylation of DNA has the general characteristics needed for an ideal diagnostic testing technology, applicable to most common diseases. Particularly, the methylation-based strategy would be the perfect tool for creating a comprehensive cancer-management system concerning early detection (asymptomatic people), as well as molecular classification, cancer resistance, pharmacogenetic testing and monitoring.