Chronic myelogenous leukemia is a clonal cancer arising from neoplastic transformation of a hematopoietic stem cell. A biologic feature of the leukemic blast that has been demonstrated to be a strong predictor of treatment response is the presence of certain specific chromosome translocations. The first translocation shown to have prognostic significance is the t(9:22). It is characterized by a reciprocal chromosomal translocation t(9:22)(q34:q11). The resulting shortened chromosome 22 is classically called the Philadelphia Chromosome (Ph'). In CML, studies have found that the break in chromosome 22 is limited to a 5.8 kb section named breakpoint cluster region (bcr), specifically bcr exon 2 or exon 3, and the reciprocal break in chromosome 9 involves movement of most of the ABL proto-oncogene. Expression of the fused gene product results in a 8.5 kb chimeric mRNA transcript and a large 210 kDa translation protein, p210, with increased tyrosine kinase activity relative to the normal ABL protein.

Expression of these chimeric fusion proteins is thought to be important in the pathogenesis of these neoplasms and have recently been shown to be strong predictors of poor prognosis. Therefore, patients whose leukemic blasts contain the t(9:22) were typically offered the option of bone marrow transplantation (BMT) soon after remission was achieved. The advent of a targeted molecular therapy for CML in the late 1990s has lead to a revolution in treatment for this previously unrelenting disease. Imatinib* therapy is now the treatment of choice for CML and is used as first line therapy for patients expressing the p210 fusion transcript in their peripheral blood and bone marrow mononuclear cells. Qualitative analysis of the bcr/abl p210 by RT-PCR is required prior to initiation of therapy and is therefore indicated for diagnosis and therapeutic indications.

This procedure has been shown to detect one abnormal cell in a background of one million normal cells. Due to its sensitivity, PCR analysis is appropriate for both bone marrow and peripheral blood analysis and can be performed on recovering marrow with extremely low cell counts.