

# 30 - SECTION 2

## Hematopoietic Disorders

### SECTION 2 Hematopoietic Disorders

traditionally been performed by oncologists, but the magnitude of the problem mandates that primary care providers and preventive medicine specialists be trained in the follow-up of treated cancer patients in remission or undergoing chronic therapy. All former cancer patients should undergo surveillance for recurrence and second malignancies and be monitored for long-term effects of treatment; however, nearly all recurrences are detected because of symptoms. Health promotion and disease prevention with age- and sex-specific routine screening tests (e.g., colonoscopy, Pap smears, mammography, human papillomavirus vaccination, dual-energy x-ray absorptiometry scans) should be a focus of survivorship care along with psychosocial well-being. Annual mammography should start no later than 10 years after breast radiation. Patients receiving radiation fields encompassing thyroid tissue should have regular thyroid examinations and TSH testing. Localized pain or palpable abnormality in a previously radiated field should prompt radiographic evaluation. Patients treated with alkylating agents or topoisomerase inhibitors should have a complete blood count every 6–12 months, and cytopenias, abnormal cells on peripheral smear, or macrocytosis should be evaluated with bone marrow biopsy and aspirate and include cytogenetics, flow cytometry, or fluorescence in situ hybridization (FISH) studies as appropriate.

As the population of cancer survivors increases and patients live longer, cancer survivorship has become increasingly important, and the Institute of Medicine and National Research Council have published a monograph entitled *From Cancer Patient to Cancer Survivor: Lost in Transition*. The monograph proposes a plan that would inform clinicians caring for cancer survivors of the complete details of patients' previous treatments, complications thereof, signs and symptoms of late effects, and recommended screening and follow-up procedures. PART 4 Oncology and Hematology OUTLOOK Survivorship care is a burgeoning problem facing oncologists today. The challenge is to develop cancer treatments that maximize clinical benefit including cure of disease while also mitigating the risks of long-term toxicity. As cancer treatments continue to improve, the prevalence of cancer survivors increases along with an increase in life expectancy. Further, since emerging therapies often have improved tolerability profiles, a greater number of patients with advanced age or comorbid medical conditions will become cancer survivors with persistent treatment-related toxicities. As treatment paradigms continue to evolve, the nature and biologic basis for toxicities

will change and pharmacovigilance of new therapies is critical. Advances in genomic medicine may allow for more risk-stratified personalized care. The choice of therapy needs to be tailored to the type of cancer, expected outcomes, and patient-related risk factors for both acute and long-term toxicities. After therapy is complete, longitudinal monitoring of the health and health-related quality of life of cancer survivors is critical since the incidence of late effects of treatment does not appear to plateau over time. Acknowledgment We would like to acknowledge the contribution of Carl E. Freter who coauthored a previous version of this chapter; material from his chapter was retained in this version. ■ ■ FURTHER READING Armenian SH et al: Cardiovascular disease in survivors of childhood cancer: Insights into epidemiology, pathophysiology, and prevention. *J Clin Oncol* 36:2135, 2018. Brinkman TM et al: Psychological symptoms, social outcomes, socioeconomic attainment, and health behaviors among survivors of childhood cancer: Current state of the literature. *J Clin Oncol* 36:2190, 2018. Chow EJ et al: New agents, emerging late effects, and the development of precision survivorship. *J Clin Oncol* 36:2231, 2018. Ehrhardt MJ et al: Health care transitions among adolescents and young adults with cancer. *J Clin Oncol* 42:743, 2024. Lustberg MB et al: Mitigating long-term and delayed adverse events associated with cancer treatment: Implications for survivorship. *Nat Rev Clin Oncol* 20:527, 2023.

Rowland JH et al: Survivorship science at the NIH: Lessons learned from grants funded in fiscal year 2016. *J Natl Cancer Inst* 111:109, 2019. Shapiro CL: Cancer survivorship. *N Engl J Med* 379:2438, 2018. Shapiro CL et al: ReCAP: ASCO core curriculum for cancer survivorship education. *J Oncol Pract* 12:e08, 2016. Shree T et al: Impaired immune health in survivors of diffuse large B-cell lymphoma. *J Clin Oncol* 38:1664, 2020. Turcotte LM et al: Risk, risk factors, and surveillance of subsequent malignant neoplasms in survivors of childhood cancer: A review. *J Clin Oncol* 36:2145, 2018. Section 2 Hematopoietic Disorders David T. Scadden, Dan L. Longo

## Hematopoietic Stem

Cells All of the cell types in the blood and some cells in every tissue of the body are derived from hematopoietic (hemo: blood; poiesis: creation) stem cells. If the hematopoietic stem cell is damaged and can no longer function (e.g., due to a nuclear accident), a person would survive 2–4 weeks in the absence of extraordinary support measures. With the clinical use of hematopoietic stem cells, tens of thousands of lives are saved each year (Chap. 119). Stem cells produce hundreds of billions of blood cells daily from a stem cell pool that is estimated to be only 20,000–200,000. How stem cells do this, how they persist for many decades despite the production demands, and how they may be better used in clinical care are important issues in medicine. The study of blood cell production has become a paradigm for how other tissues may be organized and regulated. Basic research in hematopoiesis includes defining stepwise molecular changes accompanying functional changes in maturing cells, aggregating cells into functional subgroups, and demonstrating hematopoietic stem cell regulation by a specialized microenvironment; these concepts are worked out in hematology and offer models for other tissues. Moreover, these concepts may not be restricted to normal tissue function but extend to malignancy. CARDINAL FUNCTIONS OF HEMATOPOIETIC STEM CELLS All stem cell types have two cardinal functions: self-renewal and differentiation (Fig. 101-1). Stem cells exist to generate, maintain, and repair tissues. They function successfully if they can replace a wide variety of shorter-lived mature cells over prolonged periods. The process of self-renewal (see below) assures that a stem cell population can be sustained over time. Without self-renewal, the stem cell pool would become exhausted and tissue maintenance would not be possible. The process of differentiation leads to production of the

effectors of tissue function: mature cells. Without proper differentiation, the integrity of tissue function would be compromised and organ failure or neoplasia would ensue. In the blood, mature cells have variable average life spans, ranging from hours for mature neutrophils to a few months for red blood cells to many years for memory lymphocytes. However, the stem cell pool is the central, durable source of all blood and immune cells, maintaining a capacity to produce a broad range of cells from a single cell source, yet keeping itself vigorous over decades of life. As an individual stem cell divides, it has the capacity to accomplish one of three division outcomes: two stem cells, two cells destined for differentiation, or one stem cell and one differentiating cell. The former two outcomes are the

---

Revision #1

Created 2026-01-06 16:31:56 UTC by Omar Ayman

Updated 2026-01-06 16:31:56 UTC by Omar Ayman