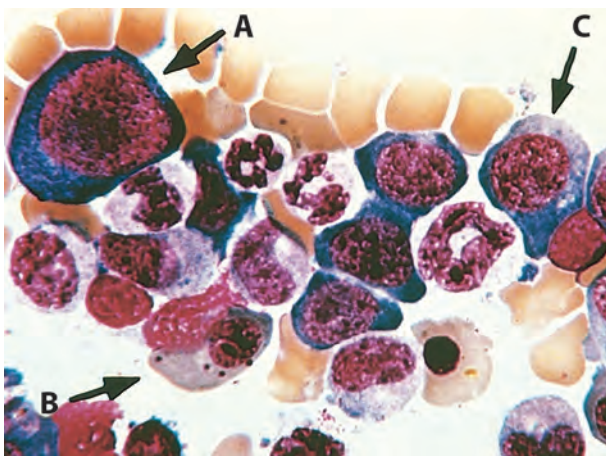


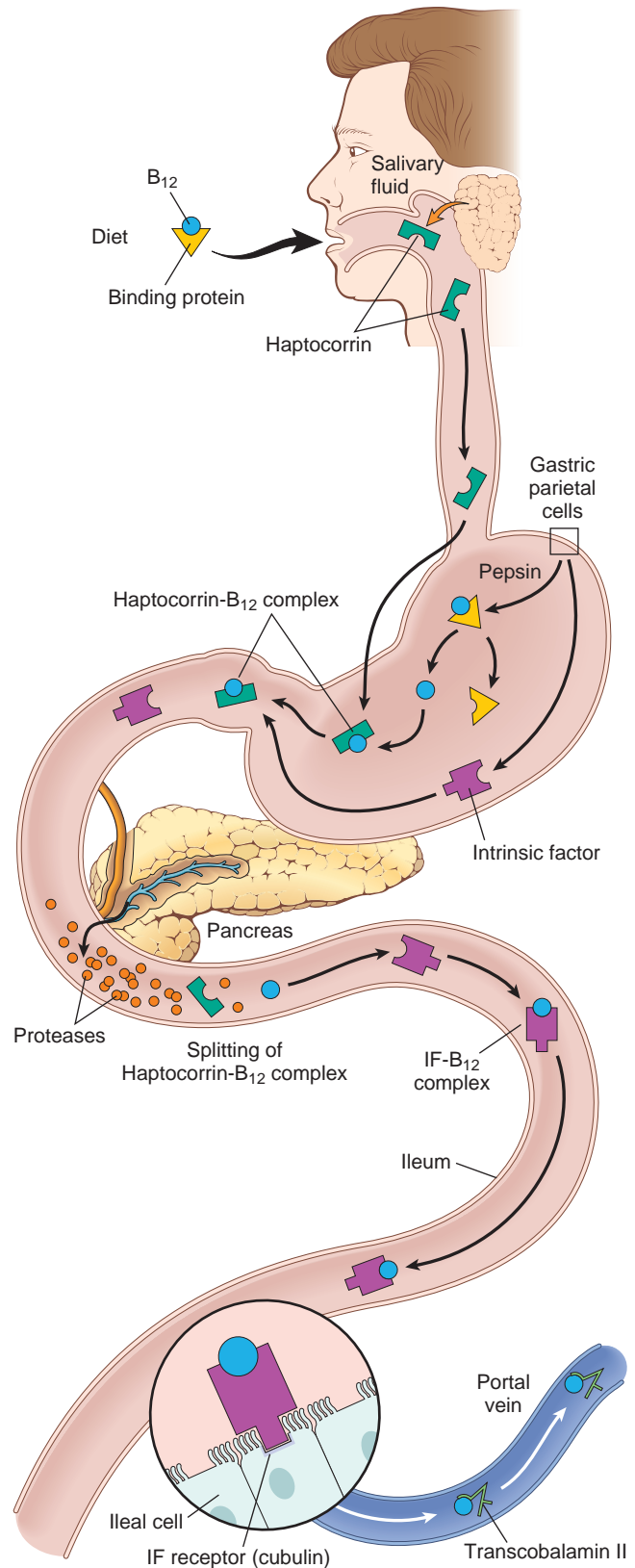
**Figure 14-16** Megaloblastic anemia. A peripheral blood smear shows a hypersegmented neutrophil with a six-lobed nucleus. (Courtesy Dr. Robert W. McKenna, Department of Pathology, University of Texas Southwestern Medical School, Dallas, Texas.)

contamination, and strictly vegetarian or macrobiotic diets do not provide adequate amounts of this essential nutrient. The daily requirement is 2 to 3  $\mu\text{g}$ . A diet that includes animal products contains significantly larger amounts and normally results in the accumulation of intrahepatic stores of vitamin B<sub>12</sub> that are sufficient to last for several years.

**Absorption of vitamin B<sub>12</sub> requires intrinsic factor, which is secreted by the parietal cells of the fundic mucosa (Fig. 14-18).** Vitamin B<sub>12</sub> is freed from binding proteins in food through the action of pepsin in the stomach and binds to a salivary protein called *haptocorrin*. In the duodenum, bound vitamin B<sub>12</sub> is released from haptocorrin by the action of pancreatic proteases and it associates with intrinsic factor. This complex is transported to the ileum, where it is endocytosed by ileal enterocytes that express a receptor for intrinsic factor called *cubilin* on their surfaces. Within ileal cells, vitamin B<sub>12</sub> associates with a major carrier



**Figure 14-17** Megaloblastic anemia (bone marrow aspirate). **A** to **C**, Megaloblasts in various stages of differentiation. Note that the orthochromatic megaloblast (**B**) is hemoglobinized (as revealed by cytoplasmic color), but in contrast to normal orthochromatic normoblasts, the nucleus is not pyknotic. The early erythroid precursors (**A** and **C**) and the granulocytic precursors are also large and have abnormally immature chromatin. (Courtesy Dr. Jose Hernandez, Department of Pathology, University of Texas Southwestern Medical School, Dallas, Texas.)



**Figure 14-18** Schematic illustration of vitamin B<sub>12</sub> absorption. IF, Intrinsic factor; haptocorrin, cubilin, see text.