



## Supporting Online Material for

Adult Stem Cell Treatments for Diseases?  
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### **This PDF file includes:**

Table S1

References

List of references for applications of adult stem cells from the Web site DoNoHarm: The Coalition of Americans for Research Ethics, as it was accessed by the authors on 8 May 2006.

## TABLE S1. DISEASE AND INJURY CHART

### Overview of Facts about the Diseases and Injuries on the Prentice list of 65 Purported Adult Stem Cell Treatments

**NOTES:** The first column of this chart provides the names of the diseases or injuries included on the Prentice list of supposed adult stem cell treatments in the order Prentice listed them. The second column provides a YES or NO answer to the question of whether an existing FDA-approved adult stem cell treatment is available for general use to treat each listed condition. The third column describes the actual nature of the information Prentice used as a basis for the claim he made for each disease or injury. The fourth column provides additional explanatory comments to help clarify certain facts or provide more context.

Disease or injury cited in Prentice list	Is an FDA-approved adult stem cell treatment generally available to treat this disease or injury?	Actual nature of the study or studies cited by Prentice	Additional comments
Brain Tumors (Medulloblastoma and Glioma)	No	Two clinical studies and one literature review indicated that some patients who have their brain cancers treated with high-dose chemotherapy show improved long-term survival rates when transplants of adult stem cells from bone marrow or blood are used to alleviate side effects of the chemotherapy (1-3).	Adult stem cells from bone marrow are not used to treat brain cancer. They are sometimes used to alleviate side effects of the toxic chemotherapy and radiation treatments used to treat the disease.
Retinoblastoma	No	Two clinical reports indicated that a small group of patients with malignant retinoblastoma show improved survival rates when transplants of adult stem cells from bone marrow or blood are used to alleviate side effects of chemotherapy (4, 5).	Adult stem cells from bone marrow are not used to treat retinoblastoma. Rather, because they alleviate side effects of toxic chemotherapy, adult stem cell transplants may enable doctors to apply a stronger chemotherapy dose.
Ovarian Cancer	No	One clinical study and one literature review	Adult stem cell transplants from bone marrow

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		indicated that a subset of ovarian cancer patients responds better to high-dose chemotherapy when treatment is followed by adult stem cell transplants (6, 7).	or blood are not used to treat ovarian cancer. They are sometimes used to alleviate side effects of toxic chemotherapy, though not all patients show improvement with this combination therapy.
Merkel Cell Carcinoma	No	A case study reporting that a single Merkel cell carcinoma patient showed a longer-than-expected survival time when given an adult stem cell transplant after chemotherapy (8).	Merkel cell carcinoma is a rare, metastatic skin tumor. This case study suggests a treatment improvement may be possible when adult stem cell transplants accompany high-dose chemotherapy, but the patient experienced remission for only six months.
Testicular Cancer	No	Bhatia et.al described a clinical evaluation showing improved long-term survival of relapsed testicular cancer patients following a radical therapy that included a transplant of adult stem cells from bone marrow or blood (9). The second paper by Hanazawa et.al did not actually report on patient response to adult stem cell therapy, but rather evaluates different methods of adult stem cell isolation (10).	Adult stem cells from bone marrow or blood are not used to treat testicular cancer. Rather, adult stem cells enable testicular cancer patients to withstand a higher dose of chemotherapy intended to eliminate the cancer.
Lymphoma	No	Three clinical reports of various lymphoma types and patient numbers indicated that some patients show improved long-term survival when adult stem cell transplants follow high-dose chemotherapy (11-13).	Transplants of adult stem cells from bone marrow or blood improve the survival of lymphoma patients undergoing high-dose chemotherapy, with patients whose tumors were diagnosed early showing the most improvement. However, residual tumor cells often escape the high-dose chemotherapy, and lasting survival following malignant lymphoma remains elusive.

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Acute Lymphoblastic Leukemia; Chronic Myelogenous Leukemia; Juvenile Myelomonocytic Leukemia	Yes	Two clinical studies, each incorporating multiple leukemia types, indicated that adult stem cell transplants from bone marrow or umbilical cord blood improve the survival of children with leukemia when the transplants are performed during the early phase of disease. Some of these studies also include high-dose chemotherapy or radiation therapy (14, 15).	Adult stem cell transplants from bone marrow or blood can induce lasting remission when leukemias are diagnosed early. However, patients with more advanced tumors frequently relapse, and access to genetically matched cell transplants remains a serious problem for many patient populations.
Myelodysplasia	Yes	Two clinical studies, each incorporating a small number of patients with myelodysplasia, suggested that high-dose chemotherapy in combination with adult stem cell transplants from bone marrow or umbilical cord blood improve the survival of myelodysplasia patients, particularly when this treatment is performed during the early phase of disease (14, 16). The study by Bensiger et.al was actually designed to compare patient outcomes following transplantation of cells from bone marrow versus blood (16).	Adult stem cell transplants from bone marrow or blood enable myelodysplasia patients to withstand a higher dose of chemotherapy, thereby increasing the chances of the treatment inducing lasting remission. However, patients with more advanced tumors frequently relapse, and access to genetically matched cell transplants remains a serious problem for many patients.
Acute Myelogenous Leukemia	Yes	Three clinical studies indicated that AML patients who receive adult stem cell transplants after initial disease remission demonstrate improved overall survival (14, 17, 18).	Adult stem cell transplants from bone marrow or blood can accomplish significant improvements in the survival of early-stage AML. However, patients with more advanced tumors frequently relapse, and access to genetically matched cell transplants remains a serious problem for many patients.
Angioimmunoblastic Lymphadenopathy with	No	A case study reported that a single AILD patient experienced an extended disease-free	AILD is a lymphoma-like disease that results from the deregulated growth of immune cells.

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Dysproteinemia		period after receiving high-dose chemotherapy and a transplant of stem cells derived from blood (19).	As is done with lymphomas, adult stem cell transplants may be used to restore the immune and blood systems following intensive chemotherapy. However, this treatment is still experimental, and access to genetically matched cell transplants remains a serious problem for many patients.
Multiple Myeloma	Yes	Laughlin et.al demonstrated that transplanting adult stem cells derived from umbilical cord blood improved the overall survival of patients with one of a variety of blood disorders (though no multiple myeloma patients were included in the study group), but these transplants were also associated with graft rejection (20). Vesole et.al showed that a high-dose chemotherapy regimen followed by transplanting adult stem cells from blood resulted in modest survival improvements in half of study participants (21).	Multiple myeloma remains a frequently incurable disease. However, long-term survival rates have improved through the combination of high-dose chemotherapy and stem cell transplantation. By these strategies, adult stem cells from bone marrow or blood are used to alleviate side effects from high-dose chemotherapy. It should be noted that the Laughlin paper presents no data on multiple myeloma (20).
Breast Cancer	No	Four clinical studies reported that patients with high-risk or advanced breast cancer had improved survival rates when intensive radiation and/or chemotherapy was followed by a transplant of adult stem cells derived from bone marrow or blood (22-25).	In these studies, adult stem cells from bone marrow were not intended to treat breast cancer. Rather, because they alleviate side effects of toxic chemotherapy, adult stem cell transplants can enable doctors to apply a stronger chemotherapy dose. However, this approach does not appear to benefit all women with breast cancer, and the National Cancer Institute now says that adult stem cell transplants in combination with high-dose chemotherapy are no better than standard chemotherapy alone in the treatment of breast

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			cancer (26-29).
Neuroblastoma	No	A clinical study indicated that transplantation of adult stem cells derived from blood is associated with improved survival rates for a specific kind of high-risk neuroblastoma (30).	Adult stem cells from bone marrow or blood are not used to treat neuroblastoma, a kind of childhood brain tumor. Rather, adult stem cells enable neuroblastoma patients to withstand a higher dose of chemotherapy, increasing the likelihood that the treatment will eliminate the cancer.
Non-Hodgkin's Lymphoma	No	Three clinical studies reported that some non-Hodgkin's lymphoma patients show improved long-term survival when adult stem cell transplants follow high-dose chemotherapy (11, 12, 31). A fourth paper by Yao et.al did not directly assess the treatment value of adult stem cell transplantation (32).	Transplants of adult stem cells from bone marrow or blood improve the survival of non-Hodgkin's lymphoma patients undergoing high-dose chemotherapy, with patients whose tumors were diagnosed early showing the most improvement. However, residual tumor cells often escape these cancer treatments, and lasting survival following malignant lymphoma remains elusive.
Hodgkin's Lymphoma	No	Two clinical studies indicated that some patients with Hodgkin's lymphoma show overall improved survival rates when transplanted with adult stem cells from blood (12, 33).	Adult stem cell transplants from bone marrow or blood improve the survival of Hodgkin's lymphoma patients undergoing high-dose chemotherapy by returning healthy blood- and immune-forming cells to the patient. However, residual tumor cells often escape these cancer treatments, and immune rejection remains an issue for many patients.
Renal Cell Carcinoma	No	One clinical study and one case report indicated that, in patients with metastatic renal cell carcinoma, transplants of donated adult stem cells from blood delayed cancer spread and resulted in overall increase in	More recent evidence indicates that the observed survival increase may be due to a direct anti-tumor effect by the adult stem cell transplant when the stem cells are donated by a genetically-matched sibling (36).

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		long-term survival of some patients (34, 35).	Unfortunately, access to genetically matched cells and transplant-related toxicity remain barriers to the widespread use of this therapy.
Various Solid Tumors (repeats ovarian, breast and pediatric brain tumors)	No	Four clinical studies evaluating the safety and/or efficacy of adult stem cell transplants as a treatment for various solid tumors (inc. breast, ovarian, pediatric brain cancers) showed that adult stem cell transplants may reduce chemotherapy-related side effects for some cancer patients (37-40).	Adult stem cells are not used to treat these cancers. They are sometimes used to alleviate side effects of the toxic chemotherapy and radiation treatments used to treat the disease. Large clinical trials have established that adult stem cell therapy does not improve the survival of breast cancer patients relative to conventional treatment (26).
Soft Tissue Sarcoma	No	One clinical study indicated that some STC patients exhibited higher survival rates when treated with adult stem cells from blood after high-dose chemotherapy (41).	Adult stem cells from blood are not used to treat soft tissue carcinoma. They are sometimes used to alleviate side effects of the toxic chemotherapy used to treat this disease.
Hemophagocytic Lymphohistiocytosis	No	A case study reported that a child with HLH received a transplant of stem cells donated by the patient's mother 2 months after a transplant of liver tissue from the same parent (42). The patient was disease-free for four months post-stem cell transplant.	Hemophagocytic lymphohistiocytosis is a rare disorder characterized by an overactive immune system. Immuno-suppressive therapy followed by adult stem cell transplantation has improved survival of some children with HLH. However, access to genetically matched cell transplants remains a serious problem for many patients.
Waldenstrom's Macroglobulinemia	No	One clinical study indicated that some WM patients receiving both high-dose chemotherapy and a transplant of blood-forming stem cells showed improved survival rates (43).	Waldenstrom's macroglobulinemia is a malignant bone marrow disorder. Transplants of healthy blood-forming stem cells help restore a patient's bone marrow after chemotherapy. However, adult stem cell transplant alone is insufficient to treat disease, and access to genetically matched cell transplants remains a serious problem for many patients.

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POEMS Syndrome (Osteosclerotic Myeloma)	No	An initial clinical study indicated that transplants of adult stem cells from blood alleviated some of the symptoms of POEMS (44).	POEMS syndrome is a bone marrow disorder characterized by nerve and connective tissue abnormalities. Transplants of healthy blood-forming stem cells help restore a patient's bone marrow after chemotherapy. However, adult stem cell transplant alone is insufficient to treat the disease, and access to genetically matched cell transplants remains a serious problem for many patients.
Scleromyxedema	No	A case study reported the treatment of a relapsed scleromyxedema patient with high-dose chemotherapy followed by adult stem cell transplantation using cells from the patient's own bone marrow. (45)	Scleromyxedema is an autoimmune disease of the skin. More recent evidence indicates that high-dose chemotherapy followed by transplants of blood-forming stem cells reverse many disease symptoms for an extended period, but this treatment is not curative (46). Importantly, the adult stem cell transplant was used to alleviate the side effects of chemotherapy.
Scleroderma	No	Two literature reviews written by the same first author described early clinical studies of adult stem cell transplants as a treatment for various autoimmune diseases (47, 48). The authors propose that these transplants can cause disease remission in some patients.	Scleroderma is a severe autoimmune disease of the skin. Some researchers believe that transplants of healthy blood-forming stem cells (e.g. from bone marrow) might "reset" the immune systems of scleroderma patients. However, this concept has yet to be confirmed in large-scale clinical trials. Of note, the two papers cited as evidence of an adult stem cell treatment for scleroderma are, in fact, broad literature reports that only marginally touch upon scleroderma. Further, in the 1999 paper (48), the authors concede that patients suffering from progressive autoimmune diseases like scleroderma often experience post-transplant

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			relapses.
Multiple Sclerosis	No	These references included three early clinical evaluations of adult stem cell transplants in combination with high-dose chemotherapy or immune suppression as a treatment for multiple sclerosis (among other autoimmune diseases) (49-51). Three reviews, including two previously cited for scleroderma, were included in this section (47, 48, 52). The combination of adult stem cell transplantation and radical therapy decreased the number of observable MS lesions, but following the extent of disease-free remission would have required further study.	More recent research indicates that radical treatments that include adult stem cell transplants can improve the overall quality of life of patients with severe multiple sclerosis (for whom there are no effective alternative treatments). However, the transplant's ability to reverse the onset of MS remains unproven, and in most cases the transplant is intended to help alleviate the side effects of harsh chemotherapy and/or immune suppression.
Crohn's Disease	No	Three early clinical studies and one literature review reported that high-dose chemotherapy and/or immune suppression followed by transplants of the patients' own stem cells was tried in a total of 4 patients with Crohn's Disease (51, 53-55). The Hawkey review cautions that, because Crohn's disease is not always a fatal condition, any observed benefits of a transplant may not be sufficient reason to risk the toxic immune suppressive drugs that must be given to transplant recipients.	As has been tried for other diseases with an autoimmune component, radical immune suppression followed by transplants of stem cells from blood have been attempted in patients with severe Crohn's disease. Initial, small-scale clinical evaluations suggest that this combination approach can suppress disease in some patients who fail standard treatments, but the adult stem cell transplants are intended to help patients survive the immune suppressive regimen, not directly treat the disease.
Rheumatoid Arthritis	No	Five early clinical studies and two literature reviews indicated that transplants of adult stem cells, either donated or from the patient him/herself, in combination with radical use of conventional therapies (e.g. immune	More recent evidence suggests that some patients with severe rheumatoid arthritis who have failed conventional therapies can experience an extended disease-free period when adult stem cell transplants are used as part

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		suppression, chemotherapy and/or radiation) delay the course of rheumatoid arthritis in some patients with advanced disease (47, 48, 51, 52, 56-58).	of a radical treatment protocol. However, the durability of this response remains unclear, and this combination treatment is not a cure.
Juvenile Arthritis	No	These references included two papers previously cited for multiple sclerosis and scleroderma (48, 51).	Juvenile arthritis is a chronic inflammatory disease of the joints. More recently, adult stem cell transplants have been used in combination with immune suppression or radiation treatment (59). Results indicate that about half the patients show disease remission following this treatment. However, these treatments are also associated with a high incidence of severe side effects, including death. Additional clinical research is needed to reduce transplant-associated side effects.
Systemic Lupus	No	The cited papers included a collection of early reports on the use of adult stem cell transplants as a potential therapy for lupus: three case studies (each reporting progress of a single patient) and two reports from early clinical trials (60-63). In total, these papers presented the treatment outcomes of 19 patients. Three literature reviews were also included in this section (47, 48, 52).	Lupus is an autoimmune disease that attacks multiple organs. Early reports suggest that immune reconstitution by adult stem cell transplants may induce an extended disease-free period in some lupus patients who have failed conventional therapies. However, these same reports indicate that adult stem cell treatments do not benefit all lupus sufferers, and at this early stage, can result in severe treatment-related complications. Additional research is needed before the overall benefit of transplant therapies can be confirmed.
Polychondritis	No	This reference was a small clinical study that included one polychondritis patient who received a transplant of her own blood-forming stem cells after the removal of	Polychondritis is a rare autoimmune disease that attacks cartilage. The single patient included in the cited study was reported to have achieved an extended disease-free period.

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		possible disease-causing cells (61).	However, considerable additional research would be required to confirm the validity and use of this therapy for other polychondritis patients.
Systemic Vasculitis	No	This reference was an early clinical study of the use of chemotherapy and immune suppression followed by a transplant of the patients' own stem cells from blood. The cited study included multiple autoimmune diseases, including one patient with systemic vasculitis (51).	Systemic vasculitis is an inflammatory disease that attacks blood vessels and nerves. "Resetting" the immune system with chemotherapy and an adult stem cell transplant has been observed to induce an extended disease-free state in some patients with systemic vasculitis. However, the number of patients treated in this way is small and much additional research would be required to confirm the validity and use of this therapy for other systemic vasculitis patients.
Sjorgen's Syndrome	No	This reference was an early clinical study of the use of chemotherapy and immune suppression followed by a transplant of the patients' own stem cells from blood. The cited study included multiple autoimmune diseases, including one patient with Sjorgen's syndrome (51).	Sjorgen's syndrome is a rare autoimmune disease of the salivary glands. "Resetting" the immune system with chemotherapy and an adult stem cell transplant may induce an extended disease-free state in some patients with Sjorgen's syndrome. However, it appears that only the one patient referenced in the present study has been treated in this way. Much additional research would be required to confirm the validity and use of this therapy for other Sjorgen's syndrome patients.
Behcet's Disease	No	This reference was an early clinical study of the use of chemotherapy and immune suppression followed by a transplant of the patients' own stem cells from blood. The cited study includes multiple autoimmune	Behcet's disease is a disease of unknown cause that disrupts the structural integrity of blood vessels. "Resetting" the immune system with chemotherapy and an adult stem cell transplant has been observed to induce an extended

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		diseases, including one patient with Behcet's disease (51).	disease-free state in some patients with Behcet's disease. However, the number of patients treated in this way is small and much additional research would be required to confirm the validity and use of this therapy for other Behcet's disease patients.
Myasthenia	No	This reference was an early clinical study of the use of chemotherapy and immune suppression followed by a transplant of the patients' own stem cells from blood. The cited study includes patients suffering from multiple autoimmune diseases, including one patient with myasthenia (51).	Myasthenia is a common form of muscular dystrophy, where a genetic defect impairs the ability of nerve fibers and muscles to coordinate movement. It is unclear from the published scientific literature that transplants of blood-forming adult stem cells can have any impact on the outcome of myasthenia.
Autoimmune Cytopenia	No	The paper by Rabusin et. al described an early clinical study of the use of chemotherapy and immune suppression followed by a transplant of the patients' own stem cells from blood (51). The cited study included multiple autoimmune diseases, including one patient with autoimmune cytopenia. The second paper by Papadaki does not, in fact, describe a treatment of any kind (64). Rather, it only reports that adult stem cells can be taken from autoimmune cytopenia patients.	Autoimmune cytopenia is a rare blood disorder. "Resetting" the immune system with chemotherapy and an adult stem cell transplant may induce an extended disease-free state in some patients with this disease, and a more recent clinical study suggests that such treatment can confer benefit to some patients in spite of a risk of severe side effects (65). However, the number of patients treated in this way is small and much additional research would be required to confirm the validity and use of this therapy for other autoimmune cytopenia patients.
Alopecia Universal	No	This reference was a case study reporting that a lymphoma patient who received a bone marrow transplant also experienced hair regrowth (66).	That the patient in the cited study also experience hair regrowth is interesting in that it suggests an autoimmune component to hair loss. However, bone marrow transplantation would be an unethical treatment for a cosmetic

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			condition given the risks and side effects of the transplant procedure.
X-Linked Lymphoproliferative Syndrome & X-Linked Hyperimmunoglobulin M Syndrome	No	These references were two clinical studies investigating different approaches to the transplant of donated bone marrow stem cells in patients with inherited immunodeficiency (67, 68).	Bone marrow transplants can replace the defective bone marrow stem cells of children born with an impaired immune system. In some patients, this therapy is curative, though it remains experimental. Immune rejection concerns persist throughout the life of the patient, and it is not a suitable treatment option for all patients.
Severe Combined Immunodeficiency Syndrome-X1	Yes	This reference was a case report describing a gene therapy approach to SCID treatment that involved the transplantation of genetically modified bone marrow stem cells (69). While adult stem cell transplants are indeed used to treat this disease, the cited gene therapy protocol is not an accepted medical procedure.	SCID-X1 is a severe, inherited immune disorder of patients born with a non-functioning immune system. Bone marrow transplants can replace these children's defective bone marrow stem cells with healthy cells from a donor. In some patients, this therapy is curative, though immune rejection concerns persist throughout the life of the patient.
Sickle Cell Anemia	No	One case report and one observational clinical study (totaling experience with 5 patients) indicated that adult stem cell transplants from bone marrow or umbilical cord blood can provide some benefit to sickle cell patients (70, 71). A third literature review proposed that adult stem cell transplants hold the potential to treat sickle cell anemia (72).	Because sickle cell results from a defect in blood-forming stem cells in bone marrow, restoring healthy stem cells to a patient's bone marrow can reverse the disease. However, this treatment can produce severe side effects and death, and it is reserved for patients suffering from advanced disease. Also, genetically matched cell transplants remain a serious problem for many patients, particularly those most affected by this disease. Because of the difficulty in obtaining suitable transplant material, this adult stem cell treatment has not been subjected to large scale clinical trials, and

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			it is not yet considered a standard therapy.
Sideroblastic Anemia	No	These references were two small clinical studies suggesting that transplants of adult stem cells from bone marrow or blood can reverse sideroblastic anemia for an extended period (73, 74).	Sideroblastic anemia is a blood disorder that leads to iron accumulation in the blood. More recent evidence further shows that transplants of healthy blood-forming stem cells donated by a genetically-matched donor can improve the survival of some patients (75, 76). However, access to genetically matched transplant material remains a serious problem for many patients, and this therapy has not yet been validated in large clinical trials.
Red Cell Aplasia	No	This reference was an early clinical study of the use of chemotherapy and immune suppression followed by a transplant of the patients' own stem cells from blood (51). The cited study dealt with multiple autoimmune diseases and included two patients with red cell aplasia.	Red cell aplasia is an inherited anemia-like disorder. Transplants of donated blood-forming stem cells in combination of chemotherapy may improve the long-term survival of some patients. However, access to genetically matched transplant material remains a serious problem for many patients, and this therapy has not yet been validated in large clinical trials.
Aplastic Anemia	Yes	These references were two early clinical studies of the use of immune suppression followed by a transplant of donated blood-forming stem cells in patients with aplastic anemia (77, 78).	Combinations of immune suppression and adult stem cell transplantation can improve the long-term survival of aplastic anemia patients. However, the success of this protocol requires genetically matched cell transplants, a serious problem for many patients.
AmegakaryocyticThrombocytopenia	No	This reference was a case study reporting the use of an adult stem cell transplant to treat a newborn with amegakaryocytic thrombocytopenia (79).	Amegakaryocytic thrombocytopenia is a rare, inherited blood disorder. Combinations of chemotherapy, immune suppression and adult stem cell transplants have been proposed as a potentially curative treatment. However, due to

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			the small number of patients affected by this disease, this treatment protocol remains experimental.
Chronic Epstein-Barr Infection	No	These references were two case studies reporting that a total of 2 patients with active Epstein-Barr virus infection were given an adult stem cell transplant (80, 81).	Activated Epstein-Barr virus causes a failure of the immune system. High-dose chemotherapy and bone marrow replenishment has been reported to reduce the amount of active virus in the body and can improve survival of some patients. However, this treatment can also produce severe side effects, and genetically matched cell transplants can be difficult to obtain for many patients.
Fanconi's Anemia	No	This reference is a case study reporting a transplant of blood-forming stem cells from umbilical cord blood into a single patient with Fanconi's anemia (82).	Fanconi's anemia is a genetic disorder resulting in bone marrow failure and a predisposition to cancer. Adult stem cell transplants can reverse bone marrow failure in some patients, but they do not alter the genetic defect underlying the disease and so are not curative.
Diamond- Blackfan Anemia	No	This reference is a case study reporting a bone marrow transplant into a single patient with Diamond-Blackfan anemia (83).	Diamond-Blackfan anemia is a genetic disorder resulting in bone marrow failure and a predisposition to cancer. Adult stem cell transplants can reverse bone marrow failure in some patients, but they do not alter the genetic defect underlying the disease and so are not curative.
Thalassemia Major	Yes - Advanced Thalassemia	This reference is a case report indicating that a transplant of donated blood-forming stem cells suppressed disease in two thalassemia patients (84).	Thalassemia is an inherited disorder that diminishes the blood's ability to carry oxygen. Severe thalassemia is often treated by bone marrow transplantation, although this procedure carries considerable risk and is not suitable for

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			all patients.
Primary Amyloidosis	No	This reference is a literature review proposing that transplants of adult stem cells from blood and high-dose chemotherapy provide an improved treatment for primary amyloidosis (85).	Primary amyloidosis results from a genetic defect in a certain kind of immune cell that causes protein deposits in the body to reach toxic levels. On a small scale, adult stem cell transplants have been shown to benefit patients with advanced disease, though significant treatment-related side effects were reported. Further study is required to confirm that this treatment is better than conventional therapy.
Osteogenesis Imperfecta	No	Three clinical studies, all from the same first author, suggested that transplants of bone-forming stem cells from bone marrow are feasible and can improve the bone growth of children suffering from osteogenesis imperfecta (86-88).	Osteogenesis imperfecta is a rare, inherited disorder characterized by abnormal bone growth. Transplants of healthy bone-forming stem cells may alleviate the symptoms of this disease and improve patients' quality of life. However, the long-term stability of these benefits remains under study, and not all patients will have access genetically matched cell transplants or be healthy enough to endure post-transplant immune suppression.
Osteopetrosis	No	These references were one retrospective analysis and one small clinical study indicating that transplants of adult stem cells from bone marrow (either donated or from the patient him/herself) improve the long-term survival of some children with a certain kind of osteopetrosis (89, 90).	Osteopetrosis results from a rare, inherited defect in the ability of bone-forming stem cells to generate healthy bone. For children with ample - but dysfunctional - bone-forming stem cells, adult stem cell transplants can reverse the disease when the transplant is done very early in the child's life. Unfortunately, this therapy brings fewer benefits to older children, carries a risk of severe side effects, and has not been demonstrated to benefit children suffering from an overall lack of bone-forming stem cells. A

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			major limitation to adult stem cell therapy for osteopetrosis is the paucity of genetically matched donors.
Cerebral X-Linked Adrenoleukodystrophy	No	This reference was one retrospective analysis indicating that transplants of adult stem cells from blood improve the long-term survival of some patients with early-stage cerebral X-linked adrenoleukodystrophy (91). Roughly half of study subjects ultimately succumbed to the disease, and the transplant therapy was shown to be significantly less effective for children with advanced disease.	Cerebral X-linked adrenoleukodystrophy results from an inherited defect in the brain's ability to breakdown large fat molecules. Adult stem cell transplants supply an enzyme needed to metabolize these fat molecules, and when done early in an affected child's life, succeed in substantially slowing the onset of this progressive disease. Unfortunately, these transplants do not correct the disease's underlying genetic defect, and over time patients die from the disease.
Sandhoff Disease	No	This reference was a newspaper article published in the <i>Denver Post</i> about one family's experience on the day their son received an umbilical cord blood transplant (92).	Sandhoff disease is a fatal enzymatic disorder for which there are no curative treatments. Combinations of drug therapy and bone marrow transplant appear to benefit mice with a Sandhoff-like condition. However, there are no published reports describing adult stem cell transplants in human patients, and the newspaper article cited by Prentice provides insufficient justification to claim that adult stem cells can benefit patients suffering from Sandhoff disease.
Hurler's Syndrome	No	One retrospective analysis and one small clinical study indicated that adult stem cell transplants protected some of the tissues attacked by Hurler's syndrome but provided little relief to other tissues. Long-term survival was improved, with the greatest	Hurler's syndrome is an inherited metabolic disorder characterized by defects in bone, eye and brain development. As indicated by the cited papers, transplants of adult stem cells from bone marrow or blood can restore some metabolic capacity to children with Hurler's

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		benefit seen in children transplanted early in life (93, 94).	and improve their cognitive function. However, these treatments produced only a limited effect on the eyes and skeleton, and do not correct the genetic defect underlying the disease.
Krabbe Leukodystrophy	No	Two early clinical studies reported that cognitive impairments from Krabbe's disease are reduced when children are treated with transplants of donated umbilical cord blood stem cells (95, 96).	Krabbe leukodystrophy is an inherited, fatal metabolic disorder that results in progressive deterioration of the brain and nerves. Transplants of umbilical cord blood stem cells or other blood-forming stem cells have been shown to restore some metabolic capacity to Krabbe children, and may improve their brain function for an extended period. However, though these treatments appear to contribute to extended overall survival, they do not correct the disease's underlying genetic defect and are not curative.
Corneal Regeneration	No	These references were seven clinical studies (one reported twice) detailing variations on a transplant treatment for near blindness due to problems with the cornea. Transplanted cells were derived from a variety of sources, including corneal stem cells from a donor or the patient's healthy eye, donated amniotic membrane cells, and cells from the inside of the mouth. All papers reported regeneration of the cornea and improved vision in a subset of patients (97-103).	Several eye diseases or injuries damage the cornea and thereby impair vision. Transplants of corneal tissue from tissue banks is a standard treatment for corneal diseases, but the use of corneal cells and some kinds of stem cells remains experimental.  The cited studies and more recent publications highlight the potential for adult stem cell transplants to facilitate the repair of damaged corneas and subsequently improve vision to some degree. Interestingly, transplanted cells do not remain in the treated area 3-5 years post-transplant even though visual improvements persist, suggesting that the true benefit of the

Disease or injury cited in Prentice list	Is an FDA-approved adult stem cell treatment generally available to treat this disease or injury?	Actual nature of the study or studies cited by Prentice	Additional comments
			transplanted cells is to stimulate the residual repair capacity of the damaged eye rather than directly affect repair themselves (99, 104).
Limb Gangrene	No	One pilot study reported that implantation of bone marrow stem cells into non-healing skin ulcers restored some blood flow to the affected area and accomplished moderate repair (105).	The cited paper and more recent studies suggest that bone marrow cells (which contain stem cells that generate blood vessels) may improve healing of chronic skin ulcers. However, the feasibility of this technique in its present form remains unconfirmed. It is not yet an accepted standard of care.
Surface Wound Healing	No	This reference was an animal study giving evidence for the transport of bone marrow stem cells to the skin and other organs (106).	It has been proposed that stem cells travel out of the bone marrow and incorporate into distant tissue sites, though the mechanism by which this occurs is the subject of rigorous scientific debate (107, 108). There is also disagreement about the relative contribution of bone marrow stem cells to skin healing in mice (109, 110). However, neither the scientific literature nor the cited paper supports the notion that adult stem cell therapy is presently being used to heal surface wounds.
Jaw Bone Replacement	No	A case report detailed a tissue engineering approach to making a new jaw for a patient who had lost his to cancer (111). By this technique, a jaw-shaped metal frame is seeded with bone marrow stem cells and growth-promoting drugs before implantation in the patient's shoulder. After 7 weeks bone grew over the frame and was then removed from the shoulder and installed as the patient's new jaw.	Though this technique was apparently successful, it is not clear how the bone marrow stem cells contributed to overall bone growth. More recent animal studies from the same research group omit stem cells from the implant protocol, suggesting that the growth-promoting drugs and natural growth environment of the shoulder are sufficient for bone engineering (112, 113).

Disease or injury cited in Prentice list	Is an FDA-approved adult stem cell treatment generally available to treat this disease or injury?	Actual nature of the study or studies cited by Prentice	Additional comments
Skull Repair	No	A case report described a tissue engineering approach to closing a large skull fracture (114). The open portion of the patient's skull was covered with a protein-based glue that had fat stem cells seeded within it. New bone growth was observed three months after this procedure.	Though new bone growth was observed, the study authors present no evidence for any contribution from the fat stem cells. Neither this cited paper nor the scientific literature supports the claim that adult stem cell therapy is presently being used to repair skull damage in people.
Heart Damage	No	Seven experimental or early phase clinical studies, including one placebo-controlled clinical trial, indicated that transfusion of a patient's own bone marrow-derived stem cells into the heart shortly after heart attack is relatively safe and is associated with regeneration of heart tissue and improved heart function (115-121). Two single case studies reporting a transplant of muscle stem cells into heart were also included (122, 123).	The cited studies suggest that transplantation of adult stem cells from bone marrow is associated with improved recovery after heart attack. However, larger and more rigorous clinical trials are needed to establish this protocol as a standard treatment for heart attack sufferers. Importantly, a 2006 clinical trial evaluating a similar protocol found that stem cell transfusion failed to improve heart function (as measured by left ventricle ejection fraction) even though it appeared to reduce the area of damaged heart tissue (124). Furthermore, increasing the number of blood-forming stem cells circulating in the blood and therefore available to implant in damaged tissue does not improve heart function (125).
Stroke	No	Three experimental studies reported that implantation of brain stem cells into the brains of long-term stroke patients was feasible and relatively safe (126-128).	The cited papers proposed a radical treatment for stroke patients in the hope of restoring lost brain function. Implantation of brain stem cells has been shown to improve brain function in some animal models of stroke, but this approach remains an unproven experimental therapy in people.
Parkinson's Disease	No	One abstract from a 2002 scientific meeting	While transplants of cells from various sources

Disease or injury cited in Prentice list	Is an FDA-approved adult stem cell treatment generally available to treat this disease or injury?	Actual nature of the study or studies cited by Prentice	Additional comments
		<p>reported clinical experience with one Parkinson’s patient who received a transplant of his own brain stem cells (129). Two references reported Congressional testimony by the author of the above abstract and the transplanted patient. The testimony was given before Senator Sam Brownback’s Science, Technology and Space Subcommittee on July 14, 2004 and does not contain sufficient information to assess the claims made (130, 131). Two additional references cited irrelevant papers that do not address a cell-based therapy of any kind for Parkinson’s (132, 133).</p>	<p>have been tried on an experimental basis in Parkinson’s disease, the clinical outcomes from these attempts have been mixed, with a more recent trial indicating that a fetal cell transplant confers no treatment benefit (134, 135). Neither the published scientific literature nor the cited papers support the claim that an effective stem cell therapy is available to Parkinson’s patients.</p>
Spinal Cord Injury	No	<p>This reference was testimony from one scientist and two patients with spinal cord injuries given before Senator Sam Brownback’s Science, Technology and Space Subcommittee on July 14, 2004 (136-138).</p>	<p>The cited testimony referenced the work of one Portuguese physician who claimed to treat spinal cord injury with transplants of stem cells from patients’ nasal lining. There is no evidence these claims have been subjected to rigorous scrutiny by the scientific and medical community. No FDA-approved stem cell treatment of any kind is currently available to patients with spinal cord injury.</p>

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**FOR HUMAN PATIENTS (*not a complete listing*)**  
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### **X-LINKED HYPERIMMUNOGLOBULIN M SYNDROME**

Banked unrelated umbilical cord blood was used to reconstitute the immune system in 2 brothers with X-linked lymphoproliferative syndrome and 1 boy with X-linked hyperimmunoglobulin-M syndrome. Two years after transplantation, all 3 patients have normal immune systems. These reports support the wider use of banked partially matched cord blood for transplantation in primary immunodeficiencies.

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## SPINAL CORD INJURY

See July 14, 2004 Senate testimony by Dr. Jean Peduzzi-Nelson:

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and a more extensive testimony at:

<http://www.stemcellresearch.org/testimony/peduzzi-nelson.htm>

and Ms. Laura Dominguez:

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