

from nonhuman species) has been viewed as an attractive alternative to human donors, potentially providing an unlimited supply of organs. Unfortunately, substantial immunologic barriers — as well as concerns regarding the transmission of infectious agents that are benign in one species but not in others (as the human immunodeficiency virus proved to be) — have thus far been insurmountable. As Dr. Shumway was fond of saying, “Xenografts are the future of transplantation . . . and always will be.”

However, the future is likely to hold improvements in the quality

and length of life for heart-transplant recipients, as bench work in fields such as vascular biology and immunology translates into clinical reality. Circumventing the problem of relentless graft vasculopathy will clearly prolong many lives. And achievement of the holy grail of transplantation — immune tolerance or acceptance of the graft with maintenance of normal immune function in other respects — will eventually open the door to normal lives and life spans for all transplant recipients.

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Thoughts from the Transition Zone

J. Terrance Davis, M.D.

I got the call earlier today. A teenager has been on life support at our hospital while awaiting a heart transplant. She was running out of time when we got the offer of a heart, and it was my job to recover the organ. Before I knew it, I was arriving at a suburban hospital 600 miles away, accompanied by my resident and a procurement technician. When we drove in, it seemed like any other emergency department at night.

But as we walked through the emergency room (ER), all grew quiet. There were eyes upon us, and as people stepped aside, I sensed their ambivalence at our arrival: “Something good will come of this. It’s almost over. What a shame.” In this small hospital, the tragedy of a young life lost in a motor-vehicle accident had permeated every department.

This is the donor zone. Teenagers stood in the hallways crying and comforting one another, medical teams had given their all but to no avail, and the family was trying to come to grips with the loss. It is a zone of intense sadness. Out of sight of all this, back in the operating room, a heart was beating in a body with no future.

The recovery was routine — and yet extraordinary. An army of coordinators had been on the telephone for hours to bring together people who could maximize the potential of orphaned organs in a body that was about to die. Working side by side, we and another team that was taking the liver and kidneys divided shared vessels in the middle. When we all were ready, I put the cold potassium solution into the heart, which immediately stopped beat-

ing and turned into a flaccid, pale, cold, apparently lifeless organ. I removed the heart from the body, realizing that this act completed the process of death and marked the beginning of a difficult time in the donor zone.

People here would go home grieving. But I had much to think about — no time to reflect. I thanked everyone, and we jumped into the waiting ambulance. The funeral procession for the donor was yet to come; this was a different sort of journey for a heart headed to a new home.

Soon, we will enter the recipient zone. It will be permeated by anticipation, excitement, and hope. As I walk through that ER, eyes will once again be on me, but the message they convey will be different: Good news! They’re waiting for you!

There will be a sense of both pride and hope as I enter the operating room, where the transplantation surgeon will have placed the patient on the heart–lung machine. The equipment that has kept her alive for the past week will be in the hallway, being cleaned. Everyone will be focused on installing the new heart into a person who will now have a future. I will assist the surgeon in sewing in the organ. He will unclamp the aorta, fresh blood will run into the coronary arteries, and the gray tissue will turn pink. Will the heart start? Will it work? Within a minute or two, the muscle will jump to life and start beating.

Soon, the job of the 1250-lb heart–lung machine will be taken over by this little muscle. The surgeon will tell the anxious family that all is well so far. It will have been a good day in the recipient zone.

Of course, it won't be over yet in the intensive care unit — a good outcome is not guaranteed. Although the heart's recovery is likely, other organs have been damaged, and how the liver, kidneys,

and brain will function has yet to be seen. Ultimate success will require meticulous attention to hundreds of details over the next weeks and months. And how will the whole patient herself fare? There will be much to think about and little time to reflect.

But at the moment, I am in the transition zone. I sit here, in a jet quietly cruising at 500 miles per hour, 40,000 ft above a sleeping country. It is the middle of the night. Unlike the other zones, this zone does not require me to do anything, to work out any details. I can now reflect.

This is a bizarre and surreal space. I envision the piece of flesh sterilely wrapped and packed in ice in the cooler at my feet. We are both in transition. I am in the middle of a major mood swing. I think of the intense sadness in the donor zone and the joy, anticipation, and hope in the recipient zone. The people in each zone are aware of and understand one another, but they are, quite rightly, concentrating on their respective jobs. All this activity requires speedy air travel, with pilots to transport the organ

and us safely from zone to zone in a time frame that will allow the heart to recover without damage. The transition zone represents the interface of medical science, medical technology, aeronautical engineering, aviation, and medical professionalism.

I glance out the window at the dark, moonless night. The density of the stars in the sky and the lights on the ground below are about the same. In the absence of a horizon, the stars and the lights blend, and it looks as if we are suspended in space. From this strange perspective, it dawns on me that although I understand scientifically how each part of this process happens, the process as a whole still fills me with awe and wonder. The way it can change a life, a family, a community remains a mystery.

In the meantime, at the center of it all, in the transition zone, the pound of muscle lies cool, totally relaxed, between jobs. If I were wise, I would do the same.

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Causes of Chronic Diarrhea

Henry J. Binder, M.D.

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Diarrhea can be classified in several ways. It is both a symptom and a sign. As a symptom, it is whatever the patient says it is: a decrease in consistency, an increase in the number or volume of bowel movements, or any combination thereof. As a sign, diarrhea is an increase in stool weight (or volume) of more than 200 g

(or ml) per 24 hours in a person on a Western diet. The distinction between chronic and acute diarrhea is arbitrary: it is determined by duration. Diarrhea is generally considered acute when it lasts less than two or three weeks. Such diarrhea is frequently caused by an infectious agent, is usually self-limiting, and often resolves with-

out treatment. Diarrhea is categorized as chronic when it lasts more than two or three weeks. Chronic diarrhea has multiple causes. During the past three decades, studies have delineated several ion-transport mechanisms that may be disturbed in one or more diarrheal disorders. The identification of five specific con-