Proton therapy is a pinpoint-precise form of treatment that delivers a targeted dose of radiation to tumors, sparing of normal tissue. It is also known as proton beam therapy. Protons are subatomic particles that are accelerated by a cyclotron to specific speeds in beams that penetrate the body. As positively charged protons enter the body, they slow down and interact with negatively charged electrons, releasing energy (also known as radiation). First used to treat cancer patients half a century ago, research into proton therapy, coupled with significant technological advances, has made it possible for us to use the science more focused—like proton therapy itself. The results are impressive: Proton beam therapy has a 90 percent fatality rate for patients with certain forms of brain tumors into an 80 percent survival rate. Today, researchers are discovering more and more applications for the lifesaving treatment.

To learn more about the promise of proton therapy, the Post spoke with Dr. Allan Thornton, medical director of IU’s Midwest Proton Therapy Center.

**Post:** What are the unique attributes of proton therapy in terms of precision, side effects, and impact on surrounding tissue?

**Dr. Thornton:** It is fundamentally different and, we believe, better. With proton therapy there is better sparing of normal tissue. It is far more accurate than conventional radiation, resulting in the delivery of a precise dose you can maximally give.
it does appear it is able to stop the exudation of the degeneration. It may be something we offer, but we are not ready as yet to treat routinely.

Post: What are the general eligibility criteria for proton therapy?
Dr. Thornton: You need to have a localized tumor. It needs to be gener-
ally in one spot, so we can address and cure the tumor by treating that
location. There are exceptions. We do treat metastatic disease, but for the
most part, we try to limit ourselves to curative patients who have a good
quality of life because they need to come daily for the treatments over po-
tentially a long period. Some patients require as many as 45 treatments,
some as few as four or five. Generally, it is a four- to eight-week course of
treatment.

The patient needs to be somewhat flexible to get onto the table and
work with us, because we use a tre-
mendous amount of exactitude and
verification in our process. We use an
industrial robot to move our patients
around the beam. We are the only
place in the world that has an indus-
trial robot coupled with a gantry—a
large device that rotates the beam and
the patient.

Frankly, I also spend a great deal
of time with my patients, because I
want them to understand what we
are doing and to truly understand
their disease. We want a truly well-
 informed patient. These are the main
criteria. There is no age restriction.
Twenty percent of our patients right
now are children. Our patient popula-
ranges from babies to very spry
95-year-olds.

Post: Is planning the treatment time
consuming?
Dr. Thornton: What I do is com-
puter-aided design of people—CAD. It
is similar to building a car part or an
engineered part in industry. Basically,
I do the same technology employing
the human skeleton and anatomy.
Protons are even more challenging in
that my physicists have to generate
a true three-dimensional perception
of where the tumor is located and
calculate how that proton is going to
scatter in all three dimensions. Many
of the tumors I treat are literally ad
jacent to critical structures, so they
have to verify and prove that they
have a good model to explain that
scattering. That process may take up
to a month in challenging cases.

Post: Why is this therapy so benefi-
cial to the pediatric population?
Dr. Thornton: First, we do not like
treating children with radiation. If we
have to, we want to do it in the kind-
est, gentlest way that treats the abso-
ute least of normal tissue as possible.
That is important for a couple of rea-
sions. First, we are realizing the poten-
tial for radiation to cause tumors later
in life, as with chemotherapy. Fifteen
years ago, we thought the risk was
small, but now we’re realizing that
the risk may be as much as three percent
over 20 to 40 years after treatment.
Many children will go on to live nor-
mal lives and potentially realize that
risk. With that understanding, proton
therapy treats, on average, one fifth
the normal tissue that even the most
elegant of standard therapy treats.
My common sense tells me that sig-
nificant savings of normal tissue will
translate into a significant savings of
second tumors over the lives of these
children.

Secondly, children obviously have
genital. For example, one of the
side effects of treating young patients
with eye tumors is that their cheek-
bones do not grow afterwards. When
they become adults, they have sunken
faces, misshapen foreheads, and eye
sockets as a result. We have a better
way of treating the tumor with ra-
diation. We treat them in a way that
avoids the cheekbone. It spares the
bone so that it develops proportional
growth.

Post: How many centers are in the
United States, and how many are plan-
ing to build facilities like yours in the
near future?
Dr. Thornton: Now there are five
centers in the United States. We are
the third, the fourth was M.D. An-
derson Cancer Center in Houston,
and the fifth facility was built at the
University of Florida, in Jacksonville,
Florida.

Interestingly, the first cyclotron
was built at Harvard University in
1937, and it was decommissioned and
moved to Los Alamos, where it main-
the plutonium for the first three atom
bombs in 1939 through 1945. Its
replacement was built in 1946, and
I used that machine to treat my pa-
tients in the 1990s at Harvard.

In 1975, the Indiana University
radiotherapy Institute is intended to
be a regional resource, a shared re-
source by a number of university and
pediatric hospitals in the country. The
short answer to your question is, it is
a high-cost capital investment and,
up to this point, has been a little too
large for hospitals to afford. But that
is changing. It is a reflection of chang-
es in the economics of the healthcare
system, and the lowering of technol-
gy costs.

Post: If people would like to learn
more, how would they get in touch
with the facility?
Dr. Thornton: Our telephone num-er is (812) 349-5074. Or they can go
to the website at www.mpri.org.