Report for Andy B. Fund July 2014

It is well known that tumors such as osteosarcoma change the concentration of many proteins in the blood. Different clinical states of disease, such as remission, relapse, or spread of tumor, may have different characteristic protein "fingerprints" within the blood that can help physicians detect relapse or to differentiate between osteosaroma that has spread to the lungs and bones. Our research is focusing in identifying these protein "fingerprints" in blood. Our work has begun to show that teenagers affected by osteosarcoma have a distinct protein "fingerprint" pattern that can be distinguished from teenagers with other cancer or diseases and from healthy teenagers.

The hope of our research work is that a simple blood test could be developed that would indicate whether cancer has recurred. Such a blood test would lessen the need for repeated radiologic exams and thus decrease the damaging effects of irradiation on children and teenagers affected by osteosarcoma and other cancers

In the chart below, we show some of the results of our research that was made possible by your support. Each row in the chart represents a specific protein. Each column represents a comparison of the proteins between two conditions (for example, column 5 compares Osteosarcoma to other cancers). The more colored bars in the column, the more the two conditions differ in their protein "fingerprint." White space indicates no difference in protein concentration between the two conditions. As you can see, Osteosarcoma differs quite a bit from other cancers (columns 5-7) whereas two other cancers (Wilms tumor and neuroblastoma) are more similar in their protein pattern (column 8).

Based on results from our earlier experiments looking at proteins with high blood levels , we are now characterizing the behavior of proteins with much lower blood levels . Since our last report, we have completed the work with one of the leading biotechnology companies (RayBiotech) to design and analyze microarray antibody slides containing 40 proteins each. Your prior funds enabled us to include osteosarcoma in a very large experiment looking at about 600 teenagers with different forms of cancer as well as other diseases. As a result of this experiment, we not only know the difference in blood proteins in teenagers with osteosarcoma compared to healthy teenagers but also how the proteins differ from teenagers with other cancers and other chronic diseases.

Our goal is to have a complete map of the changes of all known proteins in the blood of teenagers diagnosed with osteosarcoma compared to teenagers without any disease, with other cancers and with other common diseases.

There are about 40 more proteins that we have not looked at yet. In our next experiment we will compare the behavior of these proteins in teenagers with osteosarcoma, other cancers and other pediatric diseases compared to healthy teenagers.

Once we complete this experiment, our goal is to understand why the proteins are different in teenagers with osteosarcoma and also cancer in general. This will help us to determine which proteins can be used to detect recurrent osteosarcoma and other cancers using a blood test. Currently all children and teenagers are monitored with radiologic exams for many years. While the radiologic examinations are very good at detecting cancer there is growing concern about the hazards of irradiation to children and teenagers. Using blood tests for monitoring offers a much safer alternative.

On the next page is a heat map of our recent results. Each row represents a different protein. Each column represents a comparison between two groups. For example, the fifth column compares Osteosarcoma to other cancers. The blue color means that the protein is lower in the first group (Osteosarcoma in the fifth column) compared to the second group (other cancer in the fifth column) whereas the red color means that it is higher in the first group (Osteosarcoma) compared to second group (other cancer).

The first four columns from the left show the protein signatures of different diseases compared to healthy teenagers. What you can see is that each different disease IBD (Inflammatory Bowel disease); Pediatric cancer; Sickle cell disease; and even obesity have a distinct signature. However some of the proteins are different from healthy controls in all diseases.

The columns 5-8 look at each cancer separately and show that while cancer in general look different from other diseases; osteosarcoma also looks very different from the other two cancers we looked at.

The columns 9-11 compare all cancer again to the other diseases such as Obesity, Sickle cell disease and Inflammatory Bowel disease (IBD) .

When we first started we only looked at osteosarcoma but as you can see looking at this chart we understand so much more if we compare osteosarcoma to other cancers and other diseases.

IBD - healthy
Obese - healthy
Pediatric cancer - healthy
Sickle cell disease - healthy
Osteosarcoma - other cancer
Osteosarcoma - Wilms Tumor
Osteosarcoma - Neuroblastoma
WT - Neuroblastoma
Pediatric cancer - obese
Pediatric cancer - Sickle cell disease
Pediatric cancer - IBD