

## UNDERGRADUATE RESEARCH LONG TERM GRANT APPLICATION Budget Worksheet

BUDGET ITEM	Department or College Funds	Outside Agency Funds	Personal Funds	Undergrad. Research Funds	GRAND TOTAL
Materials		ARUP Laboratories will provide all materials.			
Equipment		Arup Laboratories will allow us to use their equipment.			
Stipend: Hrs @ \$10/hr Benefits @ 8.5% Total					
-Mileage to gather Data (.36 per mile)				371.5 miles of travel x .36/mile=\$	\$133.74
GRAND TOTAL					\$133.74

# UNDERGRADUATE RESEARCH LONG TERM GRANT APPLICATION

## Body of Proposal

### Project Description

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The objective of our project is to establish a Bone Specific Alkaline Phosphatase (BSAP) reference range for children from the ages of 6 months to 7 years old. Reference ranges, sometimes referred to as normal ranges, are a set of high and low values that the majority of healthy individuals fall into. Reference ranges are an essential tool physicians use to diagnose disease states. Reference ranges have been established for women ages 7 and older and men 7-18 and 25 and older, but there is no range for children 6 months to 7 years. Recently published data identified BSAP as a good marker of bone formation in different bone diseases and osteoporosis.<sup>1</sup>

Bone is a dynamic tissue in which formation and resorption continue throughout life by a process called remodeling. Remodeling is the function of a complex interaction between two types of bone cells: osteoblasts and osteoclasts. Osteoblasts are responsible for the formation of bone and osteoclasts for the resorption of bone. Under normal circumstances bone formation and resorption are kept in tight balance. The balance is important in maintaining the strength and organization of the skeleton.<sup>2,3</sup>

The levels of BSAP in the serum are believed to reflect the metabolic status of the osteoblasts. An accurate level is important to assess bone metabolism and for determining the severity of metabolic bone disease. Total alkaline phosphatase measurements have previously been used to evaluate and diagnose bone disorders. Because the liver can also contribute to the total alkaline phosphatase level, BSAP would be the preferred method.<sup>4</sup>

In healthy children bone is formed more readily than it is broken down. This reflects normal skeletal growth. In young adults levels of bone formation and resorption are equal. In adults the rate of bone resorption is greater than the rate of formation. For these reasons it is important to have an established reference range for each stage of development.

The 4 students conducting the research have completed the AAS degree in Clinical Laboratory Science. The students are all registered Medical Laboratory Technicians (MLT) certified through the American Society for Clinical Pathology (ASCP), and all are currently working as MLT's in local hospitals and laboratories.

Gary Nielsen will serve as our faculty mentor for this project. Our research is being done in conjunction with ARUP Laboratories under the direction of William L. Roberts M.D., Ph. D. Dr. Roberts is the medical director of the automated Core Laboratory at ARUP. ARUP will fully fund all technical expenses of our project, and an IRB has already been obtained. All the samples were collected by ARUP, and all testing will be done in the Automated Core Lab at ARUP.

The project will be done on the following research continuum:

Dependent _____	<u>X</u> Independent
(student helping faculty do research)	(student doing own research)

Upon completion of the project we will be presenting our data at the Weber State University Undergraduate Research Symposium. Our results will also be submitted for possible publication in the WSU undergraduate research journal, *ERGO* and in the *Clinical Biochemistry* journal for others in this profession.

#### Project Methods & Timeline

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We propose to determine the reference intervals of BSAP in healthy children 6 months up to 7 years of age. Specifically, in 60 boys and 60 girls from each year of life over this age range. We plan to generate data for the BSAP on approximately 1200 previously collected samples. ARUP has provided access to these samples for the purpose of this study. The data will be analyzed using EP Evaluator software (version 8) and non-parametric analysis with a minimum of 120 subjects per age group

according to the CLSI document C28-A2, which is the accepted method for establishing reference ranges.<sup>5</sup>

All testing will be carried out at ARUP in Salt Lake City. We will be measuring the BSAP on a Beckman-Coulter DxI 800. The assay is a one-step immunoenzymatic assay. This is an antigen/antibody reaction that sandwiches the BSAP complex between mouse monoclonal antibodies and goat polyclonal antibodies. The paramagnetic particle is bound to the goat antibody. This holds the entire complex in the reaction vial while everything else is washed away. A chemiluminescent substrate is added and the amount of light generated is measured with a luminometer. The amount of light produced is directly proportional to the amount of BSAP in the specimen.<sup>6</sup>

<b>Project timeline</b>		
<b>Steps</b>	<b>Description</b>	<b>Completion deadlines</b>
1.	Submit ARUP IRB to WSU	Oct. 23, 2009
2.	Submit grant proposal to WSU DCHP UR Committe	Oct. 27, 2009
3.	Grant proposal to WSU OUR	Nov. 2, 2009
4.	Perform testing at ARUP	Dec. 14-18, 2009
5.	Data analysis and develop reference range	Jan. 18-24, 2010
6.	Write research paper on BSAP	Feb. 1-5, 2010
7.	Create poster	Feb. 7-12, 2010
8.	Create Power Point presentation	Feb. 7-12, 2010
9.	Present at WSU Undergraduate Research Symposium	Mar. 1, 2010
10.	Prepare for any other presentations	Undetermined

#### Budget Explanation

<b>Budget Explanation</b>	
<b>Expenses</b>	<b>Cost</b>
Travel to perform testing(Ogden to SLC):	\$133.74
- 74.3 miles roundtrip from WSU to ARUP	
- 5 trips	
- 1 car	
- \$.36 per mile	
<b>Grand total:</b>	<b>\$133.74</b>

References:

1. Avbersek-Luznik, Ivica, Tanja Gmeiner Stopar, and Janja Marc "Activity or mass concentration of bone-specific alkaline phosphatase as a marker of bone formation." *Clinical Chemistry & Laboratory Medicine* 45.8 (2007): 1014-1018. Academic Search Premier. EBSCO. Web. 30 Sept. 2009
2. Whyte MP. Alkaline Phosphatase and the measurement of bone formation, *Clinical Disorders of Bone and Mineral Metabolism*. Potts JT and Frame B, eds., 1983, 120-125.
3. Van Straalen JP, Sanders E, Prummel MF, and Sanders GTB. Bone alkaline phosphatase as indicator of bone formation. *Clin Chim Acta* 1991, 201:27-33.
4. Epstein S. Serum and urinary markers of bone remodeling: assessment of bone turnover. *Endocrine Reviews* 9: 1998, 437-448.
5. CLSI document C28-A2. How to Define and Determine Reference Intervals in the Clinical Laboratory, Approved Guideline 2nd Edition 2000 Clinical and Laboratory Standards Institute Wayne, PA.
6. Duda RJ, O'brien JF, Katzman JA, Peterson JM, Mann KG, and Riggs BL, Concurrent assays of circulating bone gla-protein and bone alkaline phosphatase: effects of sex, age, and metabolic disease. *J Clin Endocrin Metab* 1988, 66: 951-957.