Running title: Overview of the SWOG Biorepositories
CCR-10-3138

SWOG Cooperative Group Biorepository Resource:
Access for Scientific Research Studies

Carolyn J. Hoban¹, Wilbur Franklin², Kenneth J. Kopecky³, Laurence H. Baker¹

¹Southwest Oncology Group and University of Michigan, Ann Arbor, MI
²University of Colorado, Department of Pathology, Denver, CO
³Southwest Oncology Group Statistical Center and Fred Hutchinson Cancer Research Center, Seattle, WA

Funding: This article was supported in part by the following PHS Cooperative Agreement grant numbers awarded by the National Cancer Institute, DHHS: CA32102, CA38926 and CA114748

Corresponding Author: Carolyn J. Hoban, D.Sc.
Southwest Oncology Group
and University of Michigan
24 Frank Lloyd Wright Dr., Suite A3400
P.O. Box 483
Ann Arbor, MI 48106
Tel: 734-998-7135; Fax: 734-998-7151
carhoban@med.umich.edu
Statement of Translational Relevance

Biospecimens from cancer patients fuel basic cancer biology research and discovery of biomarkers. SWOG, an NCI-funded cooperative group, conducts multi-institutional, multi-disciplinary cancer clinical trials that often include biospecimen collection, banking and correlative laboratory studies that support the overall scientific objective of the clinical trial. The biospecimens are a highly valued resource to the research community because they are annotated with clinical data and outcomes from controlled cancer clinical trials. The biospecimens are made available to the research community as a resource after the publication of the primary endpoint of the clinical trial. This article describes the biorepositories, resources available for investigators, and the application process to obtain SWOG biospecimens for meritorious scientific research.
Abstract

SWOG, an NCI-supported cooperative group, conducts multi-institutional, multi-disciplinary clinical trials for adult patients with cancer, covering a wide range of solid tumors and hematological cancers. The group has amassed a large set of biospecimens, collected from patients in numerous studies over many years and linked to clinical data. SWOG is now actively promoting the use of this unique scientific resource by making it available to a much wider group of researchers. This biospecimen resource offers material for research on disease mechanisms, genomic changes associated with cancer progression, markers of response and resistance to therapies, diagnosis or detection of recurrence, and more. By collecting, storing, and distributing the specimens, SWOG provides the framework for translational scientists to complete the feedback loop from ‘bedside to bench.’ This article provides an overview of the group's biospecimen resources and guidelines for gaining access to them.

Introduction
SWOG (formerly the Southwest Oncology Group) conducts clinical trials of therapies for a wide range of adult cancers, including most types of solid tumors and hematologic malignancies. Approximately 6,000 individuals are enrolled in SWOG clinical studies each year, with about 32,000 people involved in ongoing SWOG clinical trials each year. The SWOG network is comprised of over 5,000 oncology health care providers who represent over 600 institutions, including NCI-designated Cancer Centers, community practices and hospitals across the US. SWOG conducts phase I-III studies across this network in numerous cancers: breast, gastrointestinal tract, genitourinary tract, gynecologic tract, leukemia, lymphoma, lung, melanoma and multiple myeloma. The Group is structured around disease treatment and prevention committees, which are comprised of multi-disciplinary teams of medical oncologists, surgical oncologists, radiation oncologists, pathologists, nurses, translational scientists, biostatisticians, clinical research associates, patient advocates and epidemiologists. SWOG conducts clinical research of new cancer drugs, drug combinations, chemoprevention agents, and combined-modality therapies, with the goals of improving survivorship, lessening morbidity and/or preventing cancer. The design of clinical trials incorporates experimental treatment regimens with specified eligibility requirements, and established clinical endpoints, such as survival, progression-free survival, or response, or toxicity, so that definitive conclusions on safety and efficacy may be obtained. The Group’s translational research is designed to advance understanding of disease mechanisms and the actions of drugs and other treatment modalities, as well as to improve
classification and prognostication of cancer. To accomplish translational research objectives, the group systematically collects specimens during the course of cancer clinical trials that are linked ultimately to mature clinical outcomes data. The inherent value of SWOG’s biorepository lies in the prescribed standardized collection of specimens, and in the centralized processing, storage and tracking of biospecimen quality, quantity, use and distribution. Use of the biorepository is aligned with the nationwide effort to advance the validation of biomarkers in cancer clinical trials and of companion diagnostics for targeted therapeutic strategies in phase II and III trials.

Materials and Methods

Rationale for Biospecimen Banking

Each SWOG clinical study may have scientific research aims that involve the collection of biospecimens for reasons that are either “integral” to the trial, i.e., necessary for the clinical study to proceed, or "integrated" into the trial as a prospective test of a research hypothesis or validation of candidate biomarkers. Additionally, for larger studies, SWOG may, with appropriate informed consent from the patients, collect specimens without a specific scientific research aim that is established prospectively ("banking"). The types of specimens collected in each clinical study are determined by the integral and/or integrated uses they will serve, and their methods of collection are specified within the study protocol in tandem with informed consent documents. At the conclusion of the clinical trial and completion of the research aims, SWOG provides to the scientific community access to banked specimens in order to support expanded scientific exploration.
The intended use of these biospecimens is to conduct research of high scientific merit related to the unique feature of the SWOG resource: to evaluate associations with endpoints obtained from the clinical study. A request for access to biospecimens only, based on a research hypothesis that does not include association with a clinical endpoint, is considered a low priority use of this unique and finite resource; the investigator is advised to request biospecimens from alternative sources.

**Biospecimen Inventory**

The role of the SWOG biorepository is to distribute high quality specimens for approved research studies. The SWOG biorepository currently consists of four facilities: the Solid Tumor Repository, the Lymphoma and Myeloma Repository, the Lymphoid Leukemia and CML Repository, and the AML/MDS Repository. Each specimen, with its derivatives (e.g., extracted nucleic acid), is recorded by the biorepository using a barcode tracking system. Specimen tracking is managed by a laboratory information management system that is designed to interface with the SWOG Statistical Center, with plans to develop an interface with data warehouse systems, such as CaBIG and Medidata Rave. Thus, it is possible to query the inventory of banked specimens using criteria related to protocol treatment, demographics (e.g., gender, age, ethnicity) and outcome, as well as by type of specimen as shown in Table 1. An additional specimen inventory from chemoprevention trials in prostate cancer can be found.
SWOG specimens are stored in various formats, including frozen (tumor tissue, peripheral blood mononuclear cells (PBMC), whole blood, plasma, and serum) and fixed (formalin-fixed paraffin embedded (FFPE) tissue blocks or slides). The number of patients represented by each collection is also available. As of January 2011, the collective inventory from the solid tumor and hematological cancer banks represents over 330,000 specimens contributed by over 20,000 patients enrolled in SWOG cancer clinical trials since 1984.

The inventory of specimens from completed clinical trials is available for translational research. Details of the clinical trials can be retrieved in one of several ways: 1) using the clinical trials identifier number at <http://clinicaltrials.gov/ct2/search>, 2) accessing the protocol abstract posted on the SWOG website by SWOG Study Number, or 3) via email to biospecimens@swog.org and publications, available in PubMed. The example in Table 2 provides an illustration of the diverse inventory of specimens at the SWOG Solid Tumor Repository for four completed breast cancer clinical studies representing almost 7,000 patients, including specimens of formalin-fixed paraffin embedded (FFPE) tissue sections (Blocks), slides (FFPE slides), whole blood, serum, mononuclear cells (MNC) and plasma frozen in multiple aliquots (1ml, 2ml). Patient identifiers, however, are protected and kept confidential by the SWOG Statistical Center.

---

1 PCPT (http://swog.org/Visitors/pcpt/) and SELECT (http://swog.org/Visitors/select/)
The repositories of specimens from patients with leukemias (myeloid and lymphoid) are composed primarily of frozen cells isolated from bone marrow aspirates and/or peripheral blood obtained at baseline (pre-study), during treatment or at follow-up (including relapses), depending on the study design. For many lymphoma and myeloma patients’ specimens of serum, FFPE blocks are obtained in addition to marrow and peripheral blood cells. The inventory of each tumor type reflects ease of specimen collection and types of trials (mostly phase 2 and 3 trials in advanced disease), for this reason, the number of cases from breast cancer exceeds lung and pancreas tumors. Access to specimens in both solid tumor and hematological cancers follows the same process described below.

**Operation and Policies**

Biospecimens contributed by patients enrolled on SWOG trials are centrally processed for use in protocol-specified research and, when patient permission is granted, banked for future studies. Protection of the participant’s privacy/confidentiality to donate tissues for research is emphasized through informed consent processes that are compliant with federal and local regulatory requirements and approved by IRBs. Individuals participating in SWOG clinical trials maintain their right to withdraw consent for biospecimen collection or for use of their specimen. Research investigators interested in using these specimens must submit an application (described below) and evidence of approval of the proposed research plan from their respective institutional review boards. In addition, investigators must provide sufficient proof of expertise and
funding to complete the proposed studies. SWOG does not provide funding for translational research studies, however, will provide supporting letters in grant applications seeking funding for approved research. There is no cost associated with standard specimen processing, e.g., DNA extraction, PBMNC isolation and creation of frozen cell pellets, however, investigators must pay cost for shipment of specimens to and from the research lab and the SWOG biorepository. The investigator has two years from the date of approval of the research plan to secure funding and initiate research. The research is expected to be completed within two years unless other considerations are mutually agreed upon.

Using established protocols for biospecimen handling, the biorepository staff complies with a manual of standard operating procedures for assisting in procurement, use of specimen collection kits, and specimen processing, storage, tracking and distribution. The quality of the specimens is monitored at many levels beginning with verification of patient and specimen identifiers on receipt in the SWOG Biorepository. Specific quality assurance measures depend on specimen type, and range from assessment of color and turbidity of serum samples, to estimates of tumor cell content in histological sections, to DNA quality and content in extracts of tumor-related specimens. The bank works closely with end users to ensure optimal specimen quality for the intended research platform and specimen requirements such as DNA quantitation or aliquots needed for genotyping assays, e.g., PCR, genotyping, genome analyses, mRNA or miRNA analyses using a variety of platforms. If biospecimens fail quality check using positive and negative internal controls in
the recipient laboratories then the biorepository will replace the specimen when possible. The biorepository will isolate DNA, quantify it by Nanodrop method, and dispense to aliquots as specified or required by specific platforms for shipment to investigators. The lifecycle of each specimen is documented according to processing method, aliquots created of a specific type (DNA, RNA, serum) and specimen integrity. The details of specimen collection schema and methods are included in the clinical study protocol (Section 15, Special Instructions) and details of methods for processing are available upon request should an investigator wish to review a method (e.g., extraction of nucleic acids from a specimen) with the biorepository. The SWOG Operations Office, Statistical Center and Biorepository are governed by SWOG policies that provide oversight for protection of privacy and confidentiality in accordance with guidelines developed by the NCI and consensus statements for the ethical use of specimens in genetics research [1]. SWOG conducts periodic performance reviews through audits at participating institutions to assure compliance with protocol stipulations for tissue collection, federal requirements and local IRB issues. Finally, biospecimen collections are audited annually to ensure accuracy of specimen tracking annotation, standard operating procedures and manual of operations, security and specimen processing, and storage methods and record keeping. In order to evaluate the quality of specimens, the sample integrity is noted on specimen intake, and pathologist review is performed before and after specimens are processed as required by the clinical protocol or research study, for example, review of tumor cellularity, histopathological review, and specific
immunohistochemical assays. If the tumor integrity does not pass the initial evaluation, then a request is sent to the site to submit additional specimens, when available.

**Access and Distribution**

To promote cancer research, SWOG provides an open access application procedure for use of specimens following publication of the primary results of the clinical trial. The process, templates and details are also available on the SWOG website\(^2\) at <www.swog.org>. Submission and distribution of SWOG specimens are tracked using the online Specimen Tracking System, a tool developed by the SWOG Statistical Center.

The process for reviewing applications for access to specimens from the SWOG biorepository involves the following steps:

i) The investigator should become familiar with the clinical data obtained on the clinical trial(s) requested, preferably through review of the published manuscripts describing the patient population and the primary trial results. The investigator must provide preliminary evidence for their hypothesis and describe how achieving the proposed aims is likely to contribute meaningfully to the knowledge base of the research field related to the clinical trial, disease or development of biomarkers.

ii) Investigator submits query by email to ascertain feasibility of request, such as whether needed specimens from the trial(s) are available and whether sample format, quantity and quality are sufficient to perform stated research. Request should be submitted in sufficient detail using forms provided on website http://swog.org/visitors/biorepository/application.asp and emailed to <biospecimens@swog.org>.

iii) Investigator consults with SWOG statisticians on the number of specimens with specified clinical or histopathologic criteria required for their study.

iv) Once notified that the request is feasible, the investigator submits a formal application using the SWOG Translational Medicine Research Proposal template. This formal application includes a scientific research plan with the following elements:

a. Name of principal investigator and location of research

b. Research hypothesis

c. Preliminary data

d. Experimental methods

e. Statistical plan (justification of number of samples requested)

f. Specimen request:

   i. Number of specimens

   ii. Type/amount/processing or special instructions
Running title: Overview of the SWOG Biorepositories

CCR-10-3138

v) The SWOG Triage Committee, consisting of internal and external advisors, meets weekly to review applications. The review follows NIH Grant Review criteria and the application is evaluated on the following categories: significance of proposed research, expertise of investigator(s), innovation, technical approach, and research environment. Investigators are deemed qualified to complete the proposed research based on prior work and institutional support, such as the use of research labs, cores and collaborations.

vi) A written response from the Triage Committee review is then provided to the investigator, indicating approval, revisions requested or rejection of application. Investigators may resubmit revised proposals.

vii) Once approved by the SWOG Triage Committee, SWOG will then submit the application to NCI CTEP (or appropriate CTEP Disease Steering Committee), if the request includes specimens from trials that were conducted by several cooperative groups (Intergroup trials) or from a SWOG trial with a tissue specimen request or patient cohort of 100 or greater.
Following approval(s) of the research plan, authorization of specimen distribution takes place once the following steps are completed:

- Confirmation of regulatory documents (IRB approval) at the submitting investigator’s institution
- Material Use Agreement (MUA) completed by all parties
- Contracts executed by SWOG
- Evidence of adequate funding to complete the research

The overall process for obtaining SWOG specimens is depicted in Figure 1. The timeline for SWOG internal review of the research proposal (steps v and vi above) is approximately 7-10 days. NCI review, such as CTEP and the Disease Steering Committee, when required, typically takes an additional 30-60 days (step vii). Once a research proposal is approved, the next steps are to initiate institutional review board (IRB) applications, negotiate contracts and complete a Material Use Agreement (MUA). The MUA includes provisions outlining use of the specimens, as approved in the research proposal and completion of the project through publication of results. The principal investigator and local host institutions control part of the process involving execution of contracts, MUAs and confirmation of IRB approval, and the timeline to complete these steps is dependent upon diligence at individual sites. Proof of funding sufficient to cover costs of specimen processing, shipment and research is provided by the investigator. Investigators often obtain funding from NIH grants,
such as R01, R21, SPORE program project grants, program project (P) and K awards.

Once the lab research is completed, the principal investigator works with the SWOG Statistical Center to perform the linkage of the laboratory data with the outcome and other clinical data, and the analyses of prognostic or predictive associations. The SWOG Statistical Center maintains the link of codes to patient identification numbers in a secure database so that protection of patient's confidentiality is upheld. In the course of the research, it may be helpful to consult with SWOG statisticians or study coordinators on specific clinical trial endpoints or secondary analyses in order to refine the research hypothesis.

**Selected Examples of Use: Retrospective Studies, Data Analysis and Clinical Annotation**

More recent examples of biospecimen use are shown in Table 3. FFPE tissue has been successfully used for creation of freshly cut tissue microarrays for immunohistochemistry (study SWOG-9313), for preparation of slides for extraction of RNA for measurement of expression of specific genes by quantitative RT-PCR (study SWOG-8814), for gene expression profiling and copy number variation detection (study SWOG-8819), for FISH analysis of gene amplification (S0342), and for genotyping studies (SWOG-9321, C150105, S0124). Secondary research using biospecimens collected may have a significant impact on the primary clinical trial, such as C08405, a clinical study investigating the contribution of either cetuximab or bevacizumab to chemotherapy treatment regimens in advanced colorectal cancer. While this trial
was ongoing, scientific evidence emerged from retrospective studies that genetic mutations in K-ras resulting in constitutive activation of EGFR signal transduction pathways is associated with lack of benefit to cetuximab treatment in colorectal cancer [2]. In response, CTEP and participating groups placed this trial on “clinical hold” in order to conduct confirmatory studies. The biorepository specimens were critically important to confirm the association between the presence of Kras mutations and lack of benefit to treatment using cetuximab, an antibody directed to EGFR. The assays used for confirmatory studies were optimized and performed in a centralized CLIA-certified laboratory of the SWOG biorepository [3]. The clinical study was resumed with modified eligibility criteria incorporating an assay for detection of mutations in Kras for determination of eligibility of patients to enroll in the clinical study. Ultimately, the FDA posted a guidance on the drug label advising molecular testing for the intended use of cetuximab in colorectal cancer3

Research using biospecimens obtained from cancer clinical studies have informed new scientific hypotheses incorporated into new clinical trial designs, such as the following examples:

- Identification of gene expression signatures in multiple myeloma [4] has been incorporated into a prospective study, S0120, "A Prospective Observational Biologic Study of Asymptomatic Patients With Monoclonal Gammopathy and Plasma Proliferative Disorders"

3 http://www.fda.gov/AboutFDA/CentersOffices/CDER/ucm172905.htm (valid as of 3-25-2011)
EGFR status by chromosomal and immunohistochemistry assays is prospectively tested in S0819, advanced non-small cell lung cancer trial incorporating clinical endpoints compared by EGFR FISH positive status [5, 6], and to prospectively test EGFR, K-ras and other biomarkers in association with efficacy⁴.

The prognostic value of the 21-gene recurrence score assay in post-menopausal women with lymph node-positive status treated with chemotherapy evaluated in retrospective studies [7] is currently being tested prospectively in a randomized phase III trial, S1007, A Phase III, Randomized Clinical Trial of Standard Adjuvant Endocrine Therapy +/- Chemotherapy in Patients with 1-3 Positive Nodes, Hormone-responsive and Her2-Negative Breast Cancer according to Recurrence Score (RS)⁵.

Ongoing biospecimen studies also use serum for proteomics, plasma for miRNA profiles, whole blood for circulating tumor cells and peripheral blood mononuclear cells for genotyping and genome wide analysis studies.

Discussion

Future Directions

Translational research using the unique resources of SWOG aims to improve existing treatment or to provide definitive data for developing new

⁴https://swog.org/Members/ClinicalTrials/ViewProtocolDetails.asp?ProtocolID=2143
⁵https://swog.org/Members/ClinicalTrials/ViewProtocolDetails.asp?ProtocolID=2197
therapeutic approaches or validating drug targets, biomarkers or molecular diagnostic markers. By associating such markers with a clinical database with mature endpoints, SWOG facilitates translational research in cancer treatment that ranges from discovery of molecular pathways involved in specific cancer subtypes, to validation and comparative effectiveness of new biomarkers to standard clinical prognostic tools.

New technologies allow more efficient use of any biospecimen resource. For example, genotyping studies now require 5 ng or less of input DNA, and multiplex biomarker assays allow multiples of markers to be interrogated simultaneously. Innovations in isolation of nucleic acid that enable analysis of both RNA and DNA are especially important, given that much of the SWOG solid tumor inventory consists of formalin-fixed paraffin embedded tissues. Limitations presented by older fixation methods on integrity of DNA, RNA and protein have spurred the study of whole genomes and epigenomics markers using unfixed tissue. There is increasing scientific reasons that serve as incentives for increasing the collection of frozen tissue in order to study phosphoproteomics, metabolomics and transcriptome states, and establishing required proper collection facilities and close collaboration with surgeons to ensure that snap-frozen tissues are properly prepared and shipped. More attention is now turned to the science of biospecimen collection, focusing on pre-analytic methods and best practices for specimen processing [8]. The introduction of next generation sequencing technologies will enable more sensitive and robust detection of genomic variation and greater depth of understanding of both global changes in
Recent advances in miRNA detection using archived serum and plasma biospecimens [10] enhance the possibility of using less invasive methods to monitor cancer disease state over time. Detection of epigenetic modulation of the cancer genome [11] is expanding, and this warrants systematic collection of tumor specimens and matched somatic tissues as part of each specimen collection protocol so that comparisons to germline (constitutive DNA profiles) may be determined.

The SWOG biorepository also preserves tissue slides so that molecular markers can be mapped onto the tumor architecture and features of the tumor tissue microenvironment. The introduction of 'virtual' pathology and direct annotation of histomorphological characteristics of the tissue slide provides instant access to this bioresource to a wider panel of experts and investigators. Biospecimen collection is a dynamic process, incorporating best practices to anticipate new technologies and faster turnaround times required by clinical trials that target therapies based on information about drug targets or pathways activated in individual tumors. Capturing these data will provide a database of great depth on populations treated in clinical trials and will offer an opportunity for in silico research on pathways across diseases. SWOG and the cooperative group system provide a valuable resource for retrospective translational research and prospectively planned validation of biomarkers [12] [13]. Together, these tools and processes are intended to increase access to biospecimens and
valuable annotated data related to SWOG clinical trials, and to advance cancer clinical trials into the era of genomic medicine.

References

Acknowledgements: The authors would like to thank patients contributing specimens in the spirit of advancing cancer treatment and research; the staff of the SWOG biorepositories, Operations and Statistical Offices; to Miguel Martinez, Pat Arlauskas, Dana Sparks, Sandi McMillan, Drs. William Barlow, Anne Schott, Frank DeSanto for careful reading of the manuscript; and to Dr. Thea Tlsty and members of the SWOG Genomic Medicine Task Force for advice on sharing resources for facilitating translational cancer research.
Figure 1. Workflow of biospecimens request and clinical data association

Timeline estimated (small box) for each step, dotted line indicates process conducted outside of SWOG and hence timeline is highly variable.
Tables

Table 1. SWOG biospecimen inventory as of January 2011

<table>
<thead>
<tr>
<th>Tumor type</th>
<th># Cases</th>
<th># FFPE Blocks</th>
<th># Stained Slide</th>
<th># Unstained Slide</th>
<th>Whole Blood (1-5x10^6 cells/vial) # (vials)</th>
<th>Serum (1 ml vials)</th>
<th>MNC (1-5x10^6 cells/vial) # (vials)</th>
<th>Plasma (vials)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breast</td>
<td>7,712</td>
<td>5,178</td>
<td>494</td>
<td>32,742</td>
<td>110</td>
<td>30,179</td>
<td>3,405</td>
<td></td>
</tr>
<tr>
<td>GU</td>
<td>920</td>
<td>104</td>
<td>107</td>
<td>2,197</td>
<td>222</td>
<td>1,871</td>
<td>621</td>
<td>3,530</td>
</tr>
<tr>
<td>GI</td>
<td>104</td>
<td>2,500</td>
<td>2,613</td>
<td>5,832</td>
<td>1,619</td>
<td>8,607</td>
<td>1,185</td>
<td>47,506</td>
</tr>
<tr>
<td>HNC</td>
<td>104</td>
<td>3,269</td>
<td>3,134</td>
<td>8,880</td>
<td>1,748</td>
<td>8,696</td>
<td>2,283</td>
<td>51,940</td>
</tr>
<tr>
<td>Leukemia, lymphoid</td>
<td>633</td>
<td><strong>8145</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Leukemia, myeloid</td>
<td>3,110</td>
<td><strong>42190</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lung</td>
<td>1,997</td>
<td>625</td>
<td>464</td>
<td>3,123</td>
<td>102</td>
<td>3,482</td>
<td>4,431</td>
<td>17,692</td>
</tr>
<tr>
<td>Lymphoma</td>
<td>2,968</td>
<td>1,554</td>
<td>1,729</td>
<td>105</td>
<td>127</td>
<td>46</td>
<td>2,303</td>
<td></td>
</tr>
<tr>
<td>Melanoma</td>
<td>123</td>
<td>215</td>
<td>0</td>
<td>64</td>
<td>27</td>
<td>458</td>
<td>66</td>
<td></td>
</tr>
<tr>
<td>Myeloma</td>
<td>1,101</td>
<td>14</td>
<td>1,730</td>
<td>878</td>
<td>16,516</td>
<td>15</td>
<td>234</td>
<td></td>
</tr>
<tr>
<td>*Prostate</td>
<td>1,505</td>
<td>490</td>
<td>240</td>
<td>3,566</td>
<td>8,78</td>
<td>19</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>20,277</td>
<td>13,949</td>
<td>7,052</td>
<td>59,863</td>
<td>4,811</td>
<td>71,656</td>
<td>12,817</td>
<td>126,158</td>
</tr>
</tbody>
</table>

**Grand total** | **316,583**

*Additional biospecimens are available from chemoprevention studies in Cancer Control & Prevention Studies, including Prostate Clinical Prevention Trial (PCPT) and SELECT. More information is available on their respective websites (http://swog.org/Visitors/pcpt/) and (http://swog.org/Visitors/select/).*

Table 2. Illustration of SWOG biospecimen collection for recently closed breast cancer studies.

<table>
<thead>
<tr>
<th>Study</th>
<th>Clinical Trials.gov Identifier</th>
<th>Phase</th>
<th>Histology</th>
<th>Stage</th>
<th>Study Agent(s)</th>
<th>Study Plan (n)</th>
<th>FFPE blocks</th>
<th>Slides</th>
<th>Whole Blood</th>
<th>PBMC</th>
<th>Serum</th>
<th>Plasma</th>
</tr>
</thead>
<tbody>
<tr>
<td>S0215</td>
<td>NCT00041067</td>
<td>II</td>
<td>HER-2 pos.</td>
<td>IV</td>
<td>Docetaxel/Vinorelbine/Fligluzin</td>
<td>29</td>
<td>29</td>
<td>100</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>S0430</td>
<td>NCT00107278</td>
<td>II</td>
<td>Her-2 neg.</td>
<td>IV</td>
<td>Capecitabine/Cyclophosphamide</td>
<td>96</td>
<td>0</td>
<td>0</td>
<td>10</td>
<td>146</td>
<td>357</td>
<td>321</td>
</tr>
<tr>
<td>S0228</td>
<td>NCT00075864</td>
<td>III</td>
<td>Her-2 neg; ER/PgR pos</td>
<td>IV</td>
<td>Anastrozole with or without Fulvestrant</td>
<td>680</td>
<td>341</td>
<td>2019</td>
<td>51</td>
<td>632</td>
<td>11001</td>
<td>1323</td>
</tr>
<tr>
<td>S0307</td>
<td>NCT00127205</td>
<td>III</td>
<td>all</td>
<td>I-III</td>
<td>Bisphosphonates (zoledronate, cladronate or ibandronate)</td>
<td>5400</td>
<td>3434</td>
<td>24547</td>
<td>20</td>
<td>2592</td>
<td>14257</td>
<td>5656</td>
</tr>
</tbody>
</table>
Table 3. Selected examples of biospecimen use

<table>
<thead>
<tr>
<th>SWOG study #</th>
<th>Study title</th>
<th>Cancer</th>
<th>reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>S9313</td>
<td>Multiplexed assessment of the Southwest Oncology Group-directed Intergroup Breast Cancer Trial S9313 by AQUA shows that both high and low levels of HER2 are associated with poor outcome</td>
<td>Breast</td>
<td>Am J Pathol. 176(4):1639-47 (2010).</td>
</tr>
<tr>
<td>S9321</td>
<td>Genetic polymorphisms of EPHX1, Gsk3β, NFκB and myeloma cell DKK-1 expression linked to bone disease in myeloma</td>
<td>Myeloma</td>
<td>Leukemia 23(10):1913-9 (2009)</td>
</tr>
</tbody>
</table>
SWOG Cooperative Group Biorepository Resource: Access for Scientific Research Studies

Carolyn Hoban, Wilbur A Franklin, Kenneth J Kopecky, et al.

*Clin Cancer Res* Published OnlineFirst May 9, 2011.

Author manuscripts have been peer reviewed and accepted for publication but have not yet been edited.

Access the most recent version of this article at:

doi:10.1158/1078-0432.CCR-10-3138

Sign up to receive free email-alerts related to this article or journal.

To order reprints of this article or to subscribe to the journal, contact the AACR Publications Department at pubs@aacr.org.

To request permission to re-use all or part of this article, contact the AACR Publications Department at permissions@aacr.org.