ASCP BOARD OF CERTIFICATION

CG PRACTICE ANALYSIS REPORT

For Development of

CG(ASCP) & CG(ASCP^{i})

Content Guideline and Examination

for CG Exam Publication January 1, 2017

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INTRODUCTION

The purpose of conducting a practice analysis (a.k.a. job analysis or job task analysis) is to provide the foundation of a certification examination by defining practice in a profession. The practice analysis provides evidence of content validation. It is required by psychometric standards and is considered best practices for high-stakes examination development. It also ensures the certification examination is fair, valid, job-related, and most importantly, legally defensible (Chinn and Hertz 2010)[1]. The ASCP Board of Certification (BOC) conducts a practice analysis approximately every five years in accordance with ASCP BOC Policy and requirements of the accrediting body, ANSI (American National Standards Institute), under ANSI/ISO/IEC 17024:2012.

A practice analysis is a formal process for determining or verifying the responsibilities of individuals in the job/profession, the knowledge individuals must possess, and the skills necessary to perform the job at a minimally competent level. The practice analysis process provides a complete and modern understanding of the duties and functions of practicing laboratory professionals. The results of the practice analysis inform the specifications and content of the ASCP BOC certification examinations. The practice analysis process ensures that the examinations are reflective of current practices. It also helps guarantee that individuals who become certified are current and up-to-date on the state of cytogenetics practice and are competent to perform as certified laboratory professionals.

PRACTICE ANALYSIS PROCESS

ASCP BOC conducted a practice analysis survey to inform the Technologist in Cytogenetics (CG) certification examination category.

The process for conducting a practice analysis consists of the following steps:

1. Survey Development
2. Demographics
3. Task Inventory – Knowledge and Skill Questions
4. Rating Criteria
5. Survey Construction
6. Pilot Testing and Revision
7. Survey Distribution
8. Survey Analysis
9. Committee Review and Discussion
10. Examination Content Guideline, Standard Setting, and Exam Publication

SURVEY DEVELOPMENT

During the 2015 ASCP BOC examination committee meeting, the Cytogenetics Examination Committee provided the input and discussion to develop a practice analysis survey. The committee members (subject matter experts) collectively discussed all pertinent aspects of their profession to design a concise survey to extract useful feedback from field professionals while maximizing response rate. The survey had two main components: demographics and task inventory with appropriate rating scales for each.

[1] Chinn, R.N., and N.R. Hertz. 2010. *Job Analysis: A Guide for Credentialing Organizations.* Lexington: Council on Licensure, Enforcement and Regulation (CLEAR).

DEMOGRAPHICS

The demographic questions asked about experience, education, gender, age, titles, work shift, type of facility, areas of lab work, work hours, etc. The purpose of these questions was to aid the committee in deciding whether the sample of respondents obtained was representative of the profession in general. The demographic data provided analytic categories that allowed refinement of the survey population to utilize only those responses from individuals at the targeted professional level.

TASK INVENTORY – KNOWLEDGE AND SKILL QUESTIONS

The committee developed a series of job-related task questions that formed the body of the survey.

The survey had five major sections:

- Specimen Preparation and Culture
- Culture Harvest
- Chromosome Banding, Staining, and Imaging
- Molecular Cytogenetic Testing
- Laboratory Operations

RATING CRITERIA

The rating scale used for the skill-related tasks assessed whether respondents performed the specific task or not in their jobs and if so, asked respondents to rate whether they had basic or advanced knowledge of the concept/protocol.

SURVEY CONSTRUCTION

The practice analysis survey was created and delivered through Key Survey, an electronic survey vendor from Highroad Solution. Using an electronic tool allowed survey review and testing via the internet, email tracking of respondents using email addresses, and the ability to send email reminders for completion of the survey.

PILOT TESTING AND REVISION

The Cytogenetics Committee tested a pilot version of the survey. They reviewed and revised different aspects of the survey (e.g., information correctness, grammar/spelling errors, electronic glitches, correct survey branching, etc.). The pilot testing comments and edits informed the final version of the survey.

SURVEY DISTRIBUTION

The Cytogenetics Committee determined that the survey should be sent to all current CG certificants in the ASCP BOC Personify database. The survey was open for a three-week period between February 11, 2016 – March 2, 2016. ASCP BOC staff also directly emailed the survey to the Cytogenetics Committee and encouraged the committee membership to disseminate the survey to their colleagues. Additionally, the survey link was posted on ASCP social media sites (e.g., Facebook and Twitter).

SURVEY ANALYSIS

The respondents were asked to answer all questions and rate all tasks in the survey. The tasks were divided amongst five major sections (Specimen Preparation and Culture; Culture Harvest; Chromosome Banding, Staining, and Imaging; Molecular Cytogenetic Testing; and Laboratory Operations).

Responses from individuals currently working as a supervisor or manager were considered to be inappropriate for the entry-level CG certification category and were therefore excluded from the analysis.

Any individuals not currently practicing (e.g., retired, unemployed, or simply not working in a clinical cytogenetics laboratory) were removed from the practice analysis survey.

COMMITTEE REVIEW AND DISCUSSION

During the 2016 examination committee meeting, the Cytogenetics Committee reviewed the practice analysis results. They agreed that the demographic results accurately reflected the CG population **(Appendix A)**.

In general, tasks performed by at least 40% of the respondents were retained on the task list and considered valid to be on the examination. The committee reviewed all tasks performed by less than 40% of the respondents. If the committee determined that these tasks were critical to patient care and/or were up-and-coming in practice, then the task was retained on the task list and considered valid for the examination. If the task was considered outdated or too esoteric, then it was removed from the task list and the exam. The committee decisions were compiled into the Final Task List for CG **(Appendix B)** which informed the exam content guideline and the content for the certification exam.

EXAMINATION CONTENT GUIDELINE, STANDARD SETTING, AND EXAM PUBLICATION

The committee revised the CG exam content guideline to reflect the practice analysis results. They reviewed the exam content area percentages and decided where to set them based on the results of the practice analysis. The committee reviewed the exam database according to the new content guideline and deleted or revised questions accordingly. They wrote new questions to fulfill the new content guideline, and reclassified questions according to the new guideline. After this work was completed, the committee set a new standard for the exam, and the new exam database was published.

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Appendix A

TECHNOLOGIST IN CYTOGENETICS (CG)

DEMOGRAPHIC ANALYSIS

Total respondents: 464
Total usable: 288

Usable individual respondents met the following criteria:

- Currently employed in a clinical cytogenetics laboratory
- Primary role is technologist

Summary:

- Certifications: individuals may have multiple credentials
  - 94% are CG certified
  - 7% are MLS certified
- Education:
  - 1% have an associate degree or lower
  - 83% have a baccalaureate degree or post-baccalaureate program certificate
  - 16% have a master's degree or higher
- Experience:
  - 41% have 10 years or less
  - 33% have 11 – 20 years
  - 26% have 20 or more years
- Geographic Distribution: there are respondents from across the U.S., and states with the highest response rate include:
  - 16% from Minnesota
  - 10% from California
  - 7% each from Texas and Tennessee
  - 5% from Ohio and Washington
- Facility:
  - 54% work in hospitals
  - 36% work in independent laboratories
  - 10% work in other types of facilities
- Age:
  - 13% are younger than 30 years of age
  - 77% are between 30 – 59 years of age
  - 10% are over 60 years of age
- Gender:
  - 85% are female
  - 15% are male

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Appendix B

TECHNOLOGIST IN CYTOGENETICS (CG)

FINAL TASK LIST (TOPICS KEPT ON EXAM BASED ON PRACTICE ANALYSIS RESULTS)

SPECIMEN PREPARATION AND CULTURE
SPECIMEN PREPARATION
1. Providing specimen requirements to referral personnel (e.g., size, containers, transport conditions)
2. Specimen assessment for quality factors (e.g., viability, cellularity, contamination)
3. Troubleshooting compromised or unacceptable specimens
4. Assessment of specimens for multiple tests
5. Verification of patient information and test order
6. Assigning of test priority
SPECIMEN CULTURE
7. Preparation of prenatal or tumor specimens for long-term, adherent cell cultures (e.g., dissection, enzymatic disaggregation)
8. Preparation of blood or bone marrow specimens for short-term suspension cell cultures
9. Selection of optimal tissue for culture
10. Determination of number of cultures per specimen
11. Preparation of media (e.g., supplements, culture conditions)
12. Aseptic culture technique to prevent cross-contamination between cultures and microbial contamination
13. Contamination: detection, identification, and control
14. Culture maintenance
15. Evaluating/subculturing monolayer cells
16. Assessment of culture for harvest
17. Investigation/documentation of culture failures
CULTURE HARVEST
18. Harvest of in situ or monolayer cultures
19. Harvest of suspension cultures
20. Chromosome elongation techniques (e.g., synchronization, intercalation)
21. Selection, preparation, and use of mitotic inhibitors, hypotonic solutions, fixatives, and processing times
22. Storage of fixed cell pellets
23. Selection of conditions for slide preparation
24. Assessment of slide quality (e.g., cell density, chromosome morphology, metaphase spreading)
25. Troubleshooting slide preparations
26. Assessment of mitotic index and need for additional slides
27. Recognition and troubleshooting of harvest failures (i.e., reagents, equipment, suboptimal specimens)

CHROMOSOME BANDING, STAINING, AND IMAGING

CHROMOSOME BANDING AND STAINING

28. Aging of slides
29. G-banding
30. Assessment and troubleshooting of staining/banding

MICROSCOPES AND IMAGING SYSTEMS

31. Microscopes (e.g., brightfield, fluorescent, phase)
32. Identification of microscope components and functions
33. Achieving optimal resolution
34. Troubleshooting microscopy
35. Capturing images
36. Enhancing images
37. Troubleshooting imaging

CHROMOSOME SELECTION, ANALYSIS, AND DOCUMENTATION

38. Selection, counting, and analysis of metaphases
39. Review of previous or related results
40. Analysis of appropriate number of cells based on specimen type
41. Analysis of appropriate number of cultures based on specimen type
42. Documentation of chromosome analysis (e.g., chromosome count, metaphase identifiers)
43. Analysis of metaphases for identification of structural and numerical chromosome abnormalities
44. Identification of chromosome abnormalities (e.g., numerical, structural, mosaicism)
45. Identification of cultural artifacts, instability syndromes, and normal variants
46. Troubleshooting chromosome analysis (e.g., discrepancies, multiple cell lines)
47. Arrangement of chromosomes using an approved format
48. Assessment of band level
49. Recording of results using ISCN
50. Selection of representative images
51. Preparation of appropriate number of karyograms
52. Clinical implications of chromosome analysis: constitutional, acquired, variants
53. Document reporting of preliminary results per regulatory guidelines

MOLECULAR CYTOGENETIC TESTING

FLUORESCENCE IN SITU HYBRIDIZATION (FISH)

54. Evaluation of specimen quality
55. Evaluation of analysis type (i.e., interphase or metaphase)
56. Identification of appropriate probe strategy (e.g., break-apart, fusion, amplification, enumeration)

57. Slide processing (e.g., denaturation, hybridization, post-hybridization wash, counterstain)
58. Identification of signal patterns for probe strategies (e.g., microdeletion, translocation, enumeration)
59. Scoring and interpretation of cells based on the probe strategies
60. Capturing of representative cell images
61. Documentation of FISH analysis using ISCN nomenclature
62. Troubleshooting FISH
63. Validation of probes and establishing reference ranges and cut-offs
64. Use of parallel positive/negative controls
MICROARRAY
65. Description of the theory and limitations of the technique
66. Evaluating adequacy and processing of specimens
67. Performance of cytogenetic and SNP microarrays
68. Evaluation of results
69. Identify, interpret, and report results with clinical relevance
70. Confirmation of results with routine cytogenetic studies/FISH
71. Quality control and validation of specific platform and sample type
LABORATORY OPERATIONS
LABORATORY PRACTICE
72. Specimen labeling
73. Reagent preparation, labeling and storage
74. Cleaning/decontamination: instruments, equipment, and work surfaces
75. Monitoring of laboratory supplies and chemicals (e.g., adequacy, expiration dates)
76. Use of appropriate retention times (e.g., specimens, cultures, analysis, images, reports)
EQUIPMENT OPERATION AND MAINTENANCE
77. General laboratory equipment (e.g., incubators, waterbaths, hoods)
78. Slide preparation equipment (e.g., Thermotron®)
79. Automated slide processing equipment (e.g., VP2000)
80. Automated specimen processing equipment (e.g., Hanabi, Genial/Tecan)
81. Automated imaging/analysis equipment (e.g., GSL, MetaSystems, BioView®)
LABORATORY SAFETY
82. Biological hazard safety (e.g., PPE, biological hazard spills)
83. Chemical safety (e.g., storage, spill clean-up)
84. Fire safety (e.g., drills, extinguishers)
85. Proper ergonomics (e.g., posture, chair adjustment)
86. Documentation/notification of laboratory accidents (e.g., needle sticks, spills, splashes)
87. Regulatory considerations (e.g., safety inspections, incident reporting)
88. Participation in safety training (e.g., fire, biological hazards)

QUALITY MANAGEMENT AND CONTINUOUS QUALITY IMPROVEMENT
89. Monitoring of equipment function (e.g., outages, maintenance)
90. Monitoring of reagent performance and/or sterility
91. Documentation of the investigation of each culture or probe failure
92. Recording of quality indicators (e.g., resolution, band length, turn-around-time, error reporting)
93. Documentation of participation in laboratory proficiency testing
94. Participation in accreditation site inspections (e.g., CAP)
95. Completion/documentation of training and competency assessments
PROFESSIONAL STANDARDS
96. Professional ethics and/or standards
97. Regulatory compliance (e.g., HIPAA, OSHA, EPA, homeland security, state, and local)