

**The Potential Workforce Development
Implications Of the Development Of
The East Baltimore Biotech Park And
The UMB Research Park**

Report Prepared For:

**The Empower Baltimore
Management Corporation**

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The Empower Baltimore Management Corporation

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Executive Summary

The Empower Baltimore Management Corporation (EBMC) retained the Jacob France Institute of the University of Baltimore to conduct an analysis of potential workforce development implications of the development of the East Baltimore Biotech Park and the University of Maryland, Baltimore Research Park. These two developments have the potential to assist in the transformation of Baltimore City into a major center for high technology and biotechnology employment. The EBMC commissioned this report for three reasons:

1. To identify the number of jobs based upon skills that might be available for low skill workers in Baltimore City.
2. To identify the skill sets and the education levels required for the jobs being created so that EBMC and the City can help prepare workers for these opportunities. For example, the EBMC has provided customized training for surgical technicians for area hospitals and clean room laboratory technicians for Chesapeake Biological Technology.
3. To help biotech businesses identify the available opportunities to train and promote workers through targeted training and skills development efforts.

This analysis consisted of three steps:

- a) The estimation of the occupational composition of the jobs created by the development of the East Baltimore Biotech Park and the UMB Research Park;
- b) An analysis of the occupational employment projections for the two developments by the level of formal education and training required by each occupation; and
- c) A presentation of information on the most important entry-level (lower formal education or training requirements) positions.

This analysis found that 37% of the estimated number of jobs at the two parks could be classified as lower education/training level jobs that only require work experience or on-the-job training. One percent (1%) of jobs require post-secondary vocational training, 9% require an associate degree, and 36% require a bachelor's degree or above. This analysis validates the findings of the Brophy report on the East Baltimore Biotech Park, which found that one-third (33%) of employment opportunities will be appropriate for high school graduates. This finding, however, is not consistent with the recent *Baltimore Bioscience Initiative: a Bioscience Sectoral Employment Strategic Plan*, which found that only 12% to 15% of employment in the Baltimore Bioscience sector are in positions that do not require a baccalaureate degree. Potential factors that contribute to the differences between this analysis and the *Baltimore Bioscience Initiative* analysis are explored in the text.

The growth of the biotechnology sector in Baltimore City stimulated by the development of the two proposed research parks will create significant new employment opportunities for Baltimore City residents. Employment opportunities will be created for both highly skilled research personnel and lower skilled research support and production personnel. However, workers in the biotechnology sector require industry specific skills and training even for lower skill and entry level jobs. In order for City residents to be able to compete for and fill these job opportunities, the City will need to create opportunities for residents to obtain the required skills and training. Otherwise, due to the high level of education and skills already existing in the overall Maryland and regional workforce, these job opportunities are likely to be filled by suburban commuters.

1.0 Introduction

The Empower Baltimore Management Corporation (EBMC) retained the Jacob France Institute of the Merrick School of Business at the University of Baltimore (The France Institute) to prepare an analysis of the potential workforce development implications of the development of the East Baltimore Biotech Park and the University of Maryland, Baltimore (UMB) Research Park. The EBMC commissioned this report for three reasons:

1. To identify the number of jobs based upon skills that might be available for low skill workers in Baltimore City.
2. To identify the skill sets and the education levels required for the jobs being created so that EBMC and the City can help prepare workers for these opportunities. For example, the EBMC has provided customized training for surgical technicians for area hospitals and clean room laboratory technicians for Chesapeake Biological Technology.
3. To help biotech businesses identify the available opportunities to train and promote workers through targeted training and skills development efforts.

The goals of this analysis are to:

- Estimate the occupational composition of the jobs created by the development of the East Baltimore Biotech Park and the UMB Research Park;
- Analyze the occupational employment projection for the two developments by the level of formal education and training required by each occupation; and
- Present information on the most important entry-level (lower formal education or training requirements) positions.

This report used occupational staffing information from the U.S. Bureau of Labor Statistics (BLS) Occupational Employment Statistics (OES) program. The OES program collects data on wage and salary workers in non-farm establishments in order to produce employment and wage estimates for over 700 occupations. Data from self-employed persons are not collected and are not included in the estimates. The OES program produces these occupational estimates by geographic area and by industry. This analysis is based on the 2000 OES National Industry-Specific Occupational Employment and Wage Estimates by industry data. This data includes occupational employment and wage estimates for over 400 industry classifications at the national level. The industry classifications correspond to the 2- and 3-digit Standard Industrial Classification (SIC) industrial groups.

2.0 The Direct Employment Impact Of The Proposed East Baltimore Biotech Park And The UMB Research Park

The development of the East Baltimore Biotech Park and the UMB Research Park represents a significant opportunity to not only reverse the declines that have occurred in economic activity and employment within Baltimore City but actually assist in transforming the City into a major high technology center. This report is not a feasibility study for the two proposed developments. It does not evaluate or test the projections made in the various feasibility studies conducted for the East Baltimore Biotech Park or information provided on the

UMB Research Park. This study simply uses the employment estimates from the available feasibility studies for the East Baltimore Biotech Park¹ and derives its own estimates for the UMB Research Park in a manner consistent with the East Baltimore Biotech Park study.

The first step in this analysis is the development of an estimate for the size and industry composition of the projected employment for the two developments. The final estimate available for the employment impact of the East Baltimore Biotech Park was for a total of 8,000 jobs to be created once the project is fully developed and leased. The total employment in the UMB Research Park is estimated at 3,000², for a total of 11,000 jobs to be created directly in the two developments.

There was no data available on the expected distribution of this employment by industry. Thus, an estimate of employment by industry was made. There is a general consensus that both the East Baltimore Biotech Park and the UMB Research Park will be focused on biotechnology and related companies. However, there is no generally accepted industry-based definition of the biotechnology sector. For example, in its analysis of high technology employment in Maryland, the Maryland Department of Labor, Licensing and Regulation (DLLR) has developed a definition of the Biotechnology and Biomedical sector. This industry-based definition includes Standard Industrial Classification (SIC) codes 283 - Medicinals and Botanicals (pharmaceuticals), 384 - Medical Instruments and Supplies, and 385 - Ophthalmic Goods. This definition is restrictive and only includes pharmaceutical and medical equipment production. Many biotechnology firms are classified in other industry classifications, most importantly High Technology Research, another high technology sector analyzed by DLLR. Because of the proximity of the East Baltimore Biotech Park to the Johns Hopkins Medical School and Hospital and the UMB Research Park to the UMB Medical School and University of Maryland Medical System, it is likely that a significant portion of the firms attracted to the site will be involved in general medical and biotechnology research and even medical testing in addition to pharmaceutical and medical instrument production. Thus, this analysis bases its estimate of the industry of employment for the 11,000 jobs projected to be created by the two developments on the state-level distribution of employment in the combined Biotechnology and Biomedical and High Technology Research³ sectors in 2000. As presented in Table 1, the East Baltimore Biotech Park and the UMB Research Park are projected to create 11,000 jobs, 2,487 (23%) jobs in the Biotechnology and Biomedical Sector and 8,513 in the High Technology Research sector (77%).

¹ *The East Baltimore Study: Final Report*, by Urban Design Associates, Brophy & Reilly, Glatting Jackson, Nottingham & Associates, and Zimmerman Volk Associates.

² Estimated by dividing the total square footage of the UMB Research Park – 500,000 square feet in Phase I and 250,000 square feet in Phase II or a total of 750,000 square feet by an estimated one employee per 250 square feet of space. This is the same employment per square foot figure used in the East Baltimore Biotech Park study.

³ The DLLR High Tech Research classification includes both engineering and research services. The industry classification used in this analysis is research, development and testing - SIC 873 only.

Table 1
Direct Employment Impacts Of The
East Baltimore Biotech Park And The UMB Research Park On Baltimore City

Industry	East				Total	
	Baltimore Biotech Park	UMB Research Park Total	Phase I	Phase II	Baltimore City	% of Total
<u>Total Employment</u>	<u>8,000</u>	<u>3,000</u>	<u>2,000</u>	<u>1,000</u>	<u>11,000</u>	<u>100%</u>
Biotechnology and Biomedical	1,809	678	452	226	2,487	23%
Pharmaceutical Manufacturing	1,361	510	340	170	1,871	17%
Medical Instruments/Ophthalmic Goods	448	168	112	56	616	6%
High Technology Research	6,191	2,322	1,548	774	8,513	77%

Source: The Jacob France Institute, EBMC.

3.0 The Occupational Distribution Of The Direct Employment Created By The East Baltimore Biotechnology Park And The UMB Research Park

Once the data for the size and industrial composition of the projected employment for the East Baltimore Biotech Park and the UMB Research Park are available, it is possible to use the BLS-OES data to estimate the occupational profile of the jobs being created. The BLS-OES data includes information on the percentage of each industry's total employment that is in a particular occupation. The occupations used are from the Standard Occupational Classification (SOC) system. The new SOC system, which will be used by all Federal statistical agencies for reporting occupational data, consists of 821 detailed occupations, grouped into 449 broad occupations, 96 minor groups, and 23 major groups.

The employment by industry information presented in Table 1 was multiplied by the occupational employment information from the BLS-OES program to estimate the occupational profile of each industry. The 11,000 total jobs created by the East Baltimore Biotech Park and the UMB Research Park were divided into the 316 occupations present in the three industries modeled.

A core goal of this analysis was to identify the occupational opportunities for lower-skilled individuals. Once the distribution of employment by occupation was estimated, it was possible to describe the formal educational and training requirements for the occupations. The BLS has developed an eleven-point occupational and educational training classification system. The system is presented in Table 2. This data can be linked to the occupational employment information in order to classify occupations by their formal educational and training requirements.⁴

⁴ Not all occupations linked perfectly to an education/training code. Where the education/training requirements were not available they were estimated by France Institute personnel using O*NET or other occupational classification tools.

Table 2
BLS Training and Education Codes

BLS Education		BLS Education	
Code	Description	Code	Description
1	First professional degree	7	Postsecondary vocational award
2	Doctoral degree	8	Work experience in a related occupation
3	Master's degree	9	Long-term on-the-job training
4	Degree plus work experience	10	Moderate on-the-job training
5	Bachelor's degree	11	Short-term on-the-job training
6	Associate degree		

Source: BLS

The results of this analysis are presented in Table 3 and Table 4. The total distribution of employment by education and training level for the two developments by industry is presented in Table 3. As presented in Table 3, 37% of the estimated number of jobs at the two parks can be classified as lower education/training level jobs that only require work experience or on-the-job training. One percent (1%) of jobs require postsecondary vocational training, 9% require an associate degree, and 36% require a bachelor's degree or above. It is important to note that 17% of occupational employment could not be classified into occupations or classified by education or training level. Some occupational information was suppressed in the BLS-OES data and some was only available at a high level of aggregation and could not be used in this analysis.

Table 3
Employment by Educational Level

Educational Level	Drugs		Medical Instruments and Supplies		Research & Development		Total	% of Total
	Total	% of Total	Total	% of Total	Total	% of Total		
Total	1,871	100%	616	100%	8,513	100%	11,000	100%
First Professional Degree	5	0%	0	0%	15	0%	21	0%
Doctoral degree	0	0%	0	0%	41	0%	41	0%
Master's degree	2	0%	0	0%	83	1%	84	1%
Degree plus work experience	117	6%	39	6%	1,033	12%	1,189	11%
Bachelor's degree	321	17%	64	10%	2,270	27%	2,654	24%
Associate degree	120	6%	15	2%	908	11%	1,042	9%
Postsecondary vocational award	5	0%	7	1%	54	1%	66	1%
Work experience in a related occupation	86	5%	27	4%	198	2%	311	3%
Long-term on-the-job training	140	7%	52	8%	144	2%	336	3%
Moderate-term on-the-job training	530	28%	240	39%	990	12%	1,761	16%
Short-term on-the-job training	349	19%	96	16%	1,202	14%	1,647	15%
Unallocated	197	11%	75	12%	1,575	18%	1,848	17%

Source: EBMC, The Jacob France Institute, and the BLS.

Table 4 presents total employment and the education and training level required by occupational for all major biotechnology-related⁵ occupations with more than 50 employees.

⁵ The BLS-OES industry occupational information was available only by major industry. The data for Standard Industrial Classification (SIC) code 873 Research and Testing Services combines biomedical and biotechnology research with other types of scientific and social science research and testing. Thus, this analysis is based on a broader industry classification than is likely to locate in either of the two parks. This may skew the results of this analysis. However, it is likely that the two developments will attract at least some number of non-biotech research operations.

Table 4
Leading Biotechnology Related Occupations

Occupation	Number of Jobs	Education Level
Chemists	329	Bachelor's degree
Team Assemblers	308	Moderate-term on-the-job training
Executive Secretaries and Administrative Assistants	300	Moderate-term on-the-job training
General and Operations Managers	272	Degree plus work experience
Biological Technicians	258	Associate degree
Medical Scientists, Except Epidemiologists	233	Bachelor's degree
Chemical Technicians	222	Associate degree
Office Clerks, General	220	Short-term on-the-job training
Secretaries, Except Legal, Medical, and Executive	207	Moderate-term on-the-job training
Inspectors, Testers, Sorters, Samplers, and Weighers	205	Moderate-term on-the-job training
Packaging and Filling Machine Operators and Tenders	143	Short-term on-the-job training
First-Line Supervisors / Managers of Office and Admin. Support Workers	126	Work experience in a related occupation
Management Analysts	118	Degree plus work experience
Market Research Analysts	116	Bachelor's degree
Natural Sciences Managers	113	Degree plus work experience
Engineering Managers	110	Degree plus work experience
Maintenance and Repair Workers, General	105	Long-term on-the-job training
Chief Executives	104	Degree plus work experience
Bookkeeping, Accounting, and Auditing Clerks	100	Moderate-term on-the-job training
Biochemists and Biophysicists	95	Bachelor's degree
Computer Programmers	94	Bachelor's degree
Electrical and Electronic Engineering Technicians	93	Associate degree
Accountants and Auditors	92	Bachelor's degree
Electrical Engineers	90	Bachelor's degree
First-Line Supervisors / Managers of Production and Operating Workers	86	Work experience in a related occupation
Mechanical Engineers	85	Bachelor's degree
Customer Service Representatives	85	Moderate-term on-the-job training
Computer and Information Systems Managers	77	Degree plus work experience
Financial Managers	77	Degree plus work experience
Human Resources Managers	77	Degree plus work experience
Computer Software Engineers, Applications	71	Bachelor's degree
Marketing Managers	70	Degree plus work experience
Computer Software Engineers, Systems Software	69	Bachelor's degree
Data Entry Keyers	68	Moderate-term on-the-job training
Computer Systems Analysts	66	Bachelor's degree
Sales Reps., Wholesale and Manufacturing, Technical and Scientific Products	64	Moderate-term on-the-job training
Administrative Services Managers	62	Degree plus work experience
Mixing and Blending Machine Setters, Operators, and Tenders	59	Moderate-term on-the-job training
Receptionists and Information Clerks	59	Short-term on-the-job training
Microbiologists	59	Bachelor's degree
Janitors and Cleaners, Except Maids and Housekeeping Cleaners	57	Short-term on-the-job training
Computer Support Specialists	57	Associate degree
Registered Nurses	55	Associate degree
Environmental Science and Protection Technicians, Including Health	54	Associate degree
Production, Planning, and Expediting Clerks	53	Short-term on-the-job training
Mechanical Engineering Technicians	52	Associate degree
Environmental Scientists and Specialists, Including Health	51	Bachelor's degree
Shipping, Receiving, and Traffic Clerks	50	Short-term on-the-job training

Source: EBMC, The Jacob France Institute, and the BLS.

4.0 Analysis of Findings

This report's finding that 37% of employment opportunities created by the East Baltimore Biotech Park and the UMB Research Park will not require advanced degrees validates the analysis conducted by Brophy et al⁶, which found that one-third (33%) of employment opportunities will be appropriate for high school graduates. This finding, however, is not consistent with the recent *Baltimore Bioscience Initiative: a Bioscience Sectoral Employment Strategic Plan*, which found that only 12% to 15% of employment in the Baltimore Bioscience sector are in positions that do not require a baccalaureate degree. A core potential source of this difference is this analysis' use of aggregate, national occupational staffing patterns on local employment estimates. As described in footnote 3 (above), occupational employment for SIC 873 was only available for all research and testing companies, not for biotechnology and biomedical companies only. If the occupational staffing and education/training profile of biotechnology-biomedical companies is significantly different than the sector as a whole, this could skew the results of this analysis. Furthermore, this analysis uses national average industry, rather than local industry, occupational staffing patterns. Thus, Maryland's research oriented activities are being "averaged" with national, production-oriented activities. Finally, the BLS education/training information is based on average basic educational/training levels. Firms may apply more restrictive criteria. These differences may lead to a higher estimate of lower education/training level jobs than the survey and interviewed based *Baltimore Bioscience Initiative* study. However, local occupational employment estimates were not available. Given these issues, it is the analyst's belief that the East Baltimore Biotech Park and the UMB Research Park are likely to attract a broad-based group of tenants that are similar in size and composition to the industries analyzed in this report.

This analysis indicates that the development of the East Baltimore Biotech Park and the UMB Research Park is likely to create a number of employment opportunities for lower-skilled workers. These positions will require specialized training programs from organizations such as the Biotechnical Institute of Maryland, Inc. As a tool for planning, a description of each of the occupations with more than 75 jobs that only require work experience or on-the-job training is included in Appendix A. A description of each of the occupations with more than 75 jobs that require an Associate degree are also presented in Appendix B, given that these positions could potentially be filled with individuals receiving specialized training or certificates.

⁶ See note #1.

Appendix A
Leading Lower Education Level Jobs Associated With the Development
Of the East Baltimore Biotech Park

Team Assemblers

308 Jobs

Work as part of a team having responsibility for assembling an entire product or component of a product. Team assemblers can perform all tasks conducted by the team in the assembly process and rotate through all or most of them rather than being assigned to a specific task on a permanent basis. May participate in making management decisions affecting the work. Team leaders who work as part of the team should be included.

This occupation is a newly defined occupation within O*NET for which no data are yet available.

Executive Secretaries and Administrative Assistants

300 Jobs

Provide high-level administrative support by conducting research, preparing statistical reports, handling information requests, and performing clerical functions such as preparing correspondence, receiving visitors, arranging conference calls, and scheduling meetings. May also train and supervise lower-level clerical staff.

Baltimore Metro Median Annual Salary: \$34,590

Education and Training Requirements

Overall Experience	A minimum of two to four years of work-related skill, knowledge, or experience is needed for these occupations.
Job Training	Employees in these occupations usually need several years of work-related experience, on-the-job training, and/or vocational training.
Education	Most of these occupations require a four-year bachelor's degree, but some do not.

Occupational Requirements

- Approving requests, handling paperwork, and performing day-to-day administrative tasks.
- Providing information to supervisors, fellow workers, and subordinates. This information can be exchanged face-to-face, in writing, or via telephone/electronic transfer.
- Identifying underlying principles, reasons, or facts by breaking down information or data into separate parts.
- Observing, receiving, and otherwise obtaining information from all relevant sources.
- Compiling, coding, categorizing, calculating, tabulating, auditing, verifying, or processing information or data.
- Monitoring and controlling resources and overseeing the spending of money.
- Coordinating members of a work group to accomplish tasks.

- Translating or explaining what information means and how it can be understood or used to support responses or feedback to others.
- Combining, evaluating, and reasoning with information and data to make decisions and solve problems. These processes involve making decisions about the relative importance of information and choosing the best solution.
- Developing constructive and cooperative working relationships with others.

Required Skills

Skills	Skill Definitions
Reading Comprehension	Understanding written sentences and paragraphs in work related documents
Writing	Communicating effectively with others in writing as indicated by the needs of the audience
Coordination	Adjusting actions in relation to others' actions
Synthesis/Reorganization	Reorganizing information to get a better approach to problems or tasks
Time Management	Managing one's own time and the time of others
Speaking	Talking to others to effectively convey information
Information Organization	Finding ways to structure or classify multiple pieces of information
Monitoring	Assessing how well one is doing when learning or doing something
Active Listening	Listening to what other people are saying and asking questions as appropriate
Management of Material Resources	Obtaining and seeing to the appropriate use of equipment, facilities, and materials needed to do certain work

Perform duties too varied and diverse to be classified in any specific office clerical occupation, requiring limited knowledge of office management systems and procedures. Clerical duties may be assigned in accordance with the office procedures of individual establishments and may include a combination of answering telephones, bookkeeping, typing or word processing, stenography, office machine operation, and filing.

Baltimore Metro Median Annual Salary: \$24,030

Education and Training Requirements

Overall Experience	No previous work-related skill, knowledge, or experience is needed for these occupations.
Job Training	Employees in these occupations need anywhere from a few days to a few months of training. Usually, an experienced worker could show how to do the job.
Education	These occupations may require a high school diploma or GED certificate. Some may require a formal training course to obtain a license.

Occupational Requirements

- Entering, transcribing, recording, storing, or maintaining information in either written form or by electronic/magnetic recording.
- Compiling, coding, categorizing, calculating, tabulating, auditing, verifying, or processing information or data.
- Communicating with persons outside the organization, representing the organization to customers, the public, government, and other external sources. This information can be exchanged face-to-face, in writing, or via telephone/electronic transfer.
- Approving requests, handling paperwork, and performing day-to-day administrative tasks.
- Observing, receiving, and otherwise obtaining information from all relevant sources.
- Controlling computer functions by using programs, setting up functions, writing software, or otherwise communicating with computer systems.
- Providing information to supervisors, fellow workers, and subordinates. This information can be exchanged face-to-face, in writing, or via telephone/electronic transfer.
- Developing constructive and cooperative working relationships with others.
- Using one's own hands and arms in handling, installing, forming, positioning, and moving materials, or in manipulating things, including the use of keyboards.
- Evaluating information against a set of standards and verifying that it is correct.

Required Skills

Skills	Skill Definitions
Reading Comprehension	Understanding written sentences and paragraphs in work related documents
Writing	Communicating effectively with others in writing as indicated by the needs of the audience
Information Organization	Finding ways to structure or classify multiple pieces of information
Speaking	Talking to others to effectively convey information
Active Listening	Listening to what other people are saying and asking questions as appropriate
Mathematics	Using mathematics to solve problems
Product Inspection	Inspecting and evaluating the quality of products
Information Gathering	Knowing how to find information and identifying essential information

Secretaries, Except Legal, Medical, and Executive

207 Jobs

Perform routine clerical and administrative functions such as drafting correspondence, scheduling appointments, organizing and maintaining paper and electronic files, or providing information to callers.

Baltimore Metro Median Annual Salary: \$24,490

Education and Training Requirements

Overall Experience	Some previous work-related skill, knowledge, or experience may be helpful in these occupations, but usually is not needed.
Job Training	Employees in these occupations need anywhere from a few months to one year of working with experienced employees.
Education	These occupations usually require a high school diploma and may require some vocational training or job-related course work. In some cases, an associate's or bachelor's degree could be needed.

Occupational Requirements

- Providing information to supervisors, fellow workers, and subordinates. This information can be exchanged face-to-face, in writing, or via telephone/electronic transfer.
- Communicating with persons outside the organization, representing the organization to customers, the public, government, and other external sources. This information can be exchanged face-to-face, in writing, or via telephone/electronic transfer.
- Controlling computer functions by using programs, setting up functions, writing software, or otherwise communicating with computer systems.
- Developing constructive and cooperative working relationships with others.

- Compiling, coding, categorizing, calculating, tabulating, auditing, verifying, or processing information or data.
- Observing, receiving, and otherwise obtaining information from all relevant sources.
- Performing for people or dealing directly with the public, including serving persons in restaurants and stores, and receiving clients or guests.
- Approving requests, handling paperwork, and performing day-to-day administrative tasks.
- Entering, transcribing, recording, storing, or maintaining information in either written form or by electronic/magnetic recording.
- Evaluating information against a set of standards and verifying that it is correct.

Required Skills

Skills	Skill Definitions
Active Listening	Listening to what other people are saying and asking questions as appropriate
Coordination	Adjusting actions in relation to others' actions
Writing	Communicating effectively with others in writing as indicated by the needs of the audience
Reading Comprehension	Understanding written sentences and paragraphs in work related documents
Information Organization	Finding ways to structure or classify multiple pieces of information
Service Orientation	Actively looking for ways to help people
Speaking	Talking to others to effectively convey information
Time Management	Managing one's own time and the time of others

Production Inspectors, Testers, Graders, Sorters, Samplers, Weighers 205 Jobs

Inspect, test, grade, sort, sample, or weigh nonagricultural raw materials or processed, machined, fabricated, or assembled parts or products. Work may be performed before, during, or after processing.

Baltimore Metro Median Annual Salary: \$31,560

Education and Training Requirements

Overall Experience	No previous work-related skill, knowledge, or experience is needed for these occupations.
Job Training	Employees in these occupations need anywhere from a few days to a few months of training. Usually, an experienced worker could show how to do the job.
Education	These occupations may require a high school diploma or GED certificate. Some may require a formal training course to obtain a license.

Occupational Requirements

- Inspecting or diagnosing equipment, structures, or materials to identify the causes of errors or other problems or defects.
- Monitoring and reviewing information from materials, events, or the environment, often to detect problems or to find out when things are finished.
- Identifying information received by making estimates or categorizations, recognizing differences or similarities, or sensing changes in circumstances or events.
- Observing, receiving, and otherwise obtaining information from all relevant sources.
- Evaluating information against a set of standards and verifying that it is correct.
- Entering, transcribing, recording, storing, or maintaining information in either written form or by electronic/magnetic recording.
- Making judgments about or assessing the value, importance, or quality of things or people.
- Using one's own hands and arms in handling, installing, forming, positioning, and moving materials, or in manipulating things, including the use of keyboards.
- Identifying underlying principles, reasons, or facts by breaking down information or data into separate parts.
- Providing information to supervisors, fellow workers, and subordinates. This information can be exchanged face-to-face, in writing, or via telephone/electronic transfer.

Required Skills

Skills	Skill Definitions
Product Inspection	Inspecting and evaluating the quality of products
Testing	Conducting tests to determine whether equipment, software, or procedures are operating as expected
Problem Identification	Identifying the nature of problems
Operation Monitoring	Watching gauges, dials, or other indicators to make sure a machine is working properly
Information Gathering	Knowing how to find information and identifying essential information
Mathematics	Using mathematics to solve problems
Reading Comprehension	Understanding written sentences and paragraphs in work related documents
Information Organization	Finding ways to structure or classify multiple pieces of information
Writing	Communicating effectively with others in writing as indicated by the needs of the audience

Operate or tend machines to prepare industrial or consumer products for storage or shipment. Includes cannery workers who pack food products.

Baltimore Metro Median Annual Salary: \$26,370

Education and Training Requirements

Overall Experience	No previous work-related skill, knowledge, or experience is needed for these occupations.
Job Training	Employees in these occupations need anywhere from a few days to a few months of training. Usually, an experienced worker could show you how to do the job.
Education	These occupations may require a high school diploma or GED certificate. Some may require a formal training course to obtain a license.

Occupational Requirements

- Using either control mechanisms or direct physical activity to operate machines or processes (not including computers or vehicles).
- Monitoring and reviewing information from materials, events, or the environment, often to detect problems or to find out when things are finished.
- Using one's own hands and arms in handling, installing, forming, positioning, and moving materials, or in manipulating things, including the use of keyboards.
- Fixing, servicing, aligning, setting up, adjusting, and testing machines, devices, moving parts, and equipment that operate primarily on the basis of mechanical (not electronic) principles.
- Inspecting or diagnosing equipment, structures, or materials to identify the causes of errors or other problems or defects.
- Performing physical activities that require moving one's whole body, such as in climbing, lifting, balancing, walking, stooping, where the activities often also require considerable use of the arms and legs, such as in the physical handling of materials.
- Observing, receiving, and otherwise obtaining information from all relevant sources.
- Compiling, coding, categorizing, calculating, tabulating, auditing, verifying, or processing information or data.
- Making judgments about or assessing the value, importance, or quality of things or people.

Required Skills

Skills	Skill Definitions
Operation Monitoring	Watching gauges, dials, or other indicators to make sure a machine is working properly
Product Inspection	Inspecting and evaluating the quality of products
Operation and Control	Controlling operations of equipment or systems
Equipment Maintenance	Performing routine maintenance and determining when and what kind of maintenance is needed

First-Line Supervisors Administrative Support

126 Jobs

Supervise and coordinate activities of workers involved in providing administrative support.

Baltimore Metro Median Annual Salary: \$40,160

Education and Training Requirements

Overall Experience	Previous work-related skill, knowledge, or experience is required for these occupations.
Job Training	Employees in these occupations usually need one or two years of training involving both on-the-job experience and informal training with experienced workers.
Education	Most occupations in this zone require training in vocational schools, related on-the-job experience, or an associate's degree. Some may require a bachelor's degree.

Occupational Requirements

- Coordinating members of a work group to accomplish tasks.
- Providing guidance and direction to subordinates, including setting performance standards and monitoring subordinates.
- Approving requests, handling paperwork, and performing day-to-day administrative tasks.
- Identifying developmental needs of others and coaching or otherwise helping others to improve their knowledge or skills.
- Developing constructive and cooperative working relationships with others.
- Observing, receiving, and otherwise obtaining information from all relevant sources.
- Recruiting, interviewing, selecting, hiring, and promoting persons for the organization.
- Providing information to supervisors, fellow workers, and subordinates. This information can be exchanged face-to-face, in writing, or via telephone/electronic transfer.
- Entering, transcribing, recording, storing, or maintaining information in either written form or by electronic/magnetic recording.
- Developing plans to accomplish work, and prioritizing and organizing one's own work.

Required Skills

Skills	Skill Definitions
Management of Personnel Resources	Motivating, developing, and directing people as they work, identifying the best people for the job
Time Management	Managing one's own time and the time of others
Speaking	Talking to others to effectively convey information
Reading Comprehension	Understanding written sentences and paragraphs in work related documents
Monitoring	Assessing how well one is doing when learning or doing something
Coordination	Adjusting actions in relation to others' actions
Problem Identification	Identifying the nature of problems
Critical Thinking	Using logic and analysis to identify the strengths and weaknesses of different approaches
Active Listening	Listening to what other people are saying and asking questions as appropriate
Instructing	Teaching others how to do something

Maintenance and Repair Workers, General

105 Jobs

Perform work involving the skills of two or more maintenance or craft occupations to keep machines, mechanical equipment, or the structure of an establishment in repair. Duties may involve pipe fitting; boiler making; insulating; welding; machining; carpentry; repairing electrical or mechanical equipment; installing, aligning, and balancing new equipment; and repairing buildings, floors, or stairs.

Baltimore Metro Median Annual Salary: \$28,760

Education and Training Requirements

Overall Experience	Previous work-related skill, knowledge, or experience is required for these occupations.
Job Training	Employees in these occupations usually need one or two years of training involving both on-the-job experience and informal training with experienced workers.
Education	Most occupations in this zone require training in vocational schools, related on-the-job experience, or an associate's degree. Some may require a bachelor's degree.

Occupational Requirements

- Inspecting or diagnosing equipment, structures, or materials to identify the causes of errors or other problems or defects.

- Fixing, servicing, aligning, setting up, adjusting, and testing machines, devices, moving parts, and equipment that operate primarily on the basis of mechanical (not electronic) principles.
- Observing, receiving, and otherwise obtaining information from all relevant sources.
- Using one's own hands and arms in handling, installing, forming, positioning, and moving materials, or in manipulating things, including the use of keyboards.
- Performing physical activities that require moving one's whole body, such as in climbing, lifting, balancing, walking, stooping, where the activities often also require considerable use of the arms and legs, such as in the physical handling of materials.
- Keeping up-to-date technically and knowing one's own jobs' and related jobs' functions.
- Monitoring and reviewing information from materials, events, or the environment, often to detect problems or to find out when things are finished.
- Fixing, servicing, adjusting, regulating, calibrating, fine-tuning, or testing machines, devices, and equipment that operate primarily on the basis of electrical or electronic (not mechanical) principles
- Conducting or carrying out work procedures and activities in accord with one's own ideas or information provided through directions/instructions for purposes of installing, modifying, preparing, delivering, constructing, integrating, finishing, or completing programs, systems, structures, or products.
- Making judgments about or assessing the value, importance, or quality of things or people.

Required Skills

Skills	Skill Definitions
Installation	Installing equipment, machines, wiring, or programs to meet specifications
Repairing	Repairing machines or systems using the needed tools
Equipment Maintenance	Performing routine maintenance and determining when and what kind of maintenance is needed
Problem Identification	Identifying the nature of problems
Troubleshooting	Determining what is causing an operating error and deciding what to do about it
Equipment Selection	Determining the kind of tools and equipment needed to do a job
Testing	Conducting tests to determine whether equipment, software, or procedures are operating as expected
Product Inspection	Inspecting and evaluating the quality of products
Operation and Control	Controlling operations of equipment or systems
Operation Monitoring	Watching gauges, dials, or other indicators to make sure a machine is working properly

Compute, classify, and record numerical data to keep financial records complete. Perform any combination of routine calculating, posting, and verifying duties to obtain primary financial data for use in maintaining accounting records. May also check the accuracy of figures, calculations, and postings pertaining to business transactions recorded by other workers.

Baltimore Metro Median Annual Salary: \$27,500

Education and Training Requirements

Overall Experience	Some previous work-related skill, knowledge, or experience may be helpful in these occupations, but usually is not needed.
Job Training	Employees in these occupations need anywhere from a few months to one year of working with experienced employees.
Education	These occupations usually require a high school diploma and may require some vocational training or job-related course work. In some cases, an associate's or bachelor's degree could be needed.

Occupational Requirements

- Entering, transcribing, recording, storing, or maintaining information in either written form or by electronic/magnetic recording.
- Observing, receiving, and otherwise obtaining information from all relevant sources.
- Compiling, coding, categorizing, calculating, tabulating, auditing, verifying, or processing information or data.
- Identifying underlying principles, reasons, or facts by breaking down information or data into separate parts.
- Providing information to supervisors, fellow workers, and subordinates. This information can be exchanged face-to-face, in writing, or via telephone/electronic transfer.
- Approving requests, handling paperwork, and performing day-to-day administrative tasks.
- Identifying information received by making estimates or categorizations, recognizing differences or similarities, or sensing changes in circumstances or events.
- Making judgments about or assessing the value, importance, or quality of things or people.
- Estimating the Characteristics of Materials, Products, Events, or Information: Estimating sizes, distances, and quantities, or determining time, costs, resources, or materials needed to perform a work activity.
- Controlling computer functions by using programs, setting up functions, writing software, or otherwise communicating with computer systems.

Required Skills

Skills	Skill Definitions
Mathematics	Using mathematics to solve problems
Information Gathering	Knowing how to find information and identifying essential information
Information Organization	Finding ways to structure or classify multiple pieces of information
Reading Comprehension	Understanding written sentences and paragraphs in work related documents
Writing	Communicating effectively with others in writing as indicated by the needs of the audience
Problem Identification	Identifying the nature of problems
Monitoring	Assessing how well one is doing when learning or doing something
Product Inspection	Inspecting and evaluating the quality of products
Management of Financial Resources	Determining how money will be spent to get the work done, and accounting for these expenditures

First-Line Supervisors/Managers of Production and Operating Workers **86 Jobs**

Supervise and coordinate the activities of production and operating workers, such as inspectors, precision workers, machine setters and operators, assemblers, fabricators, and plant and system operators.

Baltimore Metro Median Annual Salary: \$43,200

Education and Training Requirements

Overall Experience	Previous work-related skill, knowledge, or experience is required for these occupations.
Job Training	Employees in these occupations usually need one or two years of training involving both on-the-job experience and informal training with experienced workers.
Education	Most occupations in this zone require training in vocational schools, related on-the-job experience, or an associate's degree. Some may require a bachelor's degree.

Occupational Requirements

- Providing information to supervisors, fellow workers, and subordinates. This information can be exchanged face-to-face, in writing, or via telephone/electronic transfer.

- Monitoring and reviewing information from materials, events, or the environment, often to detect problems or to find out when things are finished.
- Observing, receiving, and otherwise obtaining information from all relevant sources.
- Coordinating members of a work group to accomplish tasks.
- Providing guidance and direction to subordinates, including setting performance standards and monitoring subordinates.
- Developing constructive and cooperative working relationships with others.
- Entering, transcribing, recording, storing, or maintaining information in either written form or by electronic/magnetic recording.
- Scheduling events, programs, activities, as well as the work of others.
- Approving requests, handling paperwork, and performing day-to-day administrative tasks.
- Identifying developmental needs of others and coaching or otherwise helping others to improve their knowledge or skills.

Required Skills

Skills	Skill Definitions
Coordination	Adjusting actions in relation to others' actions
Reading Comprehension	Understanding written sentences and paragraphs in work related documents
Time Management	Managing one's own time and the time of others
Product Inspection	Inspecting and evaluating the quality of products
Information Gathering	Knowing how to find information and identifying essential information
Critical Thinking	Using logic and analysis to identify the strengths and weaknesses of different approaches
Speaking	Talking to others to effectively convey information
Mathematics	Using mathematics to solve problems
Writing	Communicating effectively with others in writing as indicated by the needs of the audience
Implementation Planning	Developing approaches for implementing an idea

Customer Service Representatives (Adjustment Clerks)

85 Jobs

Investigate and resolve customers' inquiries concerning merchandise, service, billing, or credit rating. Examine pertinent information to determine accuracy of customers' complaints and responsibility for errors. Notify customers and appropriate personnel of findings, adjustments, and recommendations, such as exchange of merchandise, refund of money, credit to customers' accounts, or adjustment to customers' bills.

Baltimore Metro Median Annual Salary: \$24,900

Education and Training Requirements

Overall Experience	No previous work-related skill, knowledge, or experience is needed for these occupations.
Job Training	Employees in these occupations need anywhere from a few months to one year of working with experienced employees.
Education	These occupations usually require a high school diploma and may require some vocational training or job-related course work. In some cases, an associate's or bachelor's degree could be needed.

Occupational Requirements

- Observing, receiving, and otherwise obtaining information from all relevant sources.
- Performing for people or dealing directly with the public, including serving persons in restaurants and stores, and receiving clients or guests.
- Handling complaints, arbitrating disputes, and resolving grievances, or otherwise negotiating with others.
- Communicating with persons outside the organization, representing the organization to customers, the public, government, and other external sources. This information can be exchanged face-to-face, in writing, or via telephone/electronic transfer.
- Entering, transcribing, recording, storing, or maintaining information in either written form or by electronic/magnetic recording.
- Identifying information received by making estimates or categorizations, recognizing differences or similarities, or sensing changes in circumstances or events.
- Providing information to supervisors, fellow workers, and subordinates. This information can be exchanged face-to-face, in writing, or via telephone/electronic transfer.
- Making judgments about or assessing the value, importance, or quality of things or people.
- Combining, evaluating, and reasoning with information and data to make decisions and solve problems. These processes involve making decisions about the relative importance of information and choosing the best solution.

Required Skills

Skills	Skill Definitions
Problem Identification	Identifying the nature of problems
Active Listening	Listening to what other people are saying and asking questions as appropriate
Information Gathering	Knowing how to find information and identifying essential information
Writing	Communicating effectively with others in writing as indicated by the needs of the audience
Speaking	Talking to others to effectively convey information
Reading Comprehension	Understanding written sentences and paragraphs in work related documents

Judgment and Decision Making	Weighing the relative costs and benefits of a potential action
Critical Thinking	Using logic and analysis to identify the strengths and weaknesses of different approaches
Instructing	Teaching others how to do something
Information Organization	Finding ways to structure or classify multiple pieces of information

Appendix B
Leading Middle Education Level Jobs Associated With the Development
Of the East Baltimore Biotech Park

Biological Technicians

258 Jobs

Assist biological and medical scientists in laboratories. Set up, operate, and maintain laboratory instruments and equipment, monitor experiments, make observations, and calculate and record results. May analyze organic substances, such as blood, food, and drugs.

Baltimore Metro Median Annual Salary: \$33,190

Education and Training Requirements

Overall Experience	Some previous work-related skill, knowledge, or experience may be helpful in these occupations, but usually is not needed.
Job Training	Employees in these occupations need anywhere from a few months to one year of working with experienced employees.
Education	These occupations usually require a high school diploma and may require some vocational training or job-related course work. In some cases, an associate's or bachelor's degree could be needed.

Occupational Requirements

- Entering, transcribing, recording, storing, or maintaining information in either written form or by electronic/magnetic recording.
- Using one's own hands and arms in handling, installing, forming, positioning, and moving materials, or in manipulating things, including the use of keyboards.
- Identifying information received by making estimates or categorizations, recognizing differences or similarities, or sensing changes in circumstances or events.
- Observing, receiving, and otherwise obtaining information from all relevant sources.
- Fixing, servicing, aligning, setting up, adjusting, and testing machines, devices, moving parts, and equipment that operate primarily on the basis of mechanical (not electronic) principles.
- Performing physical activities that require moving one's whole body, such as in climbing, lifting, balancing, walking, stooping, where the activities often also require considerable use of the arms and legs, such as in the physical handling of materials.
- Using either control mechanisms or direct physical activity to operate machines or processes (not including computers or vehicles).
- Monitoring and reviewing information from materials, events, or the environment, often to detect problems or to find out when things are finished.
- Inspecting or diagnosing equipment, structures, or materials to identify the causes of errors or other problems or defects.
- Providing information to supervisors, fellow workers, and subordinates. This information can be exchanged face-to-face, in writing, or via telephone/electronic transfer.

Required Skills

Skills	Skill Definitions
Science	Using scientific methods to solve problems
Mathematics	Using mathematics to solve problems
Problem Identification	Identifying the nature of problems
Operation and Control	Controlling operations of equipment or systems
Reading Comprehension	Understanding written sentences and paragraphs in work related documents

Chemical Technicians

222 Jobs

Conduct chemical and physical laboratory tests to assist scientists in making qualitative and quantitative analyses of solids, liquids, and gaseous materials for purposes, such as research and development of new products or processes, quality control, maintenance of environmental standards, and other work involving experimental, theoretical, or practical application of chemistry and related sciences.

Baltimore Metro Median Annual Salary: \$38,940

Education and Training Requirements

Overall Experience	Previous work-related skill, knowledge, or experience is required for these occupations.
Job Training	Employees in these occupations usually need one or two years of training involving both on-the-job experience and informal training with experienced workers.
Education	Most occupations in this zone require training in vocational schools, related on-the-job experience, or an associate's degree. Some may require a bachelor's degree.

Occupational Requirements

- Monitoring and reviewing information from materials, events, or the environment, often to detect problems or to find out when things are finished.
- Using either control mechanisms or direct physical activity to operate machines or processes (not including computers or vehicles).
- Identifying underlying principles, reasons, or facts by breaking down information or data into separate parts.
- Using one's own hands and arms in handling, installing, forming, positioning, and moving materials, or in manipulating things, including the use of keyboards.
- Observing, receiving, and otherwise obtaining information from all relevant sources.
- Conducting or carrying out work procedures and activities in accord with one's own ideas or information provided through directions/instructions for purposes of installing, modifying,

preparing, delivering, constructing, integrating, finishing, or completing programs, systems, structures, or products.

- Keeping up-to-date technically and knowing one's own jobs' and related jobs' functions.
- Inspecting or diagnosing equipment, structures, or materials to identify the causes of errors or other problems or defects.
- Identifying information received by making estimates or categorizations, recognizing differences or similarities, or sensing changes in circumstances or events.
- Entering, transcribing, recording, storing, or maintaining information in either written form or by electronic/magnetic recording.

Required Skills

Skills	Skill Definitions
Science	Using scientific methods to solve problems
Critical Thinking	Using logic and analysis to identify the strengths and weaknesses of different approaches
Mathematics	Using mathematics to solve problems
Reading Comprehension	Understanding written sentences and paragraphs in work related documents
Judgment and Decision Making	Weighing the relative costs and benefits of a potential action
Writing	Communicating effectively with others in writing as indicated by the needs of the audience
Active Listening	Listening to what other people are saying and asking questions as appropriate
Testing	Conducting tests to determine whether equipment, software, or procedures are operating as expected
Equipment Selection	Determining the kind of tools and equipment needed to do a job
Information Organization	Finding ways to structure or classify multiple pieces of information

Electrical and Electronic Engineering Technicians

93 Jobs

Apply electrical and electronic theory and related knowledge, usually under the direction of engineering staff, to design, build, repair, calibrate, and modify electrical components, circuitry, controls, and machinery for subsequent evaluation and use by engineering staff in making engineering design decisions.

This title represents a group of multiple specific occupations, including:

- Electronics Engineering Technician;
- Calibration and Instrumentation Technician; and
- Electrical Engineering Technician.

Some opportunities will exist for specialized electrical systems-related technicians. These will need to be identified through more research.