North East Ambition

Funded by
European Union
European Social Fund

Health and life sciences sector toolkit teacher briefing guide
Life sciences

Introduction

The resources have been designed to be used as starter/plenary sessions for subject lessons, connecting to relevant topics within the scheme of work or related subject specific skills. There are links to additional resources or optional extension activities which could support a full careers lesson if desired.

Learning objectives

- Learn about the health and life sciences sector and why it is important to the North East economy.
- Gain an awareness of the different job roles available in different industries within the North East health and life sciences sector and how these may be appealing as a future career.
- Gain an understanding of the relevance of the curriculum to careers in the North East labour market and what skills and academic subjects are required for these roles.

Life sciences in the North East – background information

Health and life sciences is a sector of strategic importance to the North East economy, due to our exceptional health and life science assets, and strengths in pharmaceutical manufacturing.

The North East is home to international academic research expertise in health and life sciences. This culture of innovation partnered with the clinical research expertise within our outstanding NHS hospital trusts has led to the development of thriving cluster of life sciences businesses across our region, which in 2020 employed over 2000 people.

Many of these businesses have channelled their world-leading expertise into finding solutions to the Covid-19 crisis; developing innovations as part of the global effort to diagnose, treat and prevent Covid-19. The Integrated COVID Hub North East was the first of its kind in the UK offering increased testing capacity, regional coordination of data, information and resources and an innovation lab based within the Biosphere, designed to evaluate the next generation of virus tests.

Within their strategy for economic growth in health and life sciences, the North East Local Enterprise Partnership have outlined an ambition to double the number of jobs and businesses within the sector by 2030.

In 2022 the North East LEP conducted research in partnership with pharmaceutical manufacturing and life sciences employers across the region, to identify the skills and roles in most demand by employers, and mapped different careers pathways into these key roles. You can find out more here.

You can access research on skills for key employment sectors in our region and the most recent ONS statistics on enterprises and employment in the North East health and life sciences sector via the North East Evidence Hub.

Video activities

Students answer questions using information provided in the videos.

The North East is a leading location for life sciences (2:16)
https://www.youtube.com/watch?v=SENUSviM7EE&list=PLGVCpm23HHF_z_m8W1dRkwU1BwV2uA5fB
This video was produced by the inward investment agency Invest North East England to promote the North East strengths in health and life sciences. It has some interesting figures on the scale of the industry cluster in the North East and highlights the region's assets and strengths in the sector.

The following videos show people working in the sector and highlight some of the skills and qualifications which could help with a career. You do not need to show all the video clips but can select those which are most relevant to your students.

High Force Research – interview with a Manufacturing Chemist (2:45)
https://www.youtube.com/watch?v=1qQKHGvWq8s
Graduate Manufacturing Chemist explains what they enjoy about their work and routes into this career.

QuantuMDX – interview with a Manufacturing Science and Technology Team lead (3:32)
https://www.youtube.com/watch?v=G1Y3er0vVC4
Insights into careers within a North East diagnostics company and routes into careers in the lab from one of their team

Centre for Process and Innovation (CPI) - interview with a higher-level apprentice Lab Scientist (3:02)
https://www.youtube.com/watch?v=71K8b3bDwFs
Higher level apprentice from CPI giving their perspective on the benefits of apprenticeships over a university route. Includes insights into what the role involves and the skills and qualifications which are helpful to this career.

Centre for Process and Innovation (CPI) - interview with a Chemical Engineer - (2:01)
https://www.youtube.com/watch?v=i_nBSkR64Z4
Graduate Chemical Engineering discussing what they enjoy about their job and routes into this career.

Curriculum links

These toolkit resources could be used to introduce a new topic, subject content or to make general links between your subject and how the skills and knowledge acquired can support a future career.

Select the links relevant to your subject from the table below and insert into slide 8 of the lesson PowerPoint template, to highlight the connections between the subject/topic taught and careers in the North East labour market.

Science curriculum links

Key stage and subject	Curriculum link	These skills and knowledge are important to this industry because
KS3 Science	**Structure and function of living organisms**	Understanding respiration and gas exchange, the musculoskeletal system, nutrition, and reproduction are essential in the development of technology, diagnostics, and treatments for diseases.
	Genetics and evolution	Understanding chromosomes, genes and DNA enables life scientists to research and develop new treatments and diagnostics for genetic and hereditary diseases.
	Waves	Understanding sound and light waves and how they are processed by the human body enables the development of new imaging technologies and therapies, to support the diagnosis and treatment of a range of diseases and medical conditions.
	Chemical reactions	The active ingredients within medicines are produced through chemical reactions. Scientists working to develop new treatments will use chemical formulae and equations to plan and predict the product of these reactions. This helps them design processes to produce new, safe, and effective treatments.
	Pure and impure substances	Analysing the formulation and purity of the products developed by researchers in the life sciences industry is a critical part of the development of new treatments. Chemists use techniques such as chromatography (e.g. HPLC) to analyse samples at every stage of manufacture.
KS4 Biology	**Cell structure**	By understanding cell structures and the differences between for example bacterial cells and animal cells, scientists can design treatments which target the harmful bacterial cells without damaging the healthy host cells. For example, penicillin works by prevent bacteria forming new cell wall, because there is no cell wall in animal cells, this means that the penicillin stops reproduction of the bacterial cells without harming the animal (human) cells.
	Cell transport	Understanding how substances are transported across cell membranes and processed by the body is important in life sciences, in order to determine the dose required of a medicine. By understanding how quickly the body will break the down the medicines, the developers can balance the therapeutic dose with any potential side effects.
	Organisation	In life sciences, an understanding of the tissues, organs and organ systems within the human body enables a better understanding of how disease occurs so targeted treatments can be developed.

	Infection and response	Analysis of pathogens and an understanding of response of the body's immune system to infection, enables those working in life sciences to understand how to prevent and treat disease. For example, analysis of the COVID-19 virus and the human immune response, enabled scientists to produce a range of safe and effective vaccines.
	DNA and genetic inheritance	Understanding the structure of DNA, the role of genes and STEM cells is leading the development of ground-breaking treatments and diagnostic techniques. For example, scientists are developing tests which can detect tiny amounts of genetic material in blood sample, which can be used to more easily diagnose conditions such as diabetes and cancer. Genetic testing enables scientists to develop individual treatment programmes for patients with cancer to help increase the efficacy of those treatments. STEM cell research could help us repair damaged tissue in patients with paralysis and sight loss.
KS4 Chemistry	**Bonding, structure, and properties of materials.**	Understanding properties of materials and how to develop new materials with certain properties helps researchers develop new products and medical technologies which are safe to use in the human body.
	Chemical analysis	Analysing the formulation and purity of the products developed by researchers in the life sciences industry is a critical part of the development of new treatments. Chemists use techniques such as chromatography (e.g. HPLC) to analyse samples at every stage of manufacture.
	Quantitative chemistry	Quantitative methods and chemical equations are used to develop the reactions and processes which to produce the active ingredients within medicines are produced through chemical reactions. Scientists working to develop new treatments will use chemical formulae and equations to plan and predict the product of these reactions. This helps them design processes to produce new, safe, and effective treatments.
KS4 Physics	**Waves**	Understanding of different types of waves, the hazardous affects they can have on the body and a person's health as well as how some can be used as a diagnostic tool.
	Atomic structure and radioactivity	Radioactive isotopes can be used to treat diseases such as cancer and produce images to support diagnosis. An understanding of radioactive particles and their properties enables those in the life sciences industry to identify which could be appropriate to use in new treatments and technologies and what precautions may be needed.
Additional subject related skills	Development of skills such as scientific thinking, experimental skills and strategies, analysis and evaluation of data and an understanding of scientific vocabulary, units and nomenclature is essential in the life sciences industry in order to research and develop new diagnostics, treatments and medicines.	

Maths curriculum links

Key stage and subject	Curriculum link	These skills and knowledge are important to this industry because
KS3	**Ratio, proportion, and rates of change**	Understanding ratios, proportions and rates of change is important in the monitoring of patients and accurate record keeping during clinical trials. Calculating and expressing the ratio between the raw materials required to make medicines, enables the life science industry to develop processes to manufacture new medicines at scale.
	Statistics	In the life sciences industry, the ability to describe, interpret and compare data sets is used to monitor trends in health needs and care to identify where further innovation is needed. The collection and interpretation of data across all stages of development of treatments and medicines and the clinical trial process is important, to help monitor how effective and safe a treatment is and to get approval for new products.
	Probability	Probability is used in life sciences to determine the likely prevalence of certain diseases and medical conditions to identify where to allocate research and development resources. The probability of certain treatments being effective and risk of side effects.
	Numbers	Understanding different measures and units to safely measure temperature, blood pressure and weight as well as administering medicine in the right doses and correct time intervals.
KS4	**Ratio, proportion, and rates of change**	Understanding ratios, proportions and rates of change is important in the monitoring of patients and accurate record keeping during clinical trials. Calculating and expressing the ratio between the raw materials required to make medicines, enables the life science industry to develop processes to manufacture new medicines at scale.
	Statistics	In the life sciences industry, the ability to describe, interpret and compare data sets is used to monitor trends in health needs and care to identify where further innovation is needed. The collection and interpretation of data across all stages of development of treatments and medicines and the clinical trial process is important, to help monitor how effective and safe a treatment is and to get approval for new products.
	Probability	Probability is used in life sciences to determine the likely prevalence of certain diseases and medical conditions to identify where to allocate research and development resources. The probability of certain treatments being effective and risk of side effects. Probability is also important when evaluating the safety of manufacturing processes. Health, safety, and environmental (HSE) considerations underpin all working practices in industry.
Additional subject related skills	Critical thinking, problem solving, analytical thinking and quantitative reasoning are skills used daily by those working in the life sciences industry. This allows proper and effective diagnosis, new advances in treatments, and the safe and development of new medicines.	

English curriculum links

Key stage and subject	Curriculum link	These skills and knowledge are important to this industry because
KS3	**Spoken language**	The ability to hold discussion and debate as well as to work collaboratively is important to communicate effectively with colleagues. Being able to use technical language and adapt the language used depending on your audience is key when presenting information on new medicines and treatments to different stakeholders e.g. healthcare professionals, scientists, regulatory bodies and patients communicating with customers and other stakeholders.
	Reading and writing	Reading for information, enhancing vocabulary through sector specific language and able to write for a variety of purposes and audiences e.g. through reading technical publications and instructions or to produce reports for a variety of audiences. Selecting and organising information and ideas effectively and persuasively for prepared spoken presentations is an important skill across many roles in pharmaceutical manufacturing. For example, when trying to secure investment into research or presenting at scientific conferences. Planning the content and language of these presentations for different purposes and audiences ensures that the information is understood, and the presentation has the intended impact. For example, the technical content and language used to present scientific research at a conference may not be appropriate to used when promoting opportunities and services to an external customer or investor. Listening to and responding appropriately to any questions and feedback is an important skill when communicating with all stakeholders.
KS4	**Spoken language**	Selecting and organising information and ideas effectively and persuasively for prepared spoken presentations is an important skill across many roles in pharmaceutical manufacturing. For example, when trying to secure investment into research or presenting at scientific conferences. Planning the content and language of these presentations for different purposes and audiences ensures that the information is understood, and the presentation has the intended impact. For example, the technical content and language used to present scientific research at a conference may not be appropriate to used when promoting opportunities and services to an external customer or investor. Listening to and responding appropriately to any questions and feedback is an important skill when communicating with all stakeholders.
	Critical reading and comprehension	Identifying and interpreting themes from written text and reading in different ways for different purposes is helpful for roles in life sciences. For example, when evaluating and interpreting clinical research papers and technical reports. The ability to accurately comprehend written standard operating procedures in detail is important to ensure safety in the labs and workshops.

	Writing	Producing clear and coherent text for different purposes and audiences, selecting, organising, and emphasising facts and key points, is important across many functions in life sciences. For example, when producing technical reports, writing safety procedures, or developing marketing materials. Accurate recording and reporting of information ensures efficacy and safety can be monitored throughout the development of new medical technologies and treatments.
Additional information	Skills developed through English are important for a variety of roles in life sciences, to ensure that employees are able to clearly read and understand safety instructions, able to accurately record and report information for a variety of audiences and to work collaboratively.	

Additional activities and further information

There is an optional research task on slides 6 and 7 of the PowerPoint presentation if you would like to expand this activity into a full lesson. There is also an optional plenary which could be used as a reflection activity following a subject lesson. These could also be set as home learning tasks.

You can access more resources relating to careers in the curriculum on the North East Ambition website and on the Careers and Enterprise Company website.

If students are interested in finding out more about the industry in the North East and the varied career routes and opportunities available, there are some links on the plenary activity on the final slide which may be of interest.

You can find out more about the North East labour market via the LMI toolkit for educators on the North East Ambition website and through the North East Local Enterprise Partnership website.

Careers in the curriculum CPD resources

Useful links for teachers to develop skills and knowledge to connect careers to the curriculum:

- Careers in the curriculum online CPD course delivered in partnership with NU:STEM
  https://www.northeastambition.co.uk/directory/careers-initial-teacher-education
- Industry insights session - life sciences - Feb 2021
  https://www.youtube.com/watch?v=boUFb3AJIUw
- Online CPD course available from STEM learning
  Linking STEM curriculum learning to careers | STEM