

Cortilens

Presents C- β [®]

TO

AstraZeneca 

Business Propositon 2024-2027

0 Legal Disclaimer

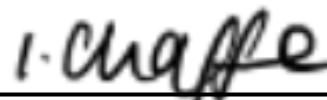
0.1 Non Disclosure Agreement

Date: 01/03/2024

Parties:

1. AstraZeneca UK Ltd., a company registered in England whose registered office is at Francis Crick Avenue, Cambridge Biomedical Campus, Cambridge, CB2 0AA (the Recipient)
 2. CortiLens Ltd., a company registered in England whose registered office is at Department of Biosciences, Stockton Road, Durham, DH1 3LE (the Discloser)
1. The Discloser intends to disclose information (the Confidential Information) to the Recipient for the purpose of discussing the possibility of the Recipient and the Discloser entering into a joint venture (the Purpose).
2. The Recipient undertakes not to use the Confidential Information for any purpose except the Purpose, without first obtaining the written agreement of the Discloser.
3. The Recipient undertakes to keep the Confidential Information secure and not to disclose it to any third party except to its employees and professional advisers who need to know the same for the Purpose, who know they owe a duty of confidence to the Discloser and who are bound by obligations equivalent to those in clause 2 above and this clause 3.
4. The undertakings in clauses 2 and 3 above apply to all of the information disclosed by the Discloser to the Recipient, regardless of the way or form in which it is disclosed or recorded but they do not apply to:
- a) any information which is or in future comes into the public domain (unless as a result of the reach of this Agreement); or
 - b) any information which is already known to the Recipient and which was not subject to any obligation of confidence before it was disclosed to the Recipient by the Discloser.
5. Nothing in this Agreement will prevent the Recipient from making any disclosure of the Confidential Information required by law or by any competent authority.
6. The Recipient will, on request from the Discloser, return all copies and records of the Confidential Information to the Discloser and will not retain any copies or records of the Confidential Information.
7. Neither this Agreement nor the supply of any information grants the Recipient any licence, interest or right in respect of any intellectual property rights of the Discloser except the right to copy the Confidential Information solely for the Purpose.
8. The undertakings in clauses 2 and 3 will continue in force indefinitely.
9. This Agreement is governed by, and is to be construed in accordance with, English law. The English Courts will have non-exclusive jurisdiction to deal with any dispute which has arisen or may arise out of, or in connection with, this Agreement.

Executed and Delivered as a Deed by CortiLens Ltd. acting by Issy Chaffe, a director, in the presence of:



Signature of Director

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1 Our Company

1.1 The Team



Issy Chaffe Chief Executive Officer

Issy completed her Natural Sciences MSc at Durham University. She then trained at Deloitte, where she achieved her ACA qualification. Within just eight years, she was made a partner within Deloitte's consulting sector, where she honed her leadership skills and implemented corporate strategy techniques to improve company outcomes.

Responsibilities:

- Setting the strategic direction
- Stakeholder relations
- Cultivating innovative culture



Emilia Havard Chief Financial Officer

Emilia received a BSc in Chemistry and Maths via Natural Sciences at Durham University. After venturing into the financial sector, through work at JP Morgan she then progressed to complete her MBA at Oxford University. Emilia now works as a Financial Manager.

Responsibilities:

- Financial reports
- Applying for grants and funding
- Investment management
- Allocating capital



Joseph Osborne

Strategy Director

Joseph completed his Natural Sciences BSc at Durham University. He then worked as a strategy consultant at McKinsey & Company for 3 years.

Subsequently he acquired an MBA in Strategy from Cambridge University where he found interest in strategy development for spinout companies.

Responsibilities:

- Ensuring business model stays competitive
- Aligning research development plan with core values



Melissa Hennessy

Chief Operations Officer

Having achieved her Masters of Business Administration at Durham University, Melissa joined the Oxford-based spinout company Osler Diagnostics®, where she gained experience in operational leads within the MedTech field. Melissa will be ensuring production of C-β® is time and cost efficient.

Responsibilities:

- Mitigating our operational risks
- Acquiring operational partners to achieve economies of scale
- Acquiring talent



Ciara Hill

Chief Science Officer

Ciara received a BSc in Biology and Chemistry from Durham University. She went on to work for Pfizer as a senior production technician, specialising in biomedical engineering. Ciara leads the Research and Development team where she is in charge of ensuring success of clinical trials.

Responsibilities:

- Research and Development
- Acquiring academic contacts
- Acquiring talent



Louis Kelly

Chief Technology Officer

Louis received a Computer Science BSc at Durham University specialising in mobile app development.

Louis leads the app development, providing customers with an interface to monitor their cortisol levels and improve their treatment.

Responsibilities:

- Leading the mobile app development
- Designing algorithms - detecting signal from noise for C-β®



Amelia Semmens

Chief Legal Officer

After achieving a BSc in Natural Sciences at Durham University,

Amelia trained as a patent attorney at Kirkland & Ellis. She has over 10 years experience in this field, and has recently become a Fellow of CIPA (Chartered Institute of Patent Attorneys).

Responsibilities:

- Ensuring protection of our IP
- Ensuring regulatory compliance
- Identifying legal risks
- Litigation management of strategic partnerships



Daniel Mason

Head of Marketing & Communications

Daniel received his BSc in Natural sciences from Durham University. He later went on to earn a CIM certificate from the Chartered Institute of Marketing. Within CortiLens his role is to understand customer needs and help establish the CortiLens brand image and create awareness.

Responsibilities:

- Understanding our customers
- Market analysis
- Acquiring distribution partners

1.2 Overview

1.2.1 About Us

CortiLens is a spin-out company founded by a group of alumni students from Durham University. CortiLens exists to create innovative technology for patients with rare diseases. With our breakout product C- β ® (C-Beta), a cortisol monitoring smart contact lens, we aim to enhance the treatment and management of Addison's disease and Cushing's syndrome, improving the quality of life for those living with these forgotten diseases.

1.2.2 Unique Selling Proposition



First on the
market



Non-invasive



Continuous



Decentralising
healthcare and
reducing strain on the
NHS

1.2.3 Company Structure and Values

CortiLens will adopt a typical spin out company organisational structure with a flat hierarchy providing a strong degree of autonomy to the highly competent team to boost their creativity and productivity. Our CEO will take a visionary approach to leadership to inspire innovation focused on the future.

We will uphold the following values:

- Continuous Learning
- Accountability
- Integrity
- Innovation
- Quality and Safety
- Adaptability

1.3 The Mission

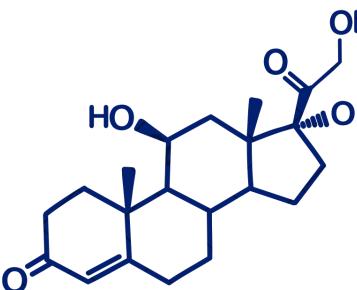
*“Enhancing patient care and outcomes
in the rare disease community.”*

1.4 Strategic Objectives

Short Term	<ul style="list-style-type: none">• Refine existing solutions.• Undertake preliminary in vitro and in vivo animal studies.• Clinical trials on humans.
Medium Term	<ul style="list-style-type: none">• Develop an algorithm for dosage recommendations.• User-friendly mobile application for presenting real-time cortisol data.• Regulatory approval.• Market entry.
Long Term	<ul style="list-style-type: none">• Mass market entry by expanding into global health and wellbeing market through continuous stress monitoring.• Strategic partnerships with wellbeing apps.• Further research into the scope of biomarkers which can be monitored in the tear fluid, allowing the healthcare system to be decentralised and reducing strain on the struggling NHS system.

2 Our Product

2.1 The Problem



Cortisol

The steroid hormone cortisol, commonly known as the ‘stress’ hormone, is released by the adrenal glands. The ability of our body to both produce and regulate cortisol levels is essential to our health and wellbeing as it influences many bodily functions such as the regulation of blood pressure and the body’s response to stress. Addison’s disease and Cushing’s syndrome are rare diseases resulting from a severe imbalance of cortisol levels. Due to the rarity of such conditions, efforts to improve the healthcare provided is minimal despite the current solutions not being sufficient.

Addison’s Disease

Addison’s disease, also known as primary adrenal insufficiency, is a rare and life-threatening condition in which the body does not produce enough cortisol. Currently 9000 people in the UK suffer from Addison’s, with over 300 new cases being diagnosed each year [1]. Those suffering from the condition must take lifelong steroid replacement medication, however always have to live with the risk of inadequate dosages leading to potentially life-threatening complications such as adrenal failure.

Cushing’s Syndrome

Cushing’s syndrome, also known as hypercortisolism, is a very rare condition in which the body produces too much cortisol, with a quoted incidence of 1 in 200,000 [2]. Cushing’s syndrome is most commonly caused by the administration of exogenous steroid treatment for conditions such as rheumatoid arthritis where the steroids are synthetic forms of cortisol. Cushing’s syndrome can also occur in the rare case of adrenal gland or pituitary gland cancer.

Problems

- **Inaccurate dosages and risk of adrenal failure:**

In the case of Addison’s disease, it is critical that the prescribed dosage of the replacement steroid, most commonly hydrocortisone, is correct. Currently the dosage is predominantly based on clinical judgement, using factors such as weight and age. However, the amount of cortisol required by the body varies over time. For example during times of physical stress such as illness or surgery, the amount of cortisol required by the body increases. As a result, the prescribed dosage may not be sufficient, leading to adverse side effects and in extreme cases leading to life-threatening adrenal crisis. Each year typically 8% of Addison’s patients experience adrenal crisis [3], highlighting the insufficiencies of the current solutions.

- **Delayed diagnosis**

Both Addison’s disease and Cushing’s syndrome symptoms are non-specific in the early stages and due to the rarity of the conditions a diagnosis is often not considered. As the levels of cortisol in the body fluctuate according to a circadian rhythm, single time measurements cannot act as a diagnostic tool and therefore the deviations of the circadian rhythm are difficult to detect with the current testing methods. As a result the diagnosis of Addison’s and Cushing’s frequently only occurs once the adverse side effects of the conditions become more prevalent and the patient becomes critically ill.

- **Secondary adrenal insufficiency**

Currently up to 2.5% of the population are taking steroid medications for inflammatory or immune-mediated conditions [4]. Whilst the use of exogenous steroids, which are synthetic forms of cortisol, poses a risk of the onset of Cushing’s syndrome, there is also a risk of developing secondary adrenal insufficiency when the prolonged dosage of steroids is discontinued. If the steroid dosage is reduced too quickly, the body may not return to producing sufficient levels of cortisol, leading to Addisonian type symptoms. Without the constant monitoring of cortisol levels, it is difficult to determine how quickly the dose can be reduced and therefore secondary adrenal insufficiency is often seen in these cases.

2.2 Current Solutions



Blood testing

During blood testing, usually two blood samples are taken – one in the morning and one in the afternoon. Subsequently the samples are analysed in the lab, to facilitate the detection of abnormally low or high cortisol levels.

Advantages

- Provides an accurate value for the cortisol concentration at a given time.

Disadvantages

- Invasive.
- Time-consuming process for both the patient and NHS staff.
- Determined cortisol concentration is only applicable to the specific time at which the sample was taken.
- Cannot be conclusive in diagnosing Addison's disease or Cushing's syndrome. Irregular results often must be followed by more testing such as an ACTH blood test.
- Delayed results due to subsequent analysis of samples in the lab.



Urine testing

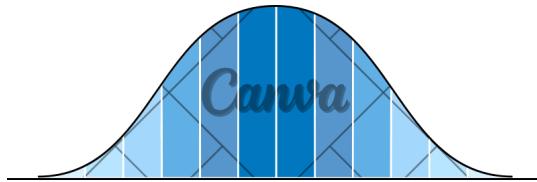
During urine testing, urine is collected over a 24-hour period and subsequently the sample is analysed in the lab, to facilitate the detection of abnormally low or high cortisol levels.

Advantages

- Non-invasive.
- Provides an accurate value for the cortisol production over the 24-hour period.

Disadvantages

- Inconvenience of collecting all urine over a 24-hour period.
- Delayed results due to subsequent analysis of urine samples in the lab.
- Only representative of the total cortisol production over a 24-hour period therefore cannot depict the diurnal circadian rhythm of cortisol and thus cannot be conclusive in diagnosing Addison's disease or Cushing's syndrome.
- Irregular results often must be followed up by more testing such as an ACTH blood test.



Hydrocortisone day curve

A hydrocortisone day curve is used to determine the correct dosage and distribution throughout the day of the replacement steroid hydrocortisone for those with Addison's disease. The test involves blood samples being taken from the patient every hour over a 6 hour period whilst the patient continues to take their prescribed dose of hydrocortisone. The blood samples are subsequently analysed in the lab to determine the efficacy of the dose.

Advantages

- Provides an accurate value of the blood cortisol levels at different times of day.
- Depicts the efficacy of the dosage for the patient at a certain time.

Disadvantages

- Invasive process.
- Delayed results due to subsequent analysis of samples in the lab.
- Time consuming process for both the patient and NHS staff. Due to the requirements of NHS facilities and staff for this process, the hydrocortisone day curve is not carried out on a frequent enough basis. As the amount of cortisol required by the body varies widely due to numerous factors such as illness or stress, the required dosage for a patient does not remain constant over time therefore the deemed 'accurate' dosage during the test may not be sufficient in the future.
- Cannot fully depict the diurnal circadian rhythm of the patient, thereby making it difficult to determine the most effective distribution of the hydrocortisone dosages throughout the day.

Overall the current solutions for cortisol monitoring are not sufficient for those living with Addison's disease or Cushing's syndrome. The current invasive solutions provide intermittent and delayed results with no capability of capturing the individuals diurnal circadian rhythm. With no solutions providing continuous monitoring of cortisol, the healthcare for those living with cortisol imbalances cannot be personally tailored to their body's needs, increasing the morbidity and mortality rates in patients.

2.3 Case Study

An Interview with Jane Rindl

As adrenal diseases such as Addison's and Cushing's are so rare, symptoms are often underestimated, ignored or misidentified. As part of CortiLens Ltd.'s research into the rare adrenal disease sector, we were able to set up an interview with Jane Rindl.

2.3.1 Diagnosis Journey

When speaking with Jane, she talked us through the main events that lead to her diagnosis in 1979. Her symptoms were often misidentified, and misdiagnoses included anaemia and, more concerningly, depression. Ms Rindl informed us "**it is very rare, and various doctors didn't recognise the symptoms, even though the symptoms were very obvious**". Addison's disease brings about a multitude of symptoms, such as discolouration of pressure points, fatigue and weight loss which were all initially overlooked by Ms Rindl's GP. In fact, when detailing her journey to a diagnosis she said "**I could hardly eat, and ended up being delirious and so dehydrated that I was getting sort of cramps all over the place. Finally, my mother called in a private general physician because our GP had been disastrous**".

Experiencing extreme fatigue and exhaustion, Jane was eventually seen by an endocrinologist. She was sent to hospital where "**they stuck me on a drip and stuck loads of hydrocortisone into me**". It was this that lead to the eventual diagnosis of Addison's disease - missed by numerous doctors and almost two years after Jane had begun noticing symptoms.



Jane Rindl, 68
Living with an Addison's diagnosis for
48 years

2.3.3 Opinions on CortiLens Ltd.'s C- β [®]

Discussing our product C- β [®] with Jane, there were certain applications which she was very encouraged by. To highlight once again, Ms Rindl was keen to reiterate how well controlled her Addison's Disease is and says that she has been extremely lucky. However, as her personal journey to diagnosis was long-winded, she stated that "**I can see for the diagnosis that's very interesting. That you would wear the monitor and it could then pick up patterns of cortisol levels and potentially diagnose Addison's disease is fantastic. So that seems like a really good application**". Moreover, Ms Rindl also shared her mother's diagnosis with Addison's. This happened very late in life and was only triggered once falling ill.

Ms Rindl has lived with an Addison's disease diagnosis since she was 20. She considers herself lucky and detailed that her Addison's is very well controlled. However, her insights into the diagnosis, treatment and management processes shed a vast amount of light onto the topic.

2.3.2 Treatment and Management Plans

Jane takes two hydrocortisone and fludrocortisone tablets daily, with hospital check-ups every 6 months. Jane stated "**I've always had to be with an Addison's disease specialist**", whose role is to monitor her dose and condition. During the check-ups, a blood test is carried out and Jane also detailed having completed a couple of hydrocortisone day curves. Jane is very stable with her management and her dosage has rarely changed; but did inform us that a new specialist once "**reduced it by about 25% / 20% - which caused me great anxiety**". Further, when discussing overall precautions which she must take, the need to be close to a hospital, carrying multiple pill boxes and informing those around her of her condition, became clear. When

Jane becomes ill, she must double her dose to account for the lack of cortisol produced in reaction to stress or infection. Ms Rindl proclaims herself lucky and says her disease is very controlled by her medicine, but is also aware that "**it's life and death and if I don't take it, I die in a couple of days**".

Her body was not producing sufficient reactive cortisol, and Jane stated that she and the doctors "wondered that if her adrenal glands had been working properly and had reacted to the presence of the pneumonia which she had, it may not have been so absolutely serious". Jane suggested that if C- β [®] had been utilised earlier, the adverse circumstances which her mother dealt with could have been minimised. Although Jane stated that she can see our product has "got all kind of benefits", she cannot say that she personally would adopt C- β [®] as a product due to her unease at contact lenses and her already well maintained management of Addison's Disease.

2.4 CortiLens

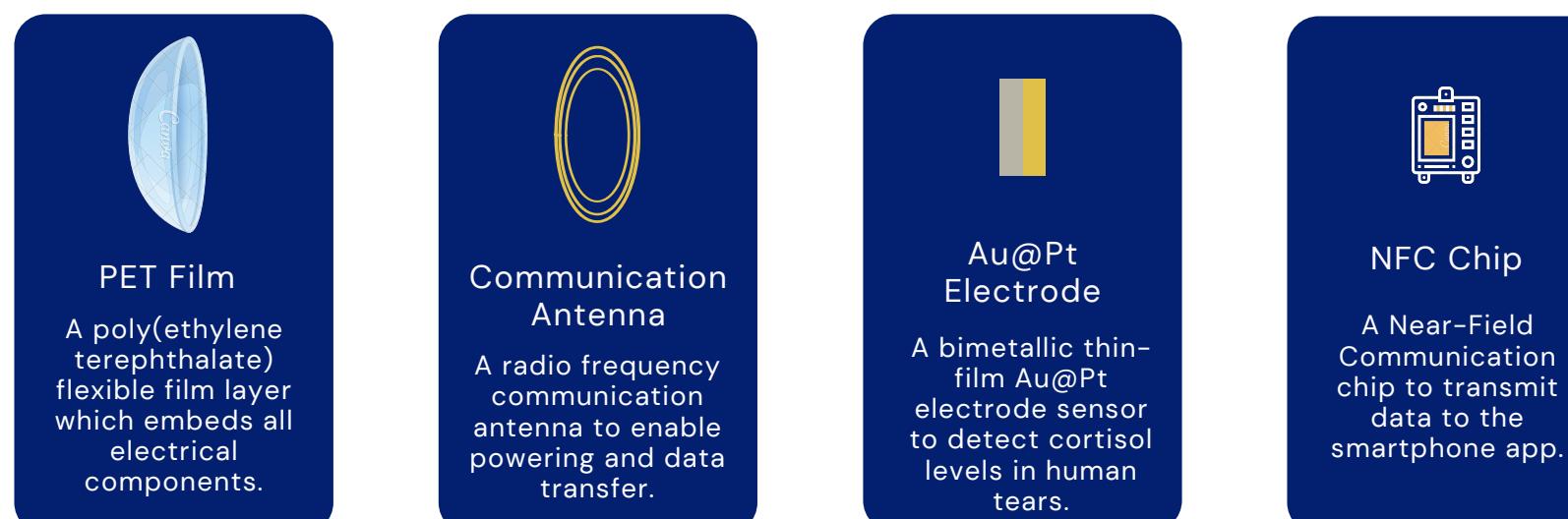
The Product: C-Beta

CortiLens proposes C- β [®] (C-Beta), a smart contact lens with the capability of continuously monitoring a user's cortisol levels, whilst transmitting the data to a smartphone app for real-time monitoring. This non-invasive alternative allows the user to go about their day as normal whilst continuously tracking their cortisol levels via a smartphone app. The data from the app can be used by endocrinologists to allow alterations in the prescribed dosage of medication to be easily made.



The Technology

C- β [®] is a wireless and battery-free smart contact lens with no need for external equipment other than a smart phone to monitor signals from the lens. Using radio frequency inductive coupling between the smartphone and the communication antenna, the smart contact lens is powered wirelessly allowing the electrochemical cell to function. Data can then be wirelessly transmitted through the NFC interface to the smartphone which receives and processes the data, displaying a user-friendly depiction of the cortisol levels on the connected app.



The Science

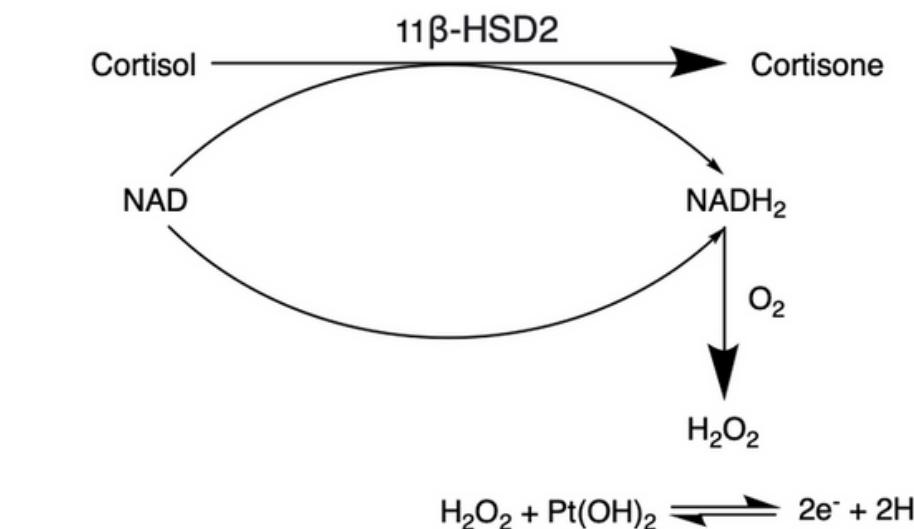


Figure 1: Reaction scheme showing the oxidation of cortisol to cortisone utilising the enzyme 11 β -HSD2.

11 β -hydroxysteroid dehydrogenase type 2 (11 β -HSD2) is an NAD-dependent enzyme which catalyses the oxidative conversion of active cortisol to inactive cortisone. Nicotinamide adenine dinucleotide (NAD) is an important cofactor which enables the redox reaction by accepting electrons and thus being reduced to NADH₂. 11 β -HSD2 is embedded into the Au@Pt electrode contained in the smart contact lens to enable the detection of cortisol in tears.

In the presence of oxygen, the reduced enzyme cofactor is oxidised quickly at the surface of the electrode, generating H₂O₂. Subsequently, the electrochemical oxidation of H₂O₂ can occur, generating two electrons which allow a detectable current to be measured.

With 11 β -HSD2 embedded in the working electrode of the contact lens, the cortisol present in tears can then react via the above mechanism. This enables the tear cortisol concentration to be determined in real-time from the change in the electrical current.

C- β [®] is crucial for improving the quality of life of Addison's and Cushing's patients. With real-time, continuous cortisol monitoring, patients will be able to have their treatment dosage personally adapted to their body's requirements, limiting any adverse side effects and decreasing morbidity and mortality rates. Additionally, C- β [®] will combat the current issues of delayed diagnosis for these rare conditions by providing a non-invasive interface for the irregular cortisol levels of patients with suspected Addison's or Cushing's to be seen.

3 The Market

3.1 Market Size

The need for continuous monitoring underscores a significant niche within the global health market, primarily due to the prevalence of conditions such as **Addison's disease** and **Cushing's syndrome**. Addison's disease affects a modest number, approximately **9 to 14 individuals per 100,000** in the developed world, with an annual incidence in Europe of 4.4 to 6.2 per million [5]. Cushing's syndrome, though rarer with **10 to 15 new cases per million** annually [6], contributes to the demand for precise and continuous monitoring solutions. This necessity highlights a broader issue - the under researched realm of rare diseases. Such conditions not only lack adequate research focus, but also represent a growing market for the pharmaceutical industry. With an anticipated 11% annual growth in rare disease therapies [7], the sector promises not only substantial revenue but also invaluable hope and relief for patients who have long been without suitable treatment options.

The Asia-Pacific region emerges as the most rapidly expanding market for smart contact lenses (SCLs), a trend likely fuelled by extensive research and development activities, notably in South Korea. In the United States, the market for SCLs is gaining traction, driven by the ongoing incidences of diabetes and glaucoma. Despite the promising utility of SCLs, market expansion is being hampered by high costs and limited public awareness about this technological innovation [8].

North America Smart contact lenses market Size, 2015-2026 (USD Million)

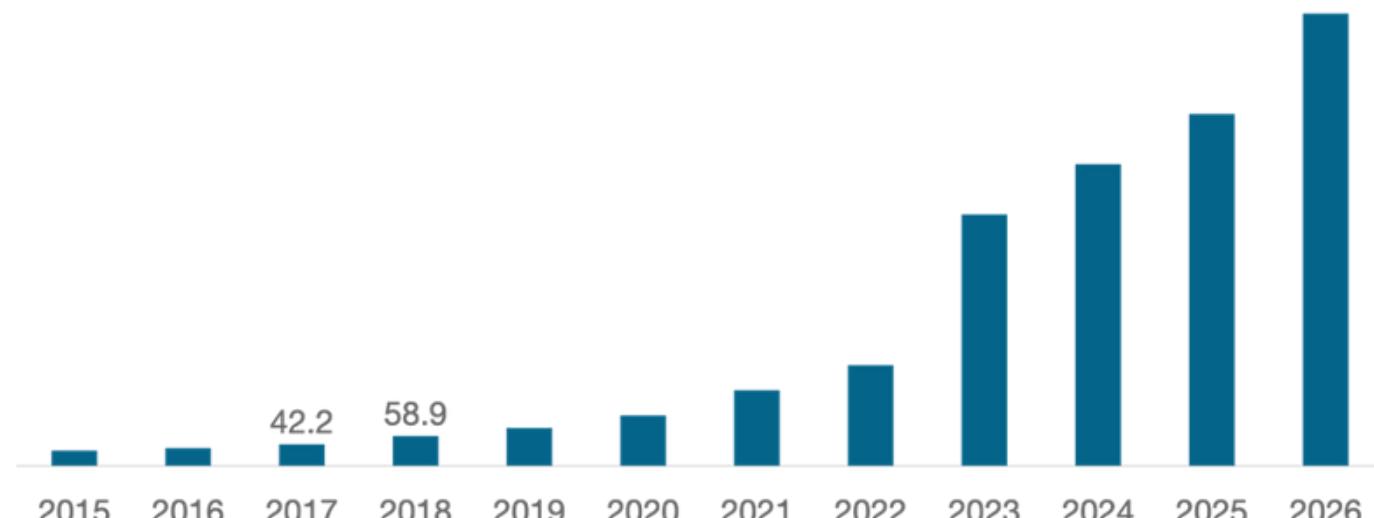


Figure 2: Dipiction on the US market for SCIs (Fortune Business Insights [8]).

3.2 Target Market

When choosing our target market we considered several key factors:

- Regional growth rates and market size
- Investments in rare diseases
- Existing healthcare infrastructure
- Opportunities for expansion



The UK stands out due to its proactive approach towards rare diseases, such as Addison's disease and Cushing's syndrome, which have historically been under-researched and lacked adequate treatments. The UK's Rare Diseases Framework and the accompanying action plan signify a robust commitment to enhancing the diagnosis, treatments and awareness of rare diseases. This initiative is particularly relevant for our product, as it aims to increase diagnosis and treatment opportunities for conditions like Addison's disease, which currently affects approximately **1 in 14,000 people in the UK**, equating to around 9000 diagnosed cases and an annual increase of 320 new diagnoses across the UK [9]. While Cushing's syndrome is much rarer in the UK, only 5 in 1 million people develop Cushing's each year, its classification as a rare disease underscores a similar demand for innovative monitoring solutions.

Furthermore, the UK's healthcare infrastructure, notably the NHS's dedication to high-quality care and its substantial investments in digital tools for quicker diagnoses and patient care, aligns with the benefits offered by C-β®. These contact lenses promise to decentralise healthcare by minimising the need for traditional blood or urine tests, thus potentially easing the NHS's laboratory workload.

The UK market's potential for growth in the healthcare sector is also a significant draw. With a heightened focus on managing stress-related health issues, a key factor in cortisol imbalance, our product meets an urgent need. Stress has a profound impact on UK society, with a significant proportion of the population experiencing stress-related health complications. The economic implications are substantial, with stress-related hospital admissions and healthcare expenditures reflecting a pressing public health issue.

The UK offers a foundation not only addressing immediate needs, but also for future expansion. Leveraging the UK's established healthcare infrastructure and its commitment to embracing technological solutions, could provide a suitable platform for the launch of C-β®.

3.3 Customer Base

CortiLens is revolutionising the management of rare diseases like Addison's disease and Cushing's syndrome with its innovative smart contact lenses that monitor cortisol levels. Our key customer segments are individuals suffering from these conditions, for whom traditional monitoring methods can be invasive and inconvenient. By focusing on rare diseases, we address a significant unmet need, offering a non-invasive, real-time solution to monitor crucial health indicators.

In alignment with our mission we hope to strategically partner with AstraZeneca, a leader in the rare disease space. This partnership will be built on a shared commitment to transform lives through innovative healthcare solutions. By planning to sell our lens design to AstraZeneca, we hope to leverage their extensive expertise in drug development and commitment to access and advocacy within the rare disease community. This collaboration would present unparalleled opportunities for our lenses, including accelerated development, enhanced patient access, and integration into comprehensive care solutions tailored to the unique genetic profiles of individuals with rare diseases.

Our proposed distribution strategy is equally innovative, focusing on distributing through the National Health Service (NHS) to ensure our lenses are not just cutting edge but also accessible. By offering our product through an affordable subscription model via the NHS, we ensure that high-quality care is not a privilege but a right, accessible to all affected by rare diseases in the UK. This approach would align with our and AstraZeneca's vision of transforming population health through equitable access to care, addressing areas of unmet need and significantly shortening the path to accurate diagnoses and personalised treatments. With the NHS's infrastructure and AstraZeneca's support, CortiLens is set to make a substantial impact on the lives of those with Addison's, Cushing's and potentially other rare diseases, marking a significant step forward in the realm of precision medicine and genomics.

UK statistics about the unmet need in rare disease

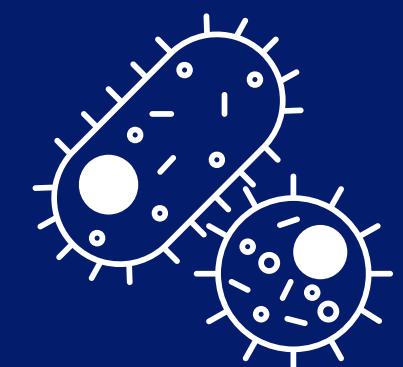
One in 17 people are affected by a rare disease which equates to approximately **3.5 million** people in the UK.



6,000 children are born with an unnamed syndrome in the UK every year.



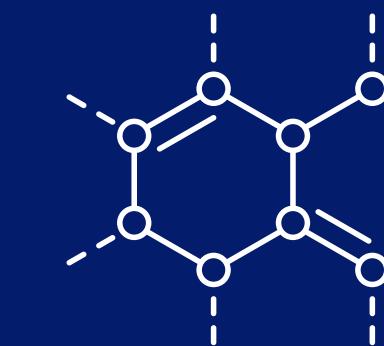
Of an estimated **10,867** rare diseases, **75%** affect children.



On average, it takes over **four years** to receive an accurate diagnosis for a rare disease.



With **80%** of rare diseases believed to have a genetic component, genomics can be essential to deliver a faster and more accurate diagnosis.



3.4 Competitors - A Medical Approach

For those living with a diagnosis such as Addison's disease or Cushing's Syndrome, current options for a reliable and safe approach to necessary cortisol tracking are limited. There are no options for medically approved continuous cortisol monitoring in the UK as of yet. The current testing methods involve detection in various biological fluids, with samples sent to a lab. This slide will discuss the most common of these approaches, and will detail why CortiLens is a competitive alternative.

Blood sample testing

Patients require a blood test, after which a sample is sent to a lab or clinic for analysis.

Advantages

- Very accurate as unbound cortisol levels measured directly from the blood.

Disadvantages

- In order to assess the fluctuations of cortisol levels throughout the day, patients are often advised to have two blood tests, one in the morning and in the afternoon.
- Even if multiple tests are taken, this blood sampling strategy still only provides a onetime reading, making it impossible to analyse changes in concentrations throughout the day.
- Hospital visits for blood tests, or even the use of an at home blood sampling kit, are time consuming and complicated.
- Hospital visits also require manpower and special equipment.
- Analysis of samples can take anywhere from 24 hours to a week, meaning results are outdated by the time of arrival.

An overview of medical techniques:

Current testing methods do not fulfil the needs of those living with serious cortisol imbalances. Invasive, intermittent and time-consuming testing methods, delivering a delayed result, hardly provide rare disease patients the opportunity for an undisrupted daily routine. Hence, CortiLens proposes the use of an unnoticeable, real-time monitoring system that can be seamlessly integrated into their lives. **A non-invasive, continuous and accurate solution is the only fair solution.** The following slide will address CortiLens' competitors in the field of continuous cortisol monitoring.

Urine sample testing

Urinary Free Cortisol (UFC) testing requires the collection of urine samples over a 24 hour period, which are subsequently sent to a lab.

Advantages

- Non-invasive and painless testing method.
- Cortisol concentrations in urine are strongly representative of that in the blood.
- Samples can be collected over a longer time (24 hours), as opposed to just one collection.

Disadvantages

- The collection of urine over a 24 hour period is impractical and inconvenient.
- This is compounded upon by the need for all samples to be stored in a refrigerated container immediately.
- The collection time frame of 24 hours limits its long term medical use.
- Pregnancy and medication can have significant impacts on urine cortisol levels.
- As with blood samples, lab analysis can be slow meaning data isn't real time.

Saliva testing

Using a swab in the mouth, saliva cortisol levels can be analysed following inspection in a lab.

Advantages

- Can be carried out at home hence is less time consuming and more convenient.
- Painless procedure.

Disadvantages

- Cortisol concentrations in the saliva are significantly lower than in the blood, generating the possibility of lower accuracy readings.
- Further, this lower concentration requires the use of higher sensitivity techniques, increasing test cost and timeframe.

3.5 Competitors in Continuous Monitoring

As of February 2024, there are no cortisol monitoring contact lenses available for purchase on the global market. Development of a graphene transducer based cortisol monitoring contact lens by researchers at Yonsei University, South Korea, is our main competition. This slide will detail the advantages of CortiLens over this, as well as over the alternative continuous cortisol monitoring options available today.

Yonsei University's smart contact lens:

Our competition

A team of academics, lead by Minjae Ku, at the Nano Science Technology Institute, Department of Materials Science and Engineering, Yonsei University, are developing a 'smart, soft contact lens for immunosensing of cortisol' [10]. Their technology involves a graphene Field Effect Transistor (FET) upon which cortisol monoclonal antibodies are fixed. The reaction of such antibodies with the cortisol in tear fluid creates a change in electrical charge, which can then be monitored. Yonsei University's Industry Academic Corporation Foundation have successfully filed for a patent on this technology, which was granted on 27/7/21.

Our competitive advantage

- **Discreet** - Ku's FET sensor technology requires a graphene transducer in the form of a coil visible to others when the lens is worn. In contrast, the nature of C- does not rely on any large elements, hence they are miniaturised so that the lenses are unnoticeable to others. CortiLens allows for discreet cortisol monitoring that does not impact vision.
- **Cost effective** - where the graphene FET technology will cost an estimated £75, production of one CortiLens contact lens is estimated at £15. This lower price point for manufacturing transfers through to a lower price point for consumers, and enables the production chain.
- **Improved production and supply chain** - graphene, although useful, is a newly discovered material on which research is limited. Due to this, the cost of graphene production alone, and the resources it requires, significantly reduces the feasibility of a reliable and realistic supply chain for a launching business. The materials required for CortiLens however are cheaper, more accessible and can be sourced reliably.
- **Longevity** - studies, for example R. Kurapati's work published in Faraday Discussions [11], suggest the degradation of graphene when used in medical devices, due to attack by human eosinophil peroxidase cells.

An overview:

The lack of cortisol monitoring contact lenses on the market leaves the opportunity for commercialisation wide open. CortiLens believe their technology shows clear advantages over others, and are the first outside of South Korea to advance this far. Other technologies, including sweat patches, show inaccurate results and further development is required for them to be seen as a competitive threat.

Stanford University's sweat patch:

Our competition

A group of academics, lead by Prof. Dr. Salleo at Stanford University, are developing a patch that when applied to the skin, draws in sweat and determines how much cortisol the wearer is producing.

Our competitive advantage

- **Suitable for daily use** - for accurate measurements, Salleo's sweat patch monitor requires the user to sweat 'enough to glisten' [12]. This is a relatively high threshold and hence is impractical for the average person's daily use. In contrast, CortiLens' technology depends on no such factor and hence provides continuous monitoring regardless of daily routine.
- **Reusable** - currently, this sweat patch is not reusable if used properly. The only circumstances in which it may be used multiple times is if the user has not sweated a particularly large amount, in which case the accuracy of the readings is questionable. Salleo discusses [12] that this is something his research team are working on, however the CortiLens technology requires no such further research as it does not have this problem.
- **Unaffected by environmental impacts** - where tear fluid cortisol levels, and hence the accuracy of C- β [®], are relatively unaffected by external factors, the concentrations measured by a sweat patch are much more susceptible to error. Evaporations, discontinuous sweat flow and the mixing of old and new sweat are examples of such issues that may lead to inaccurate readings. Further, temperature and pH of the skin are shown to interfere substantially with readings.
- **Discreet** - as mentioned previously, the miniaturisation of CortiLens technology allows an unnoticeable monitoring option, whereas a patch on the skin is not unobservable.

3.6 Primary Market Research

Survey

A survey was conducted in order to gauge public interest in health tracking with a particular focus on cortisol monitoring via a contact lens. 146 responses were collected between the 5th and 13th February, a summary is presented below.

Demographic

'Which age category do you fall into?'



Figure 4: Breakdown bar of responses to question 5 in market research survey.

● 18–25 ● 26–30 ● 31–40 ● 41–50 ● 51–60 ● 61+

- 74% of respondents fell into the age category of 18-25, with the second largest group being age 51-60 at 11%.
- The majority of respondents were students (66.7%), or in some type of employment (23.5%).
- 48% of those employed work more than 40 hours per week.

In order to gauge the baseline anxiety levels of those participating, the Generalised Anxiety Disorder (GAD) questionnaire was used.

- 18-25 year olds indicated the highest levels of anxiety, with 57.8% having reported symptoms of moderate or severe anxiety in the last 2 weeks.
- The 61+ age category reported the least anxiety, with all 10 respondents signalling mild to no anxiety.

The need for CortiLens

Only 15% of respondents believed they had a firm understanding of cortisol and its role in the body, with the remaining 85% admitting to knowing only a small amount, or nothing at all, about the hormone. Following this, and after having read a small blurb of information on cortisol, 82% of respondents go on to say that they would be interested in learning more about their blood cortisol levels and the impact this could have on their body.

This desire for knowledge indicates a clear interest in the information a product like CortiLens would provide.

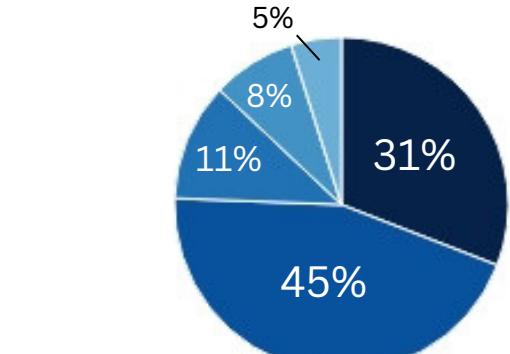
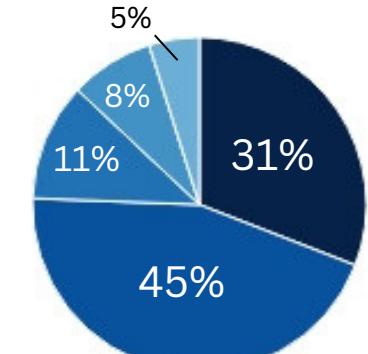
“82%
of respondents go on to say that they would be interested in learning more about their blood cortisol levels”

The use of CortiLens

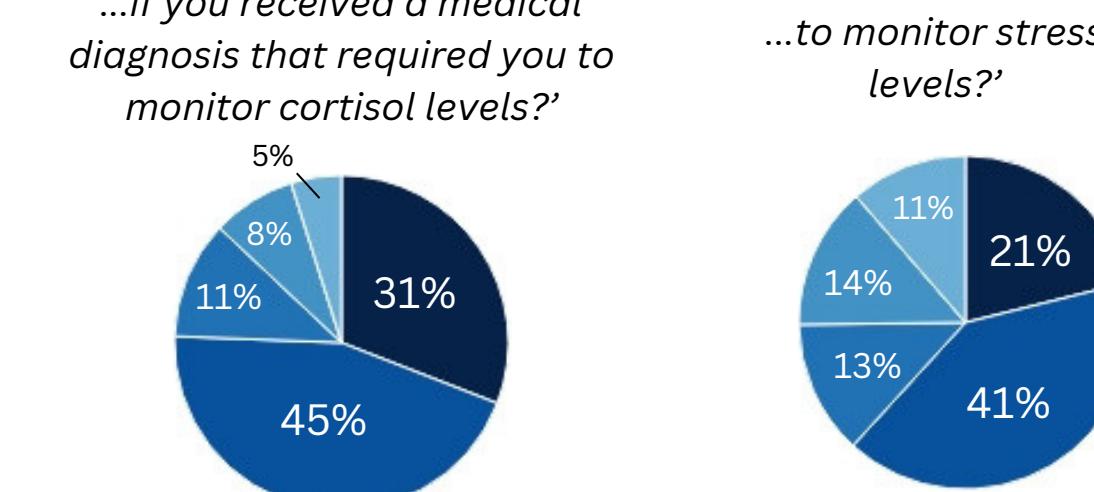
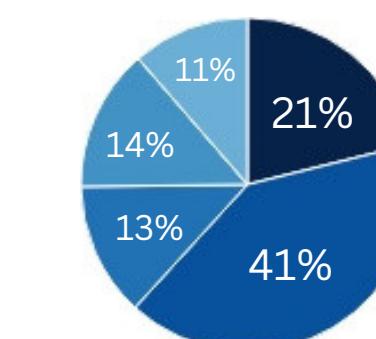
Although CortiLens' initial target market is those with a diagnosis of Addison's disease or similar, the application of the 11 β -HSD2 enzyme in an electrochemical cortisol sensor is wide-spread. Our market research survey was used to gauge interest in the potential applications of CortiLens.

'How likely would you be to consider the use of cortisol monitoring contact lenses...'

...if you received a medical diagnosis that required you to monitor cortisol levels?’



...to monitor stress levels?’



...to monitor other health factors (e.g. weight gain/loss, muscle weakness, blood pressure)?’

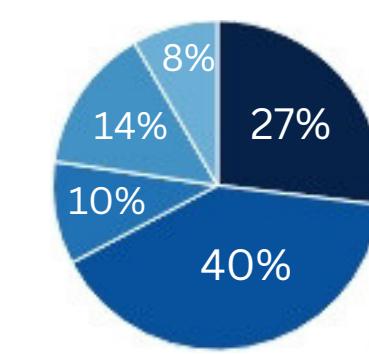


Figure 5: Pie chart summaries of responses from questions 21, 22 and 23 of the market research survey.

- As shown above, approximately 70% of all respondents said they were likely or extremely likely to consider the use of C-Beta for each of the three uses included in our survey, giving clear indication of the market available for such a product.
- Of the three potential uses, respondents were most keen to use CortiLens as a monitor for a medical condition, with **76% saying they were somewhat likely or extremely likely to do so**. This response is positive for CortiLens, whose initial market launch will be targeted to those living with Addison's disease.
- In every age category other than 31-40, at least 50% of respondents would consider the use of a product like C- β [®].
- Respondents were prepared to pay an average of £33.81 monthly for subscription extended-wear cortisol monitoring contact lenses.

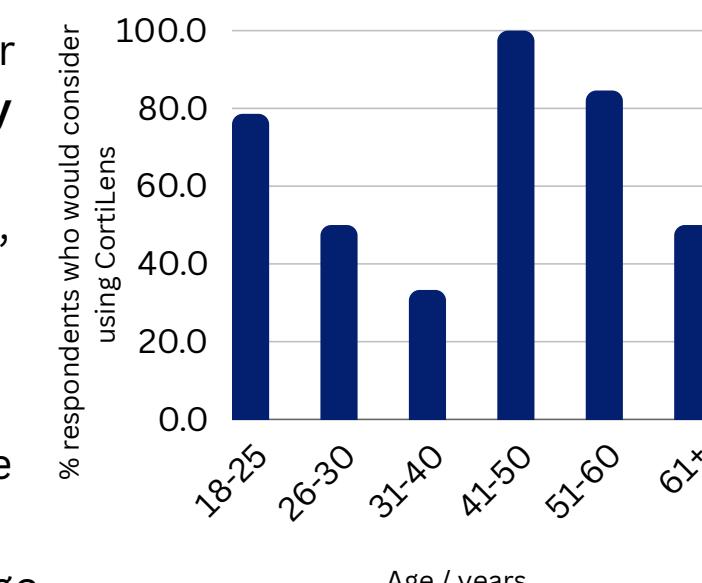


Figure 6: Bar chart displaying the percentage of respondents in each age category who would consider using CortiLens.

3.7 SWOT Analysis

Strengths

- Continuous cortisol monitoring offers a non-invasive, convenient and accurate way for patients to manage their health conditions.
- Our unique focus on tackling rare diseases such as Addison's and Cushing's, establishes CortiLens as a leader in a very specialised undeveloped market.
- There is currently no medical device on the market that offers continuous monitoring of cortisol levels.
- CortiLens will be available as a subsidised subscription making it more affordable for patients who suffer from Addison's and Cushing's.
- There is potential to further integrate with healthcare providers to increase access to specialist care and better coordination of care.

Weaknesses

- Developing and testing the product to regulatory satisfaction will have high costs.
- Our product development through the R&D process is reliant on government funding for rare diseases, which is uncertain until it has been granted.
- Gaining approval from medical and regulatory bodies can be time consuming and challenging.
- Market knowledge for such a specialised product may be limited and not well understood.
- Convincing users to adopt this new form of health monitoring may be challenging, particularly as it involves contact lenses which many users may be uncertain about.
- To mitigate these weaknesses, CortiLens seeks investments and partnerships that can provide both funding and expertise.
- Our surveys and extensive market research identified the key needs and preferences of potential users to create a more user-centric product.
- To encourage user acceptance, CortiLens plans to partner with Addison's charities so they can recommend our product to their patients and spread awareness of monitoring options. Additionally, future partnerships with companies such as Whoop, will allow us to expand into their pre-existing customer base for those interested in stress and wellness monitoring.

Opportunities

- Global interest in health technology is increasing, creating a larger market for continuous health monitoring devices.
- Looking to the future, there is opportunity to partner with pre-existing wellness apps to provide real-time stress monitoring.
- Potential to expand into using this technology to monitor other health markers.
- Opportunity to integrate AI for better health data analysis and personalised health insights.

Threats

- Data privacy concerns – handling sensitive health data requires stringent privacy measures.
- Dependence on suppliers for the lens components and reliance on specialised materials could be risky if supply chain issues arise.
- Potential health risks associated with the long-term use of smart contact lenses could lead to liability issues.
- The app has the potential to display incorrect cortisol levels, introducing significant liabilities.
- Other competitors in the cortisol monitoring field pose risks.
- To mitigate these threats, CortiLens will implement robust cybersecurity measures and comply with all data protection regulations. To avoid liability issues CortiLens will be transparent with users about how their data is used and stored.
- To reduce liability regarding health risks, CortiLens plans to have a long R&D phase to thoroughly test the product ensuring it is safe for long-term use.
- CortiLens will also obtain appropriate liability insurance to mitigate future risks.
- CortiLens is the only continuous, non-invasive wearable device currently on the market for cortisol monitoring, so it faces no threats from direct competitors.

3.8 PESTLE Analysis

Political

- In 2022 the UK government pledged £260 million to boost healthcare research and manufacturing, including developing new devices and diagnostic technologies [13].
- £60 million of which is targeted towards companies at the forefront of innovation, to encourage commercial-scale manufacturing of radical medical devices [14].
- In 2023 the UK government released a Rare Diseases Action Plan.
- New government funding for rare diseases included £790 million for the National Institute for Health and Care Research (NIHR) biomedical centres [15].

Environmental

- The NHS shared business services announced the launch of the first framework agreement that aims to help the NHS meet their net zero targets [16].
- Suppliers of sustainable management services and technologies, will help organisations across the NHS access innovative, sustainable solutions for waste management.

Social

- 1 in 17 people develop a rare disease at some point in their life (that is 3.5 million in the UK alone).
- 9000 people in the UK suffer from Addison's disease, with over 300 new cases diagnosed each year [5].
- The recent UK rare disease framework aims to increase the awareness and sensitivity towards such under-researched rare diseases.
- Consumer wearable devices containing health and wellness features are becoming increasingly common and there is a high demand amongst the public for wearable tracking devices.

Technological

- The first ever medical technology strategy in the UK was published in February 2023.
- This blue print for boosting NHS medical technology is aimed to focus on accelerating access to innovative technologies.
- Aiming 'to enable patients to manage (and monitor) their own health at home and in their day to day lives' [17].
- Rapid adoption of new technologies will directly benefit CortiLens by enabling us to quickly and effectively, launch and distribute our product.

Legal

- Following Brexit, medical device regulation in the UK has emerged as an important area for the country to differentiate itself from its continental neighbours.
- The UK government aims to establish the UK's credentials as a global regulator, placing emphasis on safety and medical innovation to attract investment and stimulate growth [18].

Economic

- Current inflation rates in the UK have caused an economic crisis; the consumer price index rose by 4.2% in the 12 months prior to December 2023 [19].
- Consumers have less disposable income which is likely to affect consumer spending on medical devices. However, recent funding into rare diseases should support the lenses to be subsided through an NHS subscription.
- Inpatient hospital admissions in the UK caused by stress-related illnesses cost the government around £8.13 billion in 2023 [20]. Over the coming years, CortiLens is looking into expanding its contact lenses to not only be used for monitoring Addison's but other cortisol related problems such as stress management.

3.9 Future Opportunities

Future target markets



Our vision to broaden the market for our smart contact lenses encompasses venturing into the private healthcare sector, targeting individuals keen on stress management. Recognising the growing interest in wellness, we plan to make our product available to the general consumer, beyond those medically diagnosed with cortisol related diseases. By integrating our device with popular fitness trackers like Fitbit and existing wellness apps such as Whoop, we aim to tap into a vast customer base already engaged in stress management strategies. This synergy will not only enhance our product's utility but also align with the lifestyle and health goals of a wider audience, democratising access to innovative health monitoring technology.

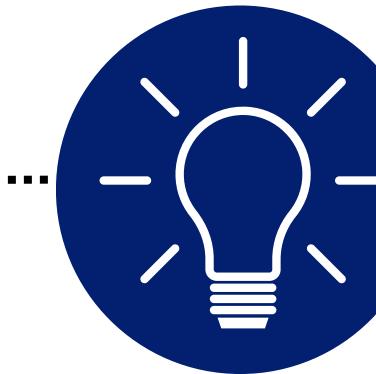
Future target locations



Building on insights from our global market research, our strategic expansion targets the U.S. and the Asia-Pacific regions, areas which have significant demand for smart contact lenses. In these regions, the continuous monitoring offered by smart contact lenses addresses a critical need within the global health market, particularly for conditions like Addison's disease and Cushing's syndrome. The prevalence of such rare diseases, coupled with the anticipated 11% annual growth in rare disease therapies [7] underscores a vital market opportunity.

Expanding into these locations will greatly benefit those struggling with rare disease management and may be of interest to many individuals looking to more closely monitor their stress levels. The interest in technology, especially in the Asia-Pacific region, noted for its rapid R&D advancements, aligns with our goals. There is a rising demand for stress management and health monitoring devices in these regions, with wellness devices gaining popularity among consumers seeking to improve their quality of life. This expansion not only taps into a market excited to embrace smart technology but also aligns with a broader interest in health and wellness monitoring technologies, promising to revolutionise how individuals manage their health.

Future technology advances



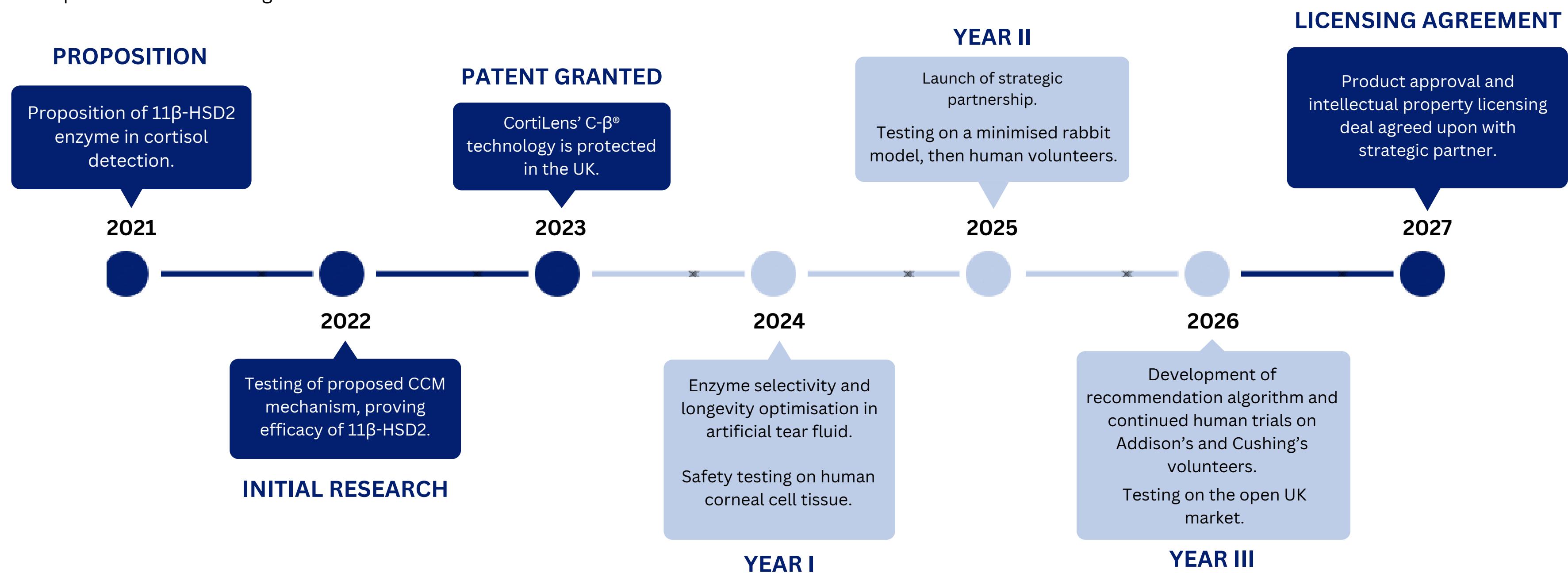
The future of smart contact lenses holds immense promise, particularly in their potential to evolve into a multifaceted diagnostic tool. Beyond monitoring cortisol levels, ongoing advancements pave the way for these lenses to detect a range of biomarkers in tears, such as glucose, offering groundbreaking implications for diabetes management and beyond. This expansion of capabilities could revolutionise the field of non-invasive monitoring, providing real-time health insights directly to users. As research progresses, the lenses are poised to become an integral part of personalised healthcare, enabling early detection and management of various conditions, thereby enhancing patient outcomes and offering a new frontier in medical technology.

4 Research and Development

4.1 Timeline

Our knowledge transfer partners in Pohang University proved the feasibility of a smart contact lens which utilises the electrochemical detection of glucose in the tear fluid. With this experience in continuous glucose monitoring (CGM), the CortiLens science team identified an enzyme-controlled reaction pathway that would allow for continuous cortisol monitoring. This involves an exchange between the glucose oxidase enzyme (used in the CGM) and the 11 β -HSD2 enzyme, which is known to oxidise cortisol in the liver.

This continuous cortisol monitoring (CCM) scheme, previously outlined in [The Science](#), has been tested in artificial tear fluid at Durham University laboratories, and a proof of concept confirmed. Following this, CortiLens' patent application for use of 11 β -HSD2 in CCMs was granted in 2023. Due to the simplicity of our modification to the CGM, which has been safety tested by our academic partners in Pohang University, we expect to quickly progress through initial trialing stages. The following timeline is proposed, and will be expanded upon in the forthcoming slides.



4.2 Outline

Year I

Following proof of concept of the reaction of 11 β -HSD2 with cortisol in the tear fluid, in vitro testing of C- β [®] will begin in Year I. The electrochemical performance of the cortisol sensor will be assessed using a potentiostat where the bimetallic electrode is immersed in an artificial tear solution. The concentration of cortisol in the solution will be gradually increased and the corresponding current change will be recorded. This will allow the confirmation of the accuracy of the determined cortisol concentration by comparing to the known concentration of the manufactured solution. This testing will also evaluate the capability of the cortisol sensor to operate effectively in the presence of ions and other interfering molecules contained in the artificial tear solution such as ascorbic acid. The long-term stability of C- β [®] will be evaluated in longevity testing by storing the lens in an artificial tear fluid for prolonged periods of time and measuring the sensitivity over regular intervals. This will prove that the lens can function over long periods of time without any significant degradation of the enzyme activity. Extensive safety testing will be carried out on human corneal tissue including monitoring any temperature changes which occur during functioning of the lens and examining any damage caused to corneal tissues after exposure to the lens.

Year II

Following the success of in vitro testing, Year II will see the beginning of in vivo testing in a minimised rabbit study, in accordance with the Draize eye test. A manufactured cortisol solution and an artificial tear solution will be mixed to a desired concentration and administered as an eye drop onto the contact lens after being placed on the live rabbit's eye. This is done to compensate for the lower cortisol concentration in the plasma of rabbits, as our cortisol sensor will be calibrated for human tear fluid. The measured cortisol concentration will then be compared to the manufactured cortisol concentration to prove the accuracy of the measurement made by the lens. Extensive safety testing will be carried out, such as the use of an IR camera to monitor heat generation whilst the rabbits wear the lens. Fluorescein staining tests will be carried out following the rabbit testing to ensure that no damage is caused to the corneal surface after wearing the lens. After obtaining clear evidence of the feasibility and safety of C- β [®] on rabbits we then aim to continue on to small scale human clinical trials after receiving funding from our strategic partner. This will involve further testing of the accuracy and safety of the lens when worn on a human subject, ensuring that no adverse side effects are seen. Further development of the user-friendly smartphone application will run concurrently with these trials.

Year III

Following success in proving the safety and accuracy of C- β [®] in the small scale clinical trials, we will begin trials where a group of volunteers who have a diagnosis of Addison's disease or Cushing's syndrome will be tested. Our CTO will commence the development of an algorithm to recommend when and how much prescribed medication our users should take to achieve optimal cortisol levels. Data collected from clinical trials and public health records will be used to develop this, with a focus on performance optimisation to ensure accurate recommendations. In addition, we will work on retrofitting our prototype lens onto existing prescription lenses to broaden the market for C- β [®]. Successful completion of human trials will then present enough evidence for UK approval of our product, allowing continuation to testing on an open market. At this point we aim to have a strategic partner whose expertise can be used to mass produce and distribute our product across the NHS. Once 12-months on the UK market has transpired and comprehensive safety evidence has been gathered, we will file for EU and US approval. Subsequently we aim to license C- β [®] to our strategic partner, in order to utilise their established manufacturing and distribution channels.

4.3 Exit Strategies

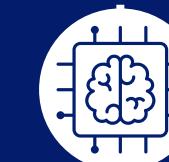
CortiLens stands at the forefront of healthcare innovation with its revolutionary contact lens, the C- β [®], designed for the continuous monitoring of cortisol levels. This technology signifies a major advancement in understanding and managing cortisol related diseases, such as Addison's and Cushing's, aligning perfectly with the urgent need for innovative treatment methods in rare diseases. To date, our diligent research and development efforts have been underpinned by a comprehensive R&D plan, including extensive clinical trials to ensure the safety and efficacy of our product. We have secured an Innovate grant projected to cover the costs through the animal testing phase. However, progressing to human clinical trial introduces significant financial and regulatory challenges.

In light of these challenges, we are reaching out to AstraZeneca, a global healthcare leader renowned for its commitment to the rare disease sector, proposing a strategic collaboration. Our vision is to integrate our lens technology with AstraZeneca's deep expertise in drug development, regulatory navigation, and patient advocacy. We believe this partnership could expedite the development process, enhance patient access, and provide comprehensive care solutions tailored to the unique needs of individuals with Addison's disease and Cushing's syndrome.

Our proposed exit strategy involves selling our lens technology to AstraZeneca. This move not only addresses the financial risks associated with mass manufacturing and navigating medical approvals but also leverages AstraZeneca's established infrastructure and distribution networks. We see this as a mutually beneficial agreement, where CortiLens can ensure the successful deployment of its innovative technology, while AstraZeneca can expand its portfolio with a cutting-edge solution for non-invasive cortisol monitoring.

We are confident that this partnership will mark a significant milestone in healthcare innovation, offering unprecedented opportunities for both CortiLens and AstraZeneca to make a profound impact in the lives of patients across the globe.

4.4 Future Developments



The future development opportunities for C- β [®] extends far beyond monitoring cortisol levels in tears. By harnessing the potential to detect a variety of biomarkers like glucose, these lenses are set to revolutionise diabetes management and other health conditions, enabling a leap forward in non-invasive health monitoring. This expansion into a multifaceted diagnostic tool signifies a significant shift towards more proactive and preventative healthcare measures, offering users real-time insights into their health status directly from their tears.

Further integration of Artificial Intelligence (AI) into the accompanying app can drastically enhance the personalised care patients receive. AI's ability to analyse large datasets can lead to more accurate predictions of health issues, tailored health advice, and optimised treatment plans based on the individual's unique biomarker profile. This could facilitate a more nuanced understanding of a patient's condition, predicting potential health crises before they occur and allowing for early intervention.

As these lenses become more sophisticated, they could act not only as a monitoring and diagnostic tool but also as a platform for delivering treatments releasing medication based on the biomarkers detected in tears.

5. Marketing strategy

5.1 Marketing Objectives

Partnering with AstraZeneca will ensure the successful launch of our product, and allow us to establish a commanding presence in the market. This collaboration not only aligns us with a reputable player in the pharmaceutical industry but also underscores our commitment to addressing rare diseases with cutting-edge technology. With the help of AstraZeneca's resources and expertise, we aim to introduce C- β [®] to our target market ahead of competitors, while instilling public confidence through a compelling USP.

Our initial target market is patients in the UK suffering from Addison's disease or Cushing's syndrome. This will be extended to a global reach in the future, and can also target health and wellbeing consumers who are interested in monitoring their stress levels.

Our marketing strategy encompasses a multi-faceted approach, including detailed reports, conference presentations, and mainstream social media campaigns to raise awareness among both scientific and public audiences. We will also leverage press releases and regular website updates to keep stakeholders informed about our progress.

5.2 Promotional Strategy

Our promotional strategy will initially focus on targeting the NHS as our primary sales channel, with plans to expand into private outlets in the future. We will leverage various marketing channels to showcase the unique features and benefits of our technology.

To reach healthcare professionals and decision makers within the NHS, we will engage in targeted promotional activities such as participation in science conferences, publication of scientific papers, and utilising online channels to disseminate information about CortiLens Ltd.

Throughout our marketing efforts, we will highlight the key USPs of CortiLens across all communication channels. Additionally, we will emphasise the economic and societal benefits of the product, particularly in direct pitches to the NHS, as these aspects are crucial considerations for buyers within the healthcare system.

Partnering with AstraZeneca will enhance the credibility of our product within the medical sector. This collaboration associates our product with a recognised leader in the industry, bolstering the trust and confidence of healthcare professionals and potential consumers.

5.3 Online Presence

In line with our promotional strategy, CortiLens recognises the pivotal role of an impactful online presence in reaching our target audience and effectively promoting our innovative technology.

Our online presence will serve as a dynamic platform to engage with healthcare professionals, potential buyers, and the general public through various online channels:

- **Website Optimisation:** Our website is user-friendly, informative, and optimised for search engines to enhance visibility and accessibility.
- **Social Media Engagement:** We have established active profiles on key social media platforms such as LinkedIn, Twitter and Instagram.
- **Webinars and Virtual Events:** We will host webinars and participate in virtual events to showcase CortiLens to a broader audience.
- **Email Marketing:** Implementing an email marketing strategy will allow us to nurture leads, share updates about CortiLens, and provide valuable educational content directly to our subscribers' inboxes. Personalised email campaigns will be tailored to specific segments of our audience to maximise engagement and conversion rates.



Email: info@CortiLens.com



Website: www.cortilens.com



Twitter: @CortiLensLtd



LinkedIn: CortiLens Ltd



Instagram: @CortiLensLtd



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CortiLens Ltd. is a young start-up company committed to finding innovative solutions to rare diseases. Our product is a smart contact lens that measures the concentration of cortisol in tear fluid for patients with diseases that cause compromised cortisol levels, such as Addison's or Cushing's.

[Click here to read about our innovative technology.](#)

Our mission is to make health-monitoring more convenient and accessible so you can feel confident in your health. Our lenses connect to your smart device for readily available feedback on your cortisol levels and personalised treatment plans, all from the comfort of your home.

UK statistics about the unmet need in rare diseases

One in 17 people are affected by a rare disease which equates to approximately 3.5 million people in the UK.	6,000 children are born with an unnamed syndrome in the UK every year.	Of an estimated 10,867 rare diseases, 75% affect children.	95% of rare diseases do not have a treatment available.
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6,000 children are born with an unnamed syndrome in the UK every year.



Of an estimated 10,867 rare diseases, 75% affect children.



95% of rare diseases do not have a treatment available.

Figure 7: Social media profiles (left) and screenshot of the website (right).

5.4 Route to Market

5.4.1 Sales and Distribution Routes

After the completion of the 3 year R&D process, we propose to exclusively licence C- β [®] to AstraZeneca in return for 30% of revenue as royalty. From here, the proposed route for taking CortiLens' C- β [®] smart contact lens to market is outlined below. The first step is acquiring approval from the Medicines and Healthcare Products Regulatory Agency (MHRA) and obtaining a UKCA Certificate from an external body. Once both have been secured, CortiLens' C- β [®] will be registered and can be lawfully sold as a medical device on the UK market. Subsequently, once working in conjunction with AstraZeneca we propose our manufacturing process is likely to cost a figure of £15 per lens [21]. The overall manufacturing process of 15,000 C- β [®] lenses each month should cost the company £225,000. Utilising AstraZeneca's current manufacturing capabilities and facilities we hope the costs of fabrication will be minimised with progression and will constantly be honed and optimised throughout the process. Our initial sales strategy is to form an alliance with the NHS as our major distribution route - through the signing a 12-month supply contract (with capability of extension). Thus, we will access our targeted demographic with ease and C- β [®] will be prescribed monthly to those who require the monitoring technology. The current cost of an NHS prescription is £9.95 [22], if we estimate the Addison's and Cushing's population at 10,000 – the monthly revenue for the 1st year will be £99,500 giving an annual turnover of £1,194,000 for the NHS. The application to diagnostics is also available as the adrenal disease community is growing each year. Therefore we estimate to supply to the NHS for £2,800,000 for the years supply. The £1,606,000 short-fall would be counteracted by the elimination of 6-month routinely blood tests, hydrocortisone day curves and diagnostic tests which each cost the NHS, £50, £300 and ~£100 [23], respectively, hence when accounting for the market of ~10,000 people, the overall NHS expenditure will be reduced via the introduction of C- β [®] to their inventory.

This would contribute extra funding to the NHS, reduce strain, and decentralise the healthcare system. This would accumulate an initial annual profit of £100,000 for CortiLens Ltd. The low annual turnover for this demographic is not viewed as a negative anyhow, as CortiLens Ltd. will have fulfilled their pledge of helping the rare disease community. Extending our sales routes to then target the private sector we will introduce a secondary revenue stream – an increased price for this sector would be considered, though not confirmed at this point.

5.4.2 Proposed CortiLens Packaging



Figure 8: C- β [®] product packaging design.

5.4.3 Route to Mass Market

Our final proposal to bring C- β [®] to mass market would then be to transfer from a prescription to subscription based service. As revealed in our market research, 82% of participants would be interested in learning more about their blood cortisol levels. The WHO claim "**stress is the health epidemic of the 21st century**," and as cortisol can also act as a direct stress indicator, there is potential to transform C- β [®] into a stress monitoring device available for anyone interested in managing their stress levels. Therefore via a partnership with a health monitoring app currently on the market, for example FitBit or Whoop - CortiLens would then have a multimillion market at their fingertips. The existing apps could then be retrofitted to reveal tips, lifestyle changes and meditative exercises to control cortisol (stress) levels. We would propose the cost of a subscription to these lenses to be increased from the prescription price to become £30 per month. This would then bring in CortiLens Ltd. an additional £180 per customer per year which can of course be multiplied greatly when considering the wellbeing monitor market. A more in depth price analysis is discussed in **8.2.7** and further in **A.8**.

"Stress is the health epidemic of the 21st century"
-WHO

A proposed packaging design for CortiLens' C- β [®] smart contact lens is displayed in Figure 8. The Company Logo is clearly displayed for recognition and marketing reasons, with the overall theme of blue tones, to give connotations of an optical and medicinal device.

6 Strategic Partnership

6.1 Existing Partnerships



Durham university

Through leveraging the University's cutting-edge research facilities and expertise in biosciences, we have been able to effectively test the proposed CCM mechanism and prove the efficacy of 11 β -HSD2 in cortisol monitoring lenses.



Pohang university

Our partnership with Pohang University, in South Korea, gave us a basis for our technology. As our knowledge transfer partner, Pohang University has inspired our investigation into how their electrochemical technology allowing the detection of glucose levels in tear fluids, could be modified for cortisol monitoring.



Innovate UK

Partnering with Innovate UK presents a significant opportunity for CortiLens to leverage financial support and expertise in driving its research and development efforts forward. Cortilens qualify for a 70% claim on all eligible costs, providing substantial acceleration to market.



Addison's Self Help Group

Our collaboration with the Addison's Self Help Group is not only pivotal for the development phase of C- β , but also crucial for its successful launch into the market. By engaging with a group directly impacted by the conditions C- β aims to monitor, we gain invaluable insights into patient needs and preferences.



Octopus venture

Octopus venture is renowned for its active involvement in the healthcare sector. Specialising in diagnostics, digital health, medtech and innovations that aim to decentralise the healthcare system, their investment will cover the remaining ineligible costs of our device development.

6.2 Proposal to AstraZeneca

As we navigate the pivotal second year of our Research and Development journey, we are poised to enter the final stages of C- β 's development. Our mission aligns seamlessly with AstraZeneca's focus on healthcare innovation, particularly in the realm of rare diseases. In light of this synergy, we are reaching out to propose a strategic partnership that leverages our collective strengths to overcome the challenges inherent in bringing groundbreaking therapies to market.

Our current focus is on optimising and funding the manufacturing processes.

To this end, we seek your support in **securing £415,000 in funding (£165,000 of which will help cover costs) and use of your laboratory facilities**. We estimate that the remaining £250,000 will be used for clinical trials (100% of this can be claimed back through our Innovate Grant).

This critical investment will enable us to complete our clinical trial phase, a decisive step toward making our treatment available to those suffering from Addison's disease and Cushing syndrome.

To safeguard and formalise this partnership, we propose drafting a mutual non-disclosure teaming agreement, facilitating a bidirectional exchange of knowledge and resources. This collaboration will not only enable us to utilise your extensive laboratory space and equipment but also provide us with access to your distribution channels to ensure the rapid commercialisation of C- β .

6.3 What we offer

In return for AstraZeneca's investment, CortiLens offers to exclusively license our C- β technology to AstraZeneca. The terms of this deal, including a 70/30 revenue split, will ensure that the deal is beneficial for all parties involved and that AstraZeneca's future position is protected. This collaboration not only positions AstraZeneca as a leader in patient care for rare diseases but also ensures a shared commercial path to success. Our application to Innovate UK is set to cover a substantial proportion of in-lab costs and specialised equipment. Additionally, the partnership is assured to generate positive media attention, enhancing AstraZeneca's brand as a champion of healthcare innovation. Together, our united expertise and resources will pave the way for significant advancements in patient outcomes, marking a transformative step in the management of rare diseases.

7 Legal

7.1 Legal Structure

7.1.1 Company Registration

CortiLens Ltd. was incorporated under the Companies Act 2006 as a private limited company and received a 'Certificate of Incorporation' dated 30/11/2021. The company number is 428505782. CortiLens Ltd.'s registered address is listed as Department of Biosciences, Stockton Road, Durham, DH1 3LE. Upon registration with the Companies House, CortiLens Ltd. was simultaneously registered for Corporation Tax.

7.1.2 Memorandum and Articles of Association

An Articles of Association was written (omitted from appendix for brevity) and a Memorandum of Association (appendix A7) was signed by all initial stakeholders: Issy Chaffe, Louis Kelly, Emilia Havard, Amelia Semmens, Melissa Hennessy, Ciara Hill, Daniel Mason and Joseph Osborne.

7.1.3 Company Directors

Issy Chaffe, Louis Kelly, Emilia Havard, Amelia Semmens, Melissa Hennessy, Ciara Hill, Daniel Mason and Joseph Osborne are all Directors of CortiLens Ltd. All Directors are responsible for the running of CortiLens Ltd., including the keeping of company records, accounts and activities. Directors also contribute to achieving the corporate strategy underpinned by the company's mission and values. All directors are critical in ensuring the objectives of the business are met.

7.1.4 Directors and Shareholders

The Shareholder Agreement, signed on 01/01/2021, outlines the shareholders of CortiLens, including the University of Durham. All shareholders have invested £10,000 into CortiLens Ltd. in exchange for equity shares. The University of Durham received 24.90% in shares for filing the initial patent and providing laboratory space. Shareholders have the right to participate in decision making and receive a share of company profits based on their ownership stake. Together, the founding shareholders hold the majority of shares, but no single shareholder owns more than 25%, so none are considered a Person with Significant Control (PSC) and do not need to be listed on the PSC register.

7.1.5 Shareholder Agreement Summary

Shareholder Name	Percentage	Number of Shares
Durham University	24.90%	2490
Issy Chaffe	9.33%	933
Louis Kelly	9.33%	933
Daniel Mason	9.33%	933
Emilia Havard	9.33%	933
Amelia Semmens	9.33%	933
Melissa Hennessy	9.33%	933
Joseph Osborne	9.33%	933
Ciara Hill	9.33%	933
Octopus Ventures	0.50%	50

Table 1: Summary of the Shareholder Agreement, including the breakdown of shares.

7.2 Intellectual Property

7.2.1 Patents and Future Patents

To stay ahead of our competitors, it is of utmost importance to protect our intellectual property (IP), our expertise and our product. Therefore, we have completed the necessary processing, and we will continue to do so, to prevent infringement of our IP.

A UK patent was filed on the priority date of 15/12/2023 by CortiLens Ltd, and is valid for 10 years. The patent, filed through the Intellectual Property Office (IPO), claims the use of the enzyme 11 β -HSD2 to facilitate the redox reaction of cortisol to cortisone in tear fluid. Further details of the terms of the patent can be found in Appendix A7. Durham University provided financial assistance in filing the initial patent, but CortiLens are responsible for the maintenance and renewal of the patent. CortiLens Ltd. are in the process of extending this patent to cover the European Economic Area (EEA).

In return for covering marketing and manufacturing costs, and providing laboratory space, CortiLens Ltd. will exclusively licence their IP to AstraZeneca. This will be for an initial licensing fee and royalty fees thereafter. CortiLens Ltd. and AstraZeneca will then extend the patent to include the USA in the future to reach a larger market.

7.2.2 Trademarks

CortiLens Ltd. filed for a trademark from the International Property Office on 30/04/2022, 5 months after initial registration, to protect the following:

- Company name: “**CortiLens Ltd.**”
- Company logo
- Company slogan “**Enhancing patient care and outcomes in the rare disease community**”
- Primary product name “**C- β ®**”

All trademarks are registered and protected under the Trade Marks Act of 1994. These trademarks are active for 10 years upon certification, after which renewal is necessary. The domain name www.cortilens.com has also been purchased.

In the future, our goal is to extend our market beyond the UK, necessitating a modification of our registered trademarks to be implemented under the Madrid System with the World Intellectual Property Organisation (WIPO).

7.3 Insurance

7.3.1 Key Person and Director Liability Insurance

Key Person

CortiLens Ltd. have taken out an insurance policy with Gallagher Life Sciences Insurance from 30/01/2024 to 30/01/2028, with the option for renewal for Chief Science Officer Ciara Hill. The policy protects CortiLens Ltd. from financial losses arising for up to £50,000 for critical illness and £100,000 for life insurance over a period of 4 years.

Directors Liability

The policy taken out by CortiLens Ltd. is designed to cover any legal expenses and costs against the insured individuals up to £1,500,000. All directors of CortiLens Ltd. are covered by this insurance in the event of any claims.

Laboratory Insurance

Included in our laboratory costs with Durham University, we have paid an insurance premium. This insurance covers all research undertaken on the Department of Biosciences premises, as well as insurance for tools and equipment.

7.3.2 Employee and Public Liability Insurance

Employers Liability

An insurance policy with AXA Insurance has been taken out by CortiLens Ltd. for a period of 3 years, with the option for renewal available. This policy will cover CortiLens Ltd. for any compensation claims arising due to employee illness or injury as a result of CortiLens Ltd. business practices.

Public Liability & Product Liability

These policies will be taken out in the final stages of the research and development program for the smart contact lens. In particular, the policies will put into place before the technology moves into clinical trials and is eligible for claims due to side effects of CortiLens Ltd.’s product, by third parties.

7.4 Regulations

Regulatory compliance is a vital consideration when bringing a new medical device to the UK market. Adhering to relevant regulations and obtaining necessary approvals from regulatory bodies ensures the safety and efficacy of the product. CortiLens Ltd. will register C- β [®] with the Medicines and Healthcare products Regulatory Agency (MHRA). As a 2b device, our product will require an external body for certification and the issue of a UKCA certificate. C- β [®] will conform to Medical Device Regulations 2002 (MDR) [24].

A small portion of our preclinical trials will involve testing on animals, solely rabbits. We recognise and will adhere to the stringent regulations governing animal testing, ensuring compliance with the Animals Scientific Procedures Act (ASPA) of 1986 via thorough procedural review.

All necessary animal testing for our research and development plan will be conducted at AstraZeneca's Discovery Centre (DISC) to uphold quality assurance standards. Pending our strategic partnership, we will have confirmed with the director of the facility that they possess the required personal and establishment licenses, including a certificate of designation. Moreover, we have obtained a project license for our program of work through the Animals in Science Procedures e-Licensing system, contingent upon adherence to the 25 standard conditions outlined in the 1986 ASPA.

UK legislation requires the sale of optical appliances, including contact lenses, to be through an optician, medical practitioner or registered optometrist [25]. Therefore, CortiLens look to partner with AstraZeneca, who will distribute the product to medical practitioners and opticians.

CortiLens Ltd. will implement systems for post-market surveillance to monitor the performance and safety of the product once it is commercially available. This will involve reporting and investigating adverse events and taking appropriate corrective actions if issues arise.

In terms of patient confidentiality, CortiLens will always comply with the General Data Protection Regulation (GDPR) in Europe and the Health Insurance Portability and Accountability Act (HIPAA). These regulations govern the collection, storage, processing and sharing of personal data.

7.5 Ethics

7.5.1 Ethical Standards

Several considerations must be addressed for CortiLens to uphold ethical standards:

- **Informed Consent:** Patients must provide informed consent regarding the collection and use of their health data. CortiLens will clearly explain how their data will be used, who will have access to it, and allow them to opt out if they choose.
- **Accuracy and Reliability:** The technology will be accurate and reliable in measuring cortisol levels to avoid misdiagnosis or unnecessary medical interventions based on faulty data.
- **Accessibility and Affordability:** The product will be accessible through the NHS for patients with Addison's disease or Cushing's syndrome, as we believe health technologies should not exacerbate existing healthcare disparities.
- **Avoiding Exploitation:** CortiLens will not exploit vulnerable populations or engage in deceptive marketing practices. Marketing will be truthful and transparent about the capabilities and limitations of the product.
- **Long-Term Monitoring and Support:** CortiLens will provide long-term monitoring and support for users of the lenses, including addressing any adverse effects or complications.
- **Environmental Impact:** Considering the environmental impact of producing and disposing of the smart contact lenses is important for sustainability and ethical responsibility.

7.5.2 Pre-Clinical and Clinical Trials

We acknowledge the debate surrounding animal testing, but it is necessary to test our contact lens development on model systems before human use. Our focus is on conducting as many experiments as possible *in vitro*. When animal testing is unavoidable, we will do so ethically, following the "3 R's" principle [26]:

- **Replacement:** We will explore methods to avoid or replace animal use in our R&D process.
- **Reduction:** We will employ techniques that allow researchers to gather maximum information with the minimum number of animal subjects.
- **Refinement:** Our commitment is to constantly refine methods to reduce potential pain, distress, or suffering of animals. We strive to improve animal welfare within our research facility.

Regarding the ethics of our clinical trials, we have decided to conduct all trials in the UK instead of outsourcing to developing countries. The stringent regulations by the MHRA will ensure participant safety and establish an internationally accepted standard for the safety and effectiveness of our product.

8 Financial Report

8.1 Projected 3-Year Expenditure

Currently, CortiLens Ltd. is a holding company with 8 founders, a BBSRC funded PhD studentship and has a patented electrochemical reaction for the selective enzymatic detection of cortisol in tear fluid through the use of 11β -HSD2. The patent was initially funded by Durham University (in return for 24.9% equity) but is now owned and sustained fully by CortiLens Ltd. Considering the trajectory of our proposed 3-year R&D plan, here, the forecasted expenditure is reviewed.

The total projected company expenditure to fulfil all of the aims of our 3-year R&D is £818,447.76, 80% of which are eligible and the remaining 20% of which are deemed ineligible.

8.1.1 Eligible Costs:

- Predominant eligible costs arise from research staff salaries, including our CEO, CSO, COO, CTO and Strategy Director. The total equalling £438,000.
- Lab space is divided into Durham University Lab space (3-year duration costing £93,000) and AstraZeneca lab space, used in the product trial phases which we would ask for as an in-kind investment.
- A total of £96,000 is estimated to be spent on equipping the lab spaces with consumables, and access to specialist research facilities in Year 1 for testing on human corneal cell tissue (£15,000).
- Travel and subsistence costs originate from travel between the Durham based laboratories and AstraZeneca's dedicated R&D Discovery Centre based in Cambridge, England, starting in year 2. There is also a planned international business trip to our Knowledge Transfer Partners in South Korea (£8,400).

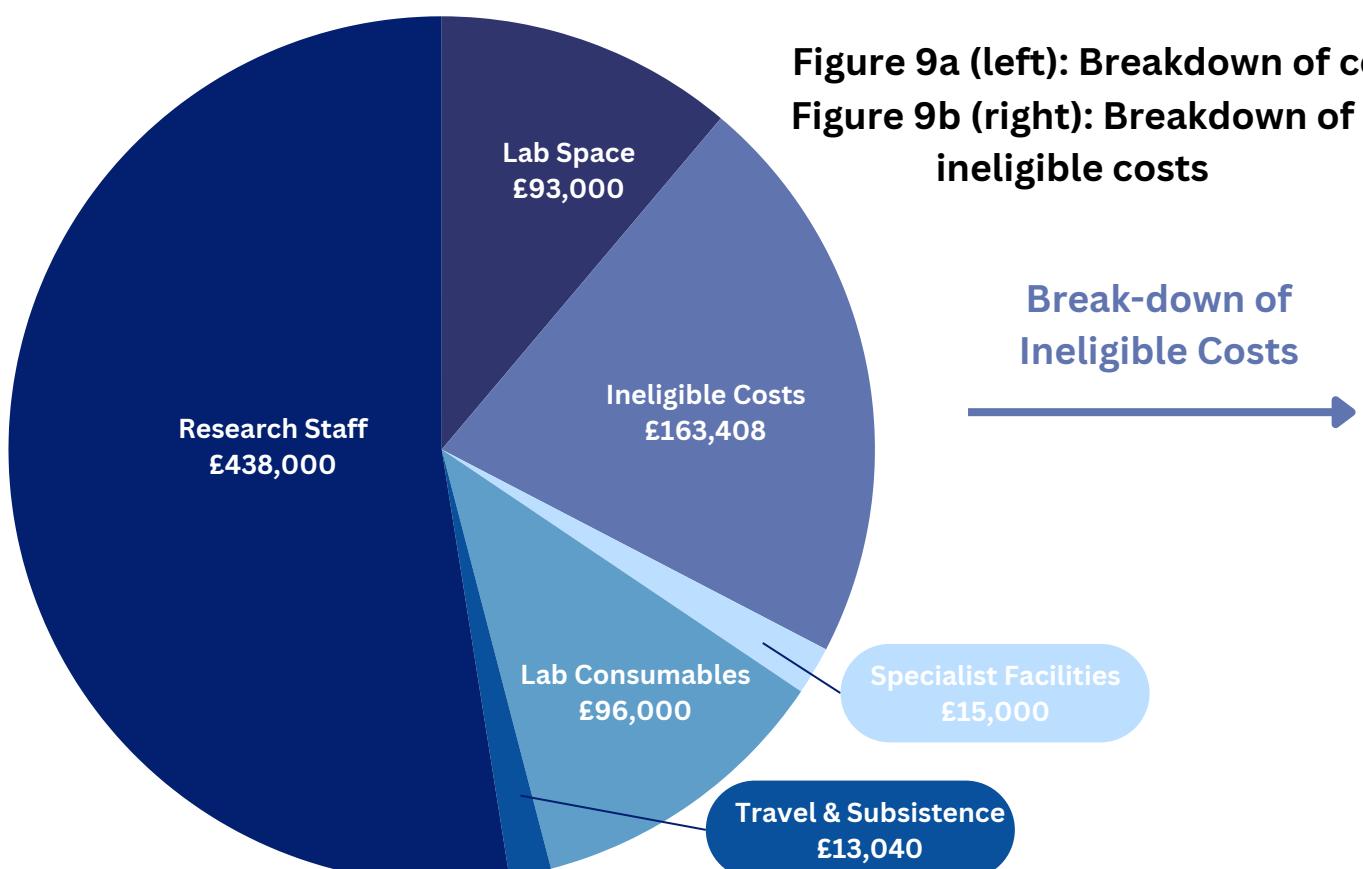
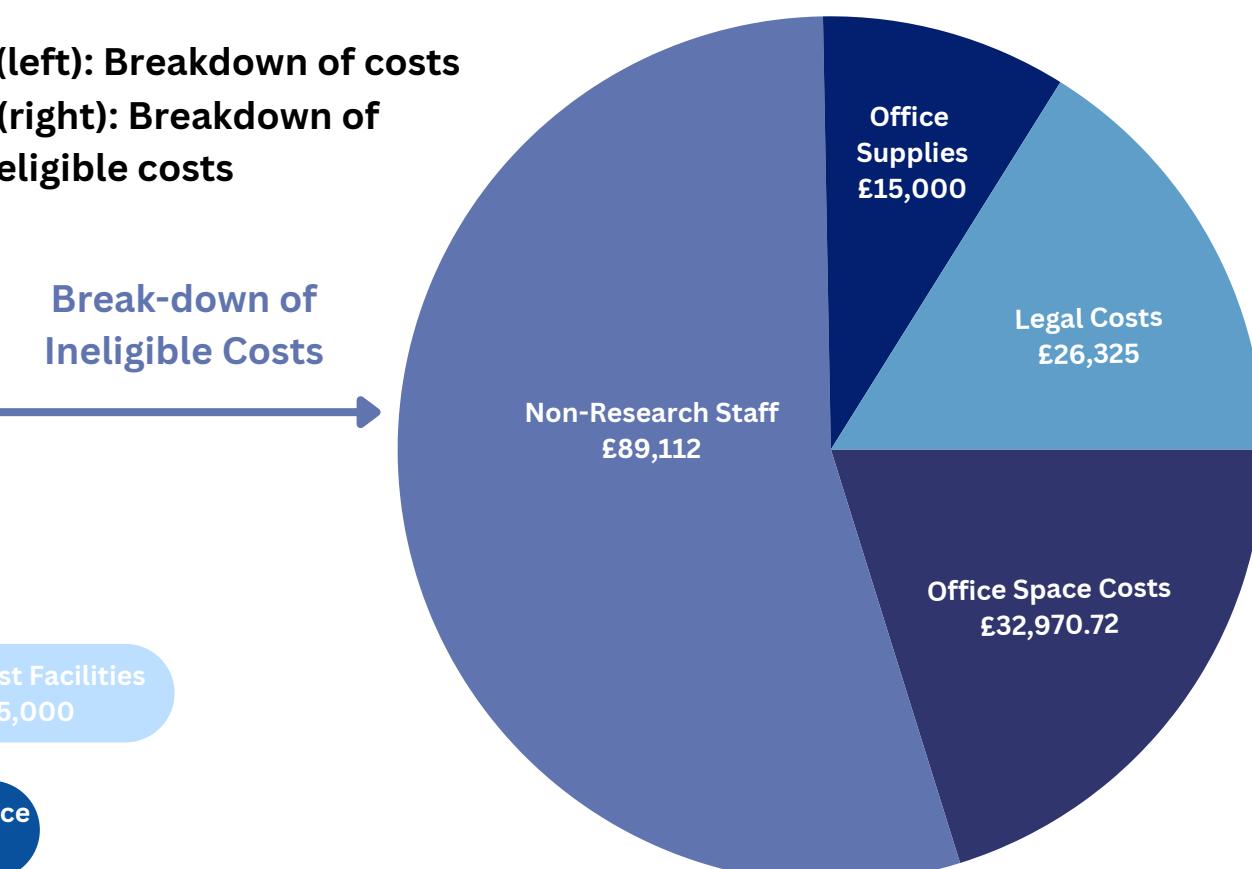


Figure 9b (right): Breakdown of ineligible costs



Here an annual break down of costs is shown – it displays an overall average expenditure of ~£270,000 per annum as the R&D plan progresses. Discrepancies are justified by increased professional fees and access to specialist testing facilities. More in depth expenditure pathways are detailed for each year below.

**Year 1
£288,336**

**Year 2
£257,256**

**Year 3
£272,856**

Throughout Year 1 the selectivity of the enzyme catalysing the reaction is improved and testing on human corneal cell tissue begins. This incurs large costs associated with specialist lab equipment and research facilities, hence the most significant year.

By this point we hope to have formed a strategic alliance with AstraZeneca to minimise production and research facility costs, and also subsidise the estimated value of initial clinical trials. Costs of travel to AstraZeneca's DISC is also factored in.

The third year projects a similar route to the second year, although our professional fees increase as more frequent marketing and financial advice is required as C- β ® gets closer to commercialisation.

8.1.2 Ineligible Costs:

- Salaries for non-research staff including our CLO, marketing executive and CFO contribute to majority of our ineligible costs at £89,112.00. This price accounts for their time for 1-day a month in the first 2 years, increasing to 2 for the CFO and Marketing Director in Year 3.
- Use of office space where non-scientific and scientific staff will work. Will be based in Durham, close to the lab facilities and rent will cost an estimated total of £10,990 per annum. Additional fees incurred for supplies.
- The upkeep of our patent, Key-People, Director, Public and Liability Insurances are our legal fees. As our trademarks were granted before the 3-years began, renewal of these is not required within this time frame.

8.2 Investment and Funding Model

In order to achieve our goal of revolutionising the continuous health monitoring industry, we are seeking funding support. The allocated funds will be used to propel CortiLens Ltd. to success, through facilitation of research and development and eventual commercialisation. CortiLens Ltd. has already secured substantial financial backing, and we are now looking for an in-kind investment from AstraZeneca. Details of funding and investment are as follows.

8.2.1 Shareholder Investments:

CortiLens Ltd. possesses 8 co-founders, each of which have personally invested £10,000 in the first year of the 3-year R&D process, supplying £80,000 of funding to cover ineligible costs. A monetary donation from each founder is a numerical representation of the deep-rooted belief that CortiLens Ltd. is destined to succeed.

8.2.2 Innovate UK SME Grant:

As a small enterprise, currently in the feasibility studies phase of the development journey, CortiLens Ltd. will utilise the UK's Innovate Biomedical Catalyst grant scheme to aid the cover of research costs. CortiLens Ltd. qualify for a 70% claim on all eligible costs, resulting in a secured £458,528 fund.

8.2.3 Charitable Investment:

CortiLens Ltd. successfully applied for a research grant from the Addison's Self Help Group Charity at a value of £12,000. The organisation's objective funding research which "seeks to improve the lives of people with Addison's and adrenal insufficiency," coincides with our company ethos. We believe this grant is further validation that the primary support is strong and hence confirms the gap in the market for CortiLens.

8.2.4 BBSRC funded PhD Studentship:

The eligible cost of our PhD student's consumables funded by The Biotechnology and Biological Sciences Research Council (BBSRC) doctoral training partnership with Newcastle Liverpool Durham (NLD). This covers £12,500 annually and will continue throughout all 3 years of the R&D plan.

8.2.5 Angel Investors:

Remaining ineligible costs will be covered by our Angel Investor, Octopus Ventures, one of the most active health tech investors of 2023, with a clear focus of funding into diagnostics, digital health, medtech and innovations which are decentralising the healthcare system. Providing £65,420 they will receive 0.5% equity in CortiLens Ltd.

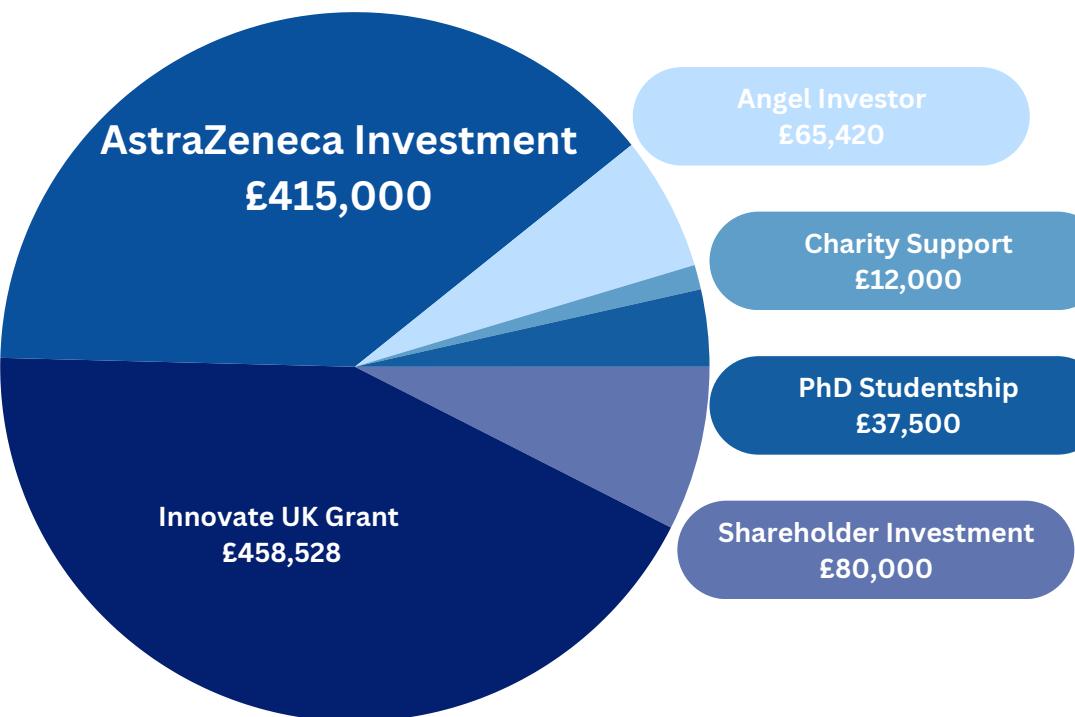


Figure 10: Pie Chart of our funding and investment model: displaying proportion secured / required from each organisation.

8.2.6 Strategic Alliance with AstraZeneca:

CortiLens Ltd. are then seeking an in-kind investment of £415,000 from our proposed strategic partner AstraZeneca. £250,000 of which is to cover associated costs of clinical trials in your animal houses and we will be looking to speak with your staff for licensing from the home office. As a large company, carrying out fundamental research trials, AstraZeneca will then be viable to claim 100% of this figure back from Innovate UK. The further £165,000 is for access to lab space, manufacturing facilities and eventually distribution routes. This partnership would entail a strong alliance with a proposed exit route in which AstraZeneca receive full licensing rights to CortiLens Ltd.'s C-β®.

**Total Income and Expenditure = £1,068,447.76
Giving a Net Balance of £0.00**

8.2.7 Commercial Proposition

During the 3 year R&D process CortiLens Ltd. will not return any profit. However, past this stage, the projected profit for years 4, 5 & 6 are depicted below. As outlined in 5.4, the initial emergence of C-β® to market is through a prescription service via the NHS which yields a profit of £100,000. As the population of the Addison's and Cushing's community increases annually by 13% the increase in profit in year 5 reflects this, proportionally. In year 6 the expansion to the stress market is calculated as though we obtained an initial 1000 customers, hence accruing a further £180,000 that year. Using the profit figure of year 6 and a medical devices industry standard P/E ratio of 38.0792 [27] plus accounting for our IP value of £1.07Mn using the cost method [28], we can value CortiLens Ltd. at £12.72Mn. This justifies the 0.5% Shareholder stake which Octopus Ventures secure in return for their investment.

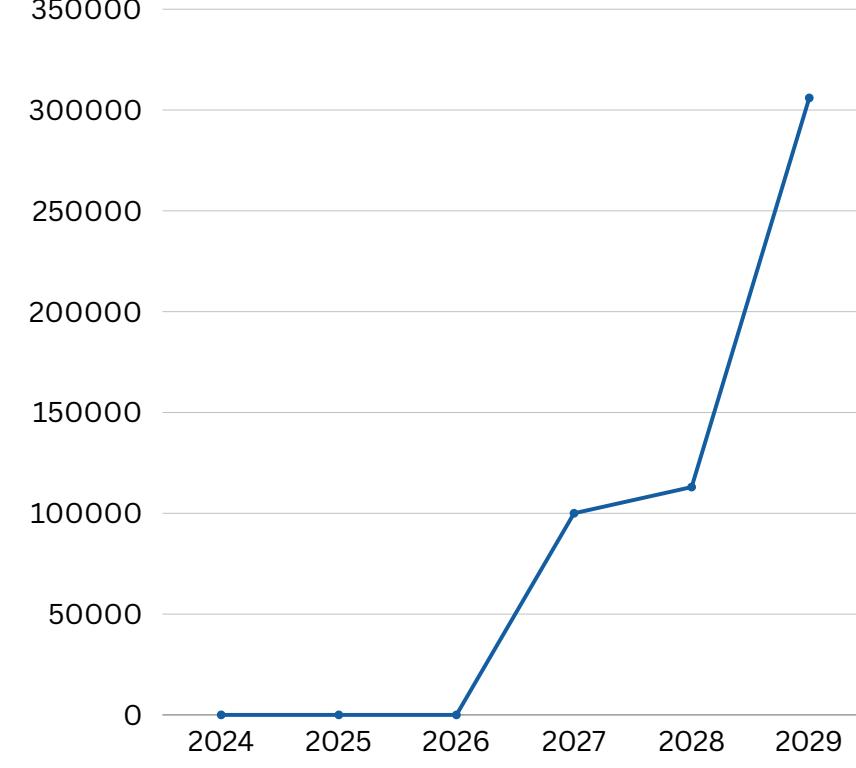


Figure 11: Projected annual profit of years 1-6

9 Risk Analysis

9.1 Risk Assessment

Table 2: Risk Matrix

	Risk	Likelihood	Impact	Rating
Operational	Failure to retain or acquire talent	3	4	12
	Unable to scale operations financially	4	3	12
Financial	Global market volatility (supplier power, import rates, exchange rates, and demand) increasing costs	3	3	9
Marketing	New competitive entrants reduce demand	2	3	6
	Insufficient demand or market size for profitability	2	4	8
Legal	Regulation process becomes slow	4	2	8
	Patent infringement	2	2	4
Scientific	Innovation rate slows	2	2	4

9.2 Mitigations

9.2.1 Operational Risks

Retaining and acquiring talent is imperative to CortiLens' success. To prevent failure, CortiLens Ltd will take the strategic approach of adopting generous compensation packages, issuing shares to talent ensuring they benefit when CortiLens succeeds and providing competitive salaries as of our strong funding. In addition, we are committed to fostering a positive and innovative work culture. These strategies ensure CortiLens incentivises our team ensuring we stay at the forefront of innovation.

Navigating the operational challenges of scaling the production of C-β® out of the prototype phase, we expect there to be high operational costs. To mitigate these expenses, we plan to form a partnership with other companies that utilise similar component parts. This collaboration will allow us to leverage purchasing economies of scales effectively reducing costs due to reduced supplier power.

9.2.2 Financial Risks

To mitigate financial risks in the global market, CortiLens plans to either partner with UK manufacturers or establish in-house production in the UK, reducing price volatility and supplier power. Additionally, our market position allows for reactive price adjustments, capitalising on the limited competition and buyer power.

9.2.3 Marketing Risks

To counter competitive entrants, CortiLens emphasises continuous innovation, fostering an innovative work culture and a flat organisational hierarchy, conducive to new ideas. To build brand loyalty, customers should continually be analysed to ensure our quality meets the highest standards. Staying on top of new innovations and paradigm shifts keeps us ahead in the market. Additionally, ensuring demand, our strategy includes exploring new markets such as treatments for other rare diseases and stress management solutions for the mass market.

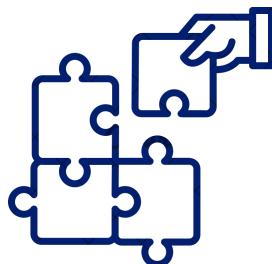
9.2.4 Legal Risks

Regulatory delays on the development of the C-β® prototype, such as resulting in an unpredictable timeline for testing, could extend the path to profitability. CortiLens will engage regulatory consultants and initiate the regulatory process imminently, following the guidelines strictly. Additionally, to protect our core competence against patent infringement in countries where CortiLens is not yet patented, like South Korea or China, we plan to register our patents worldwide in the future. This will safeguard our market share.

9.2.5 Scientific Risks

To counteract the risk of a slowed pace in innovation which could cause a competitive disadvantage and obsolescence of C-β®, CortiLens is committed to continuous investment in research and development. This ensures we remain at the technological forefront. Additionally, we aim to collaborate with academic institutions and industry partners beyond AstraZeneca to improve our research scope and integrate diverse scientific insights.

10 Concluding Remarks



The current methods for monitoring cortisol levels in patients with Addison's disease or Cushing's syndrome are invasive, inaccurate, and inconvenient. C- β [®] proposes an innovative approach that aims to continuously monitor cortisol levels in tear fluid, providing a non-invasive solution.



To advance C- β [®] from concept to reality, we seek support from AstraZeneca. Your dedication to developing solutions for rare diseases, coupled with your unmatched expertise, would accelerate our research and development efforts. Your affiliation to the NHS would facilitate access to established distribution networks with proven credentials.



At CortiLens Ltd., we share your commitment to delivering equitable access to high-quality and innovative healthcare solutions that are scalable and sustainable to address areas of unmet need in the UK. We believe our shared values will foster a long lasting partnership focused on improving patient outcomes and enhancing quality of life.

Therefore, we are requesting £415,000 of funding in-kind support to advance our research and development agenda. In return, we are offering a licensing deal. The terms of this deal, including a 70/30 revenue split, will ensure that the deal is beneficial for all parties involved and that AstraZeneca's future position is protected.

Collaboratively, we have the opportunity to develop a product that enhances patient quality of life while alleviating pressure on the NHS. Together, we will achieve our mission of

**“Enhancing patient care and outcomes
in the rare disease community.”**

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Appendix

A1. Scientific background

External research from previous studies lead to our discovery of the potential smart contact lenses for improving medical care through the constant monitoring of biomarkers in the tear fluid. Following research into Addison's disease and Cushing's syndrome, we focused on the continuous monitoring of cortisol to improve the quality of life for those struggling with these neglected diseases.

The proposal of a feasible smart contact lens for the continuous monitoring of glucose in the tear fluid for diabetics. This research utilised the electrochemical detection of glucose in the tear fluid, leading to our investigation of how this reaction could be modified for cortisol.

Han, H.H., Kim, S.K., Kim, S.J., Choi, I., Mok, J.W., Joo, C.K., Shin, S. and Hahn, S.K., 2023. Long-term stable wireless smart contact lens for robust digital diabetes diagnosis. *Biomaterials*, 302, p.122315.

A paper which highlighted the role of the enzyme 11 β -hydroxysteroid dehydrogenase type 2 (11 β -HSD2) which catalyses the NAD dependent interconversion of cortisol to inactive cortisone. We then applied this reaction to the smart contact lens which was previously designed for glucose monitoring, leading to the creation of our smart contact lens, C- β [®].

Chapman, K., Holmes, M. and Seckl, J., 2013. 11 β -hydroxysteroid dehydrogenases: intracellular gatekeepers of tissue glucocorticoid action. *Physiological reviews*, 93(3), pp.1139-1206.

The proposal of a feasible smart contact lens for the continuous monitoring of cortisol which utilises the interaction of cortisol with the cortisol monoclonal antibody (C-Mab). This smart contact lens used Near-Field Communication (NFC) technology which allowed wireless powering and transmission of data between a smartphone and the contact lens. With the significant advantage of having a wireless, battery free smart contact lens, we then applied this technology to our cortisol sensor.

Ku, M., Kim, J., Won, J.E., Kang, W., Park, Y.G., Park, J., Lee, J.H., Cheon, J., Lee, H.H. and Park, J.U., 2020. Smart, soft contact lens for wireless immunosensing of cortisol. *Science advances*, 6(28), p.eabb2891.

A2. R&D

Table 3: GANTT chart for CortiLens product development within the next 3 working years.

		CortiLens: Product Development												1/5/2024		1/5/2027																													
														START DATE		END DATE																													
		Task	Overseer	Year 1 Q1			Year 1 Q2			Year 1 Q3			Year 1 Q4			Year 2 Q1			Year 2 Q2			Year 2 Q3			Year 2 Q4			Year 3 Q1			Year 3 Q2			Year 3 Q3			Year 3 Q4								
				W1	W2	W3	W4	W5	W6	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13	P14	P15	P16	P17	P18	P19	P20	P21	P22	P23	P24	P25	P26	P27	P28								
EFFICACY	Sensor testing	Clara Hill (CSO)																																											
	Stability testing		PhD Student																																										
	Ratio testing		Clara Hill (CSO)																																										
	Longevity testing		PhD Student																																										
	Retrofitting to prescription lenses		Clara Hill (CSO)																																										
SAFETY	Artificial tear fluid testing	PhD Student																																											
	Human corneal cell tissue testing		Clara Hill (CSO)																																										
	Draize rabbit test		Clara Hill (CSO)																																										
	Small scale human trials		Clara Hill (CSO)																																										
	Testing on open uk market		Clara Hill (CSO)																																										
APP DEVELOPMENT	Data gathering	Louis Kelly (CTO)																																											
	Algorithm development		Louis Kelly (CTO)																																										
	Connection Set up		Louis Kelly (CTO)																																										
	App development		Louis Kelly (CTO)																																										
	User testing		Louis Kelly (CTO)			</td																																							

A3. Marketing

A3.1 Press Release

CortiLens

For Release date
27th November 2027

CortiLens Ltd. Announces 12-Month Supply Contract of C- β ® Smart Contact Lenses with the NHS

CortiLens Ltd. Are Continuous Monitoring Trailblazers in the Healthcare Industry

London – 27th November 2027- Today at the London Rare Disease Showcase, CortiLens Ltd. announced the successful signature of a 12-month supply contract with the NHS, enabling 8400 people with Addison's disease and thousands more¹ with adrenal disorders to immediately "see beta" and upgrade their management techniques. C- β ® smart contact lenses monitor user cortisol levels to provide members of the rare adrenal disease community with a non-invasive, non-time-consuming, at-home, and passive technique to measure their current cortisol levels. This eases strain on patients and the NHS.

"This is a huge step in shedding light and encouraging others into the often-neglected research realm of rare diseases. Easing strain on not only the patients, but also the NHS, has been one of CortiLens' objectives since our founding in 2021 and this contract is a huge milestone in the current revolutionary journey of the continuous monitoring healthcare industry. We hope to see many more companies follow in our footsteps." said Melissa Hennessy, Chief Operations Officer at CortiLens Ltd.

Positive Strategic Alliances

The supply contract of C- β ® with the NHS will propel the commercialisation of the product and utilise the primary connection between the NHS and the rare disease community - instantly accessing the target demographic. AstraZeneca, the UK's leading biopharmaceutical company, recently committed to manufacturing the smart contact lens and obtained the full licensing rights to CortiLens Ltd., hence this supply contract will enable AstraZeneca to benefit from C- β ®'s proposed future expansion.

Founded in 2021, CortiLens Ltd. is the national leader in smart continuous monitoring contact lenses. The company offers an effective, non-invasive method of cortisol monitoring with an inherent mission to ease the restrictions on rare disease sufferers whilst simultaneously fulfilling a secondary key aim of CortiLens Ltd to decentralise the healthcare system.

CortiLens Ltd. is a registered trademark with C- β ® being a trademark under CortiLens Ltd within the UK filed under the Trademarks Act of 1994.¹

The names of actual companies and products mentioned herein may be by the trademarks of their respective owners.

For more information, press only: Daniel A Mason
07948 154425
info@cortilens.com

For more information on the supply contract of CBeta with the NHS: www.cortilens.co.uk

¹ NHS Choices (2019). Overview - Addison's disease. Available at: <https://www.nhs.uk/conditions/addisons-disease/> [Accessed 26 Feb. 2024].

Figure 12: A mockup press release that we intend to have published on the AstraZeneca Media Centre. This will aim to raise awareness of the commercialisation of CortiLens, with the intention of gaining traction from potential investors.

Figure 13: A snapshot of the AstraZeneca Media Centre Website with our press release displayed. This shows the intended future release and publication when CortiLens Ltd. confirm such alliances.

The Press release displayed to the left has been drafted as a potential future publication once a strategic alliance, **6.2**, has been formed with AstraZeneca. As CortiLens Ltd. intend to use the NHS as their primary distribution outlet a signature of such a supply contract would be a significant milestone and justify such a press release. Utilising the vast media reach of our proposed strategic partner, AstraZeneca, publication on the "Media Centre" of their website, shown in Figure 12 would provide CortiLens Ltd. with great exposure and potentially propel their commercialisation to the stress market by gaining traction from investors. This hypothetical press release was checked and improved with Zoe Sycamore, Associate Director at 90TEN, a healthcare communications consultancy.

A3.2 News Articles

The newspaper articles to the right have been drafted to show examples of the exposure we hope to gain at different stages of our R&D plan. As a startup medical company, we recognise the importance of engaging with the public to bolster both trust and create interest in our product. Further, solid media coverage could also increase investor interest in our company CortiLens Ltd.

Figure 15: The Economist's announcement on successful year 1 trials, paving the way for a promising future.

Figure 14: A mock-up of The Financial Times' coverage on our strategic partnership.

Figure 16: New Scientist report on the unveiling of the C- β ® patent.

A4. Market Research

This slide presents an overview of the market research survey. The schematics to the right highlight some of the key questions and their responses.

Summary of participant information sheet

"You have been invited to take part in this study as part of our undergraduate Science Enterprise project at Durham University. This study has received ethical approval from the Biosciences Department ethics committee of Durham University. Before deciding whether to take part in the study, it is important that you understand the purpose of the research and what is involved as a participant. Please read the following information carefully, and get in contact if anything is unclear or you would like more information."

Project Title: The development of smart contact lenses for the monitoring and tracking of cortisol levels.

This study has been organised by a group of students from Durham University. It is research as part of a module in which a hypothetical scientific innovation is designed. The purpose of this study is to evaluate attitudes towards health monitoring through smart contact lenses. Your participation is voluntary, and you do not have to agree to take part. If you do agree to take part, you can withdraw at any time during the study. All information obtained during the study will be kept confidential. You will initially be asked to provide a pseudonymised code accessible only by the research team. No personal data will be shared, however anonymised data may be used in reports and presentations but all within the module. No information will leave Durham University.

I agree that I have read and understood the information above. I consent to the use of my data in the manner described above and am happy to proceed with the questionnaire."

Breakdown

Block 1: Questions in this block (Q5 - Q18) helped determine the background and general demographic of respondents.

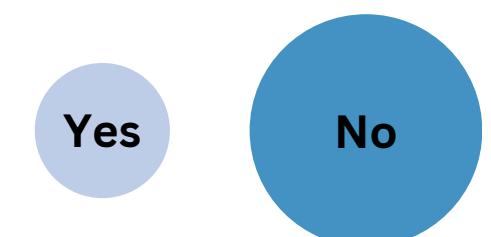
Block 2: Questions in this block (Q19 - Q27) considered the use of C- β [®] and its' applications.

Block 3: Questions in this block (Q28 & Q29) probed respondents thoughts on the use of a mobile phone application utilising data to suggest lifestyle and wellbeing tips.

Note, this survey contained 10 'drop-down' questions, hence the individual respondent's answers determined the length of their survey.

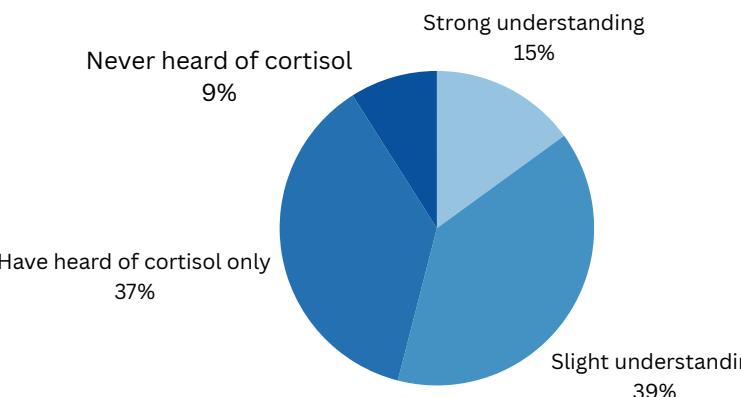
Question 9

Do you have a visual impairment?



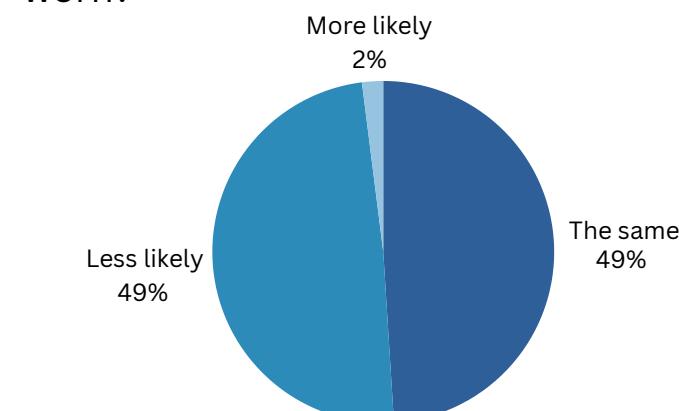
Question 18

Which of the following statements best describe yourself?



Question 26

Would you be less likely to consider the use of these cortisol monitoring contact lenses if they were slightly visible to others when worn?

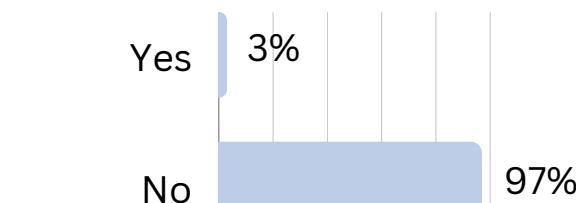


Figures 17-23:

Graphical depictions of responses to highlights of the market research survey.

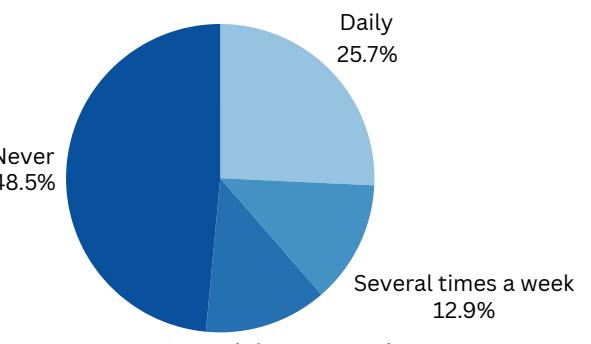
Question 15

Do you have a diagnosis which would require you to monitor cortisol levels?



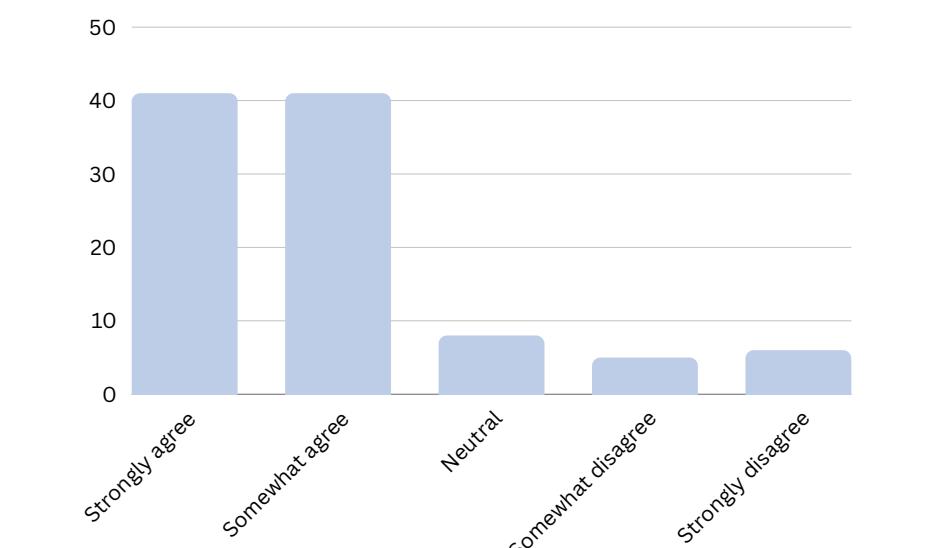
Question 17

How often do you use a health-tracking device (e.g. an Apple watch, Fitbit, Oura, Zoe?)



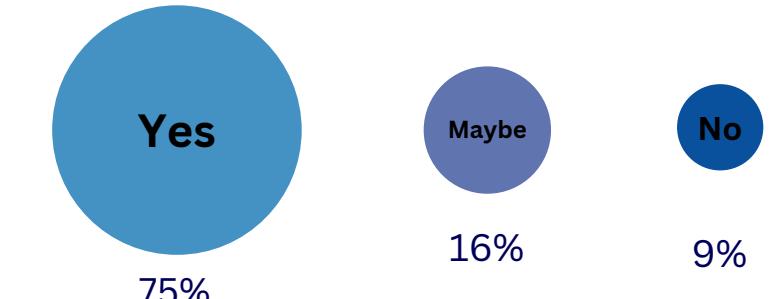
Question 20

To what extent do you agree with this statement: 'I am interested in learning more about my blood cortisol levels, and the impact this could have on my body' ?



Question 28

Would you be more inclined to use cortisol monitoring contact lenses if they came with a mobile phone application?



A5. Competitor Analysis

Product	Corti	/	Microsweat	U-Rhythm	WHOOP band	Oura Ring	NOWATCH
Company / Institution	EnLiSense LLC	Salleo Research Group, Stanford University	University of Calgary	University of Birmingham	WHOOP	OURA	NOWATCH
Location	Texas, USA	California, USA	Alberta, Canada	Birmingham, UK	Massachusetts, USA	Oulu, Finland	Amsterdam, Netherlands
Approach	Watch/Patch	Patch	Patch	Wearable device placed around waist	Watch	Ring	Watch
Description	Sweat sensor for monitoring stress, sleep, and metabolic health, comfortably	Patch applied directly to skin and measures sweat to assess cortisol levels	A wearable microfluidic patch for collecting sweat with the intent to measure cortisol	"The wearable device is worn around the waist and painlessly and automatically samples from beneath the skin every 20 minutes, without the need to collect blood" [3]	A wearable health monitoring band for sleep quality, performance, and recovery assessment	A ring that's designed to provide insights for overall health and wellness	A watch and wearable device focused on stress and recovery monitoring
Biomarkers Measured	cortisol, melatonin, glucose and several inflammatory markers	Cortisol	Cortisol	Stress hormone levels	Heart rate (HR), heart rate variability (HRV), respiratory rate, motion	HR, HRV, body temperature, readiness, activity	HR, HRV, activity
Key Differentiators	Requires patch/watch on arm, C-β® is a contact lens that isn't visible and more accurately measures cortisol.	Utilises a patch rather than lens.	In early stages of development which are still testing to "help link sweat and cortisol to stress" [1].	Detects stress hormone levels across a full 24-hour day whereas C-β® isn't worn over night [3]. This device is intrusive whereas C-β® isn't.	Doesn't monitor cortisol and is a mass market health monitor	Doesn't monitor cortisol and is a mass market health monitor	Doesn't monitor cortisol and is a mass market health monitor
Pricing	\$10 pre-order, actual price not released	/	/	/	£229 per month	\$229 for ring + \$5.99 per month	£393
Status	Not Retail-Ready	Prototyping phase	Human testing phase [1]	/	Regulation-Approved and Retail-Ready.	Regulation-Approved and Retail-Ready.	Regulation-Approved and Retail-Ready.

Table 4: Depiction of the competitor analysis

A6. Correspondence

A6.1 Email from Pohang University of Science and Technology

From: Hye Hyeon Han hhappy@postech.ac.kr
Subject: Knowledge Transfer Partnership: Pohang University of Science and Technology x Durham University
Date: 21 March 2023 at 15:55
To: Daniel Mason daniel.a.mason@durham.ac.uk

Dear Mr Mason,

Thank you for getting in touch regarding our paper and patent: "Long-term stable wireless smart contact lens for robust digital diabetes diagnosis."

The premise of retrofitting our glucose technology to cortisol is an exciting and feasible concept - albeit challenging. The 3 year R&D plan which I have looked through, however, has reassured me that the enzymatic selectivity concerns will be overcome, and so I support the venture of CortiLens Ltd. taking the C-β lens to market eventually.

I have discussed with Su-Kyung Kim and the other collaborators on the paper who are all in agreement for our team, on behalf of Pohang University of Science and Technology, to be an Academic Alliance.

In regards to the components of the lens and cost breakdown, I am happy to share such information with you, as our patent only protects our innovation within South Korea. In order to fully demonstrate the process and models of parts though, I would suggest an international trip to Pohang, South Korea in which we can more coherently share our advancements.

I look forward to speaking with you and more of your team soon and I am excited to see where CortiLens Ltd. will go in the future.

Regards,

Hye Hyeon Han
Ph.D. candidate
POSTECH, Republic of Korea



Figure 24: A correspondence email from Hye Hyeon Han, the lead researcher within our Knowledge Transfer Partnership with Pohang University of Science and Technology in South Korea.

Outlined throughout, namely in **4.1** and **6.1** CortiLens Ltd. have an academic alliance in place with POSTECH University. The premise is retrofitting their patent and paper on diabetes diagnosis to the cortisol applications and hence we have utilised the model components and certain processes within the assembly. The email is from Mr Han, the lead name on both the paper and patent.

A6.2 Email from our Angel Investor

octopus ventures

15th November 2023
33 Holborn, London EC1N 2HT
0800 294 6831
ianperry@octopusventures.com

Dear Mr Mason,

Thank you for sending CortiLens Ltd.'s company pitch to Octopus Ventures for pre-seed funding.

Your application was very detailed, well thought-through and the overall idea is an exciting one, and anchored on solving a problem, which is one of the main principles of our company ethos. I am able to inform you that Octopus Ventures are interested in providing up to a £100k angel investment into CortiLens Ltd. to help fulfil your company targets.

Octopus Ventures, a top, active investor in STEM start-ups within the UK, focusing primarily on decentralising the healthcare system and providing medical technology hope to be an asset in your journey by provide guidance and funding to aid your endeavours.

To begin our journey together we would like to set up a call with your CEO and any other key team members to decide our next steps. I hope our investment is a clear display of Octopus Venture's support and backing for your company and I look forward to speaking with you all soon.

Warm regards,

Ian Perry
Venture Partner
Octopus Ventures



Figure 25: An email confirming interest as an Angel Investor from Octopus Ventures.

This email from Ian Perry, Venture Partner at Octopus Ventures, was the first step in securing our angel investment. As mentioned in **8.2.5** £65,420 of our funding is from Octopus Ventures, a lead, active, early-stage health tech investor in the UK.

A6.3 Email from a Trustee at Charity Addison's Self Help Group

From: Philippa Sharman enquiries@addisons.org.uk
Subject: Charity Support - Addison's Self Help Group working with CortiLens Ltd.
Date: 17 January 2024 at 09:35
To: Daniel Mason daniel.a.mason@durham.ac.uk

Dear Mr Mason,

Thank you so much for your detailed email regarding your research project and your application to our **Addison's Self Help Group Research Grant**.

We are delighted to inform you that your application for a funding grant has been approved. Your endeavours coincide perfectly with our Charity's aims of improving the everyday lives of patients living with Addison's by easing their time and effort put into the management of such a rare disease. As I myself, have diagnosed Addison's disease, and as I work in close contact with many others I offer you my full support in this venture. The company CortiLens Ltd. has the potential to revolutionise not only the Addison's disease community but also the rare disease space entirely.

Please keep the Charity informed of any progressions which you make and do not hesitate to get in touch if you need any more advice, or access to research participant recruitment. I wish you the best of luck for your company's future.

Best wishes,

Philippa Sharman
Communications and Engagement Manager
Addison's Self Help Group



Figure 26: An email of support from the Addison's Self Help Group Charitable Organisation - awarding an ADSHG Research Grant to CortiLens Ltd.

In **8.2 Investment and Funding Model** an investment on behalf of the Addison's Self Help Group Charity is mentioned. CortiLens Ltd. successfully applied for a research grant and received this email to confirm the funding and support from ADSHG.

A7. Legal Documents



Figure 27: Certificate of incorporation.

COMPANY HAVING A SHARE CAPITAL

Memorandum of association of CortiLens Ltd

Each subscriber to this memorandum of association wishes to form a company under the Companies Act 2006 and agrees to become a member of the company and to take at least one share.

Name of each subscriber	Authentication by each subscriber
Amelia Semmens	
Clara Hill	
Melissa Hennessy	
Issy Chaffe	
Emilia Havard	
Joseph Osborne	
Louis Kelly	
Daniel Mason	

Dated 30th November 2021

Patent Claims

Field of Invention

The present invention relates to both the use of a specific enzyme in facilitating the reaction, and its applications in health-monitoring devices. In particular, the invention pertains to an enzyme which catalyses the oxidative interconversion of active cortisol to inactive cortisone, within a smart contact lens.

Background

As evidenced in the market by the need to address rare diseases, a demand clearly exists for a non-invasive device to continuously monitor cortisol levels. Such devices would be used by patients with compromised levels of cortisol, or individuals wanting to understand more about their stress levels.

We Claim

- 1.0 A smart contact lens system for monitoring cortisol levels in a user, comprising:
 - 1.1 A poly(ethylene terephthalate) flexible film layer which embeds all electrical components, including the cortisol sensor,
 - 1.2 A radio frequency communication antenna to enable wireless powering and data transfer,
 - 1.3 A Near-Field Communication (NFC) chip to transmit data to the smart phone app
 - 1.4 A processor for analysing cortisol level data,
 - 1.5 A user interface for displaying cortisol level information to the user.
- 2.0 The smart contact lens system of Claim 1, wherein the sensor comprises:
 - 2.1 The enzyme 11 β -Hydroxysteroid dehydrogenase type 2 (11 β -HSD2) embedded into a Bimetallic thin-film Au@Pt electrode.
- 3.0 The smart contact lens system of Claim 1, wherein the contact lens further comprises:
 - 3.1 A drug delivery mechanism for administering medication based on detected cortisol levels.
- 4.0 The method of Claim 1, further comprising:
 - 4.1 Alerting the user when cortisol levels exceed predetermined thresholds.

Figure 28: Memorandum of Association.

Figure 29: The terms of our patent.

A8. Finance

A8.1 Expenditure

Partner Details	Company Name	Project Role	Grant Administered By	Cost Category Type	Organisation Size	Organisation Type												
	CortiLens Ltd.	Lead	TSB	Academic	Small Enterprise	Limited Company												
Current Claim Number	1	Forecast:		CURRENT	Forecast	Forecast	Forecast	Forecast	Forecast	Forecast	Forecast	Forecast	Forecast	Forecast	Forecast	Forecast	Forecast	Forecast
Project Start Date	1-Mar-24	Claim No.	1	2	3	4	5	6	7	8	9	10	11	12				
		From:	1-Mar-24	1-Jun-24	1-Sep-24	1-Dec-24	1-Mar-25	1-Jun-25	1-Sep-25	1-Dec-25	1-Mar-26	1-Jun-26	1-Sep-26	1-Dec-26				
		To:	31-May-24	31-Aug-24	30-Nov-24	28-Feb-25	31-May-25	31-Aug-25	30-Nov-25	28-Feb-26	31-May-26	31-Aug-26	30-Nov-26	28-Feb-27				
Cost incurred:																		
Forecast costs	Cost Item	Description	Total	1	2	3	4	5	6	7	8	9	10	11	12			
	1	Research Staff	£438,000.00	£ 36,500.00	£36,500.00	£ 36,500.00	£36,500.00	£36,500.00	£36,500.00	£36,500.00	£36,500.00	£36,500.00	£36,500.00	£36,500.00	£36,500.00			
	2	Lab Space costs	£ 93,000.00	£ 7,750.00	£ 7,750.00	£ 7,750.00	£ 7,750.00	£ 7,750.00	£ 7,750.00	£ 7,750.00	£ 7,750.00	£ 7,750.00	£ 7,750.00	£ 7,750.00	£ 7,750.00			
	3	Office Space Costs	£ 32,970.72	£ 2,747.56	£ 2,747.56	£ 2,747.56	£ 2,747.56	£ 2,747.56	£ 2,747.56	£ 2,747.56	£ 2,747.56	£ 2,747.56	£ 2,747.56	£ 2,747.56	£ 2,747.56			
	4	Lab Consumables	£ 96,000.00	£ 8,000.00	£ 8,000.00	£ 8,000.00	£ 8,000.00	£ 8,000.00	£ 8,000.00	£ 8,000.00	£ 8,000.00	£ 8,000.00	£ 8,000.00	£ 8,000.00	£ 8,000.00			
	6	Access to Specialist Research Facilities	£ 15,000.00	£ 3,750.00	£ 3,750.00	£ 3,750.00	£ 3,750.00	£ -	£ -	£ -	£ -	£ -	£ -	£ -	£ -			
	7	Travel and Subsistence	£ 13,040.00	£ 8,400.00	£ -	£ -	£ -	£ 1,160.00	£ -	£ 1,160.00	£ -	£ 1,160.00	£ -	£ 1,160.00	£ -			
	8	Other Costs (e.g. Office Supplies)	£ 15,000.00	£ 10,416.67	£ 416.67	£ 416.67	£ 416.67	£ 416.67	£ 416.67	£ 416.67	£ 416.67	£ 416.67	£ 416.67	£ 416.67	£ 416.67			
	9	Legal (inc. IP & Patent)	£ 26,325.00	£ 2,160.00	£ 2,160.00	£ 2,160.00	£ 2,160.00	£ 2,160.00	£ 2,160.00	£ 2,160.00	£ 2,160.00	£ 2,160.00	£ 2,160.00	£ 2,160.00	£ 2,160.00			
	10	Non-Research Staff Costs	£ 89,112.00	£ 6,128.00	£ 6,128.00	£ 6,128.00	£ 6,128.00	£ 6,128.00	£ 6,128.00	£ 6,128.00	£ 6,128.00	£ 6,128.00	£ 6,128.00	£ 6,128.00	£ 6,128.00			
	Total Cost for Each Quarter		£ 85,850.23	£ 67,450.23	£ 67,450.23	£ 67,450.23	£ 64,860.23	£ 64,860.23	£ 63,700.23	£ 64,860.23	£ 63,838.23	£ 68,780.23	£ 68,780.23	£ 68,780.23	£ 68,780.23			
	Total Cost for Project		£816,447.76															
	Total Eligible Costs		£855,040.00	£64,400.00	£56,000.00	£56,000.00	£56,000.00	£53,410.00	£52,260.00	£53,410.00	£52,260.00	£53,410.00	£52,260.00	£53,410.00	£52,260.00			

Figure 30: The projected SME expenditure routes displayed per quarter for the 3-year R&D plan for CortiLens Ltd.. This showcase was used to apply for the Innovate UK Biomedical Catalyst Research Grant.

Non-Research Staff Costs	Chief Financial Officer	Chief Legal Officer	Marketing Director
Daily Rate	£700 [4]	£742 [5]	£600 [6]
Working Hours	1 day per month for 2 years. Increasing to 2 days per month in year 3.	1 day per month for 3 years.	1 day per month for 2 years. Increasing to 2 days per month in year 3.
Year 1 Cost	£8,400	£8,904	£7,200
Year 2 Cost	£8,400	£8,904	£7,200
Year 3 Cost	£16,800	£8,904	£14,400
Total Expenditure	£33,600	£26,712	£28,800

Table 5: Table to show breakdown of Non-research Staff costs.

As discussed in 8.1.2 our professional fees are incurred by paying the CFO, CLO and Marketing Director. Average daily rates are displayed to the left and hence their annual fees broken down. The need for financial and marketing advice increases in year 3 to ensure C-β® is ready for market - hence the doubling of the contact hours with such professionals in the final 4 quarters of the R&D Plan.

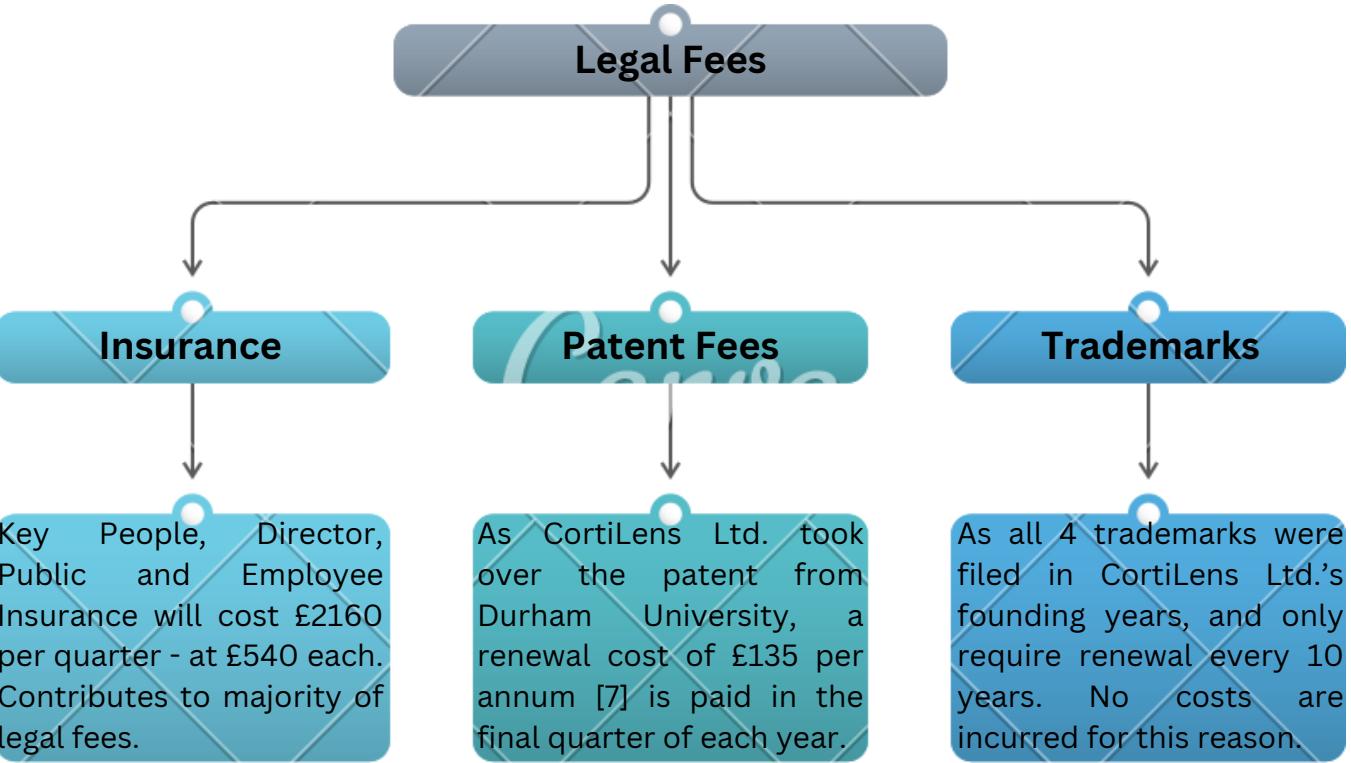


Figure 31: A Flow-chart representation of the breakdown of the £26,325 legal costs over the 3 years. Split into Insurance, Patent fees and Trademarks.

As the CEO, CSO, COO, CTO and Strategy Director are all full time employees across the 3 years, their salaries account for the research staff outgoing. Each person is paid £29,200 per year. The lab space documented is at Durham University and incurs a cost of £31,000 annually. The office space rental, also situated in Durham, UK, costs £10,990 per year with office supplies incurring a minimal charge, except for in the first quarter when initially equipping the space with PCs etc. Distributed evenly amongst the quarters of Year 1 only, £15,000 is estimated to be spent on access to specialist research facilities to conduct our testing on human corneal cell tissue. Travel and Subsistence includes proposals of costs associated with sending 4 team members (CEO, COO, CSO and Strategy Director) to Pohang, South Korea for collaboration with our KTP and then once an alliance has formed with AstraZeneca, intended travel to the DISC in Cambridge, UK. The Legal and Non-Research Staff costs are discussed more clearly to the left hand-side.

A8. Finance

A8.2 Funding

As discussed in more detail in **8.2 Funding and Investment Model**, CortiLens Ltd. have numerous investors and financial donors. 70% of eligible costs are covered by the Innovate UK SME Grant. The Shareholder Investments are all bestowed evenly throughout the first year of the R&D plan, as is the investment from Octopus Ventures. As the Strategic Alliance only forms in the 2nd year, so do the financial contributions from AstraZeneca. The BBSRC (Biotechnology and Biological Sciences Research Council) PhD Studentship funding opportunity is the most appropriate grant when considering the practices of which one will be undertaking throughout the operation. All other funding is spent evenly over the 12 quarters of the Research and Development Process.

Income	Total Amount over 3 years
Shareholder Investment	80,000.00
Innovate UK Grant (SME)	458,528.00
BBRSC PhD Studentship	37,500.00
Angel Investor	65,419.76
Charity Grant	12,000.00
Strategic Investor	415,000.00
Total	1,068,447.76

Table 6: The expected income sources and their values



The Innovate UK Small-Medium Enterprise Biomedical Catalyst Research Grant covers a large proportion of costs incurred throughout the full 3-Year R&D of CortiLens Ltd.'s C- β smart contact lens.

Applicant Business Size	Fundamental Research	Feasibility Studies	Industrial Research	Experimental Development
Micro/Small	100%	70%	70%	45%
Medium	100%	60%	60%	35%
Large	100%	50%	50%	25%

Table 7: Used to determine proportion eligible to claim from UKRI Innovate Grant.

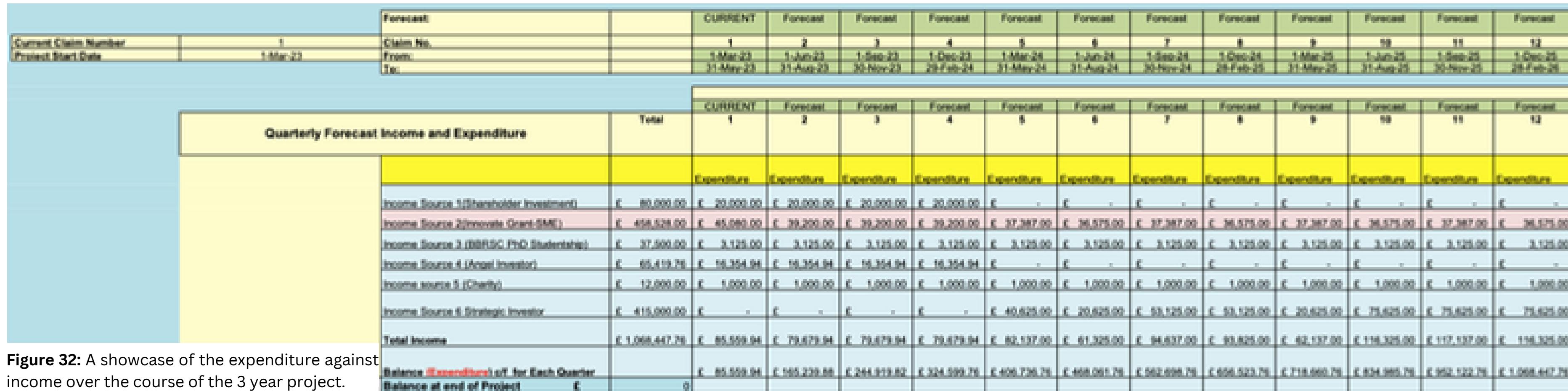
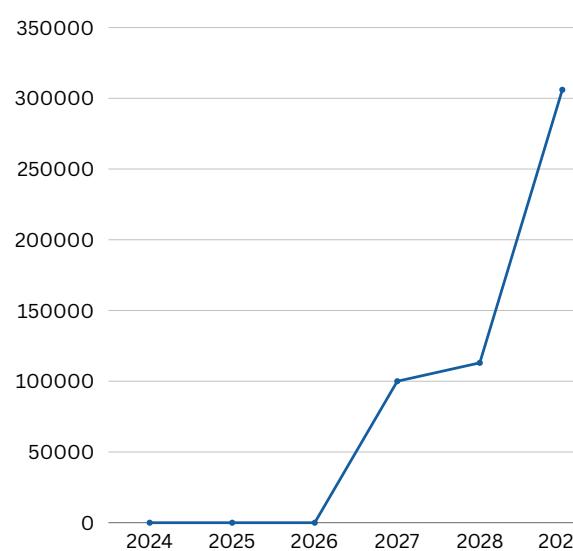


Figure 32: A showcase of the expenditure against income over the course of the 3 year project.

A8.2.7 Commercial Proposition

Proposed potential profits for the 3 years following the R&D process are displayed in **Figure 11** in **8.2.7**. The 3 years during the Research and Development do not yield any profit for the company and have a total Income & Expenditure of £1,068,447.76. Using “The Cost Method” of valuing a patent [8], which states that the costs incurred when developing an IP reflect that of somebody trying to recreate it and hence an estimated value of the patent would equal the total R&D costs. As an appropriate valuation technique for the early stages of development of an IP, it can be utilised here as total Income-Expenditure of our development process which is ~£1.07Mn.



Duplicate (Figure 11): Projected annual profit of years 1-6.

Year	Profit	Reason
2024-2026	£0	Research and Development Phase
2027	£100,000	NHS supply contract
2028	£113,000	NHS supply contract inc. increase in disease sufferers.
2029	£306,000	NHS contract, same increase + 1000 stress monitor customers (+ £180 each)

Table 8: Showing predicted profits in each of the forthcoming 6 years and the reason for this value.

The 12-month NHS supply contract only brings in £100,000 worth of profit in year 4. Then the increase of £13,000 is due to the population of adrenal disease sufferers 13% increase also. This increase is systematic throughout every subsequent year. In year 6, the expansion to the stress monitoring / well-being market is predicted, a low-park estimate of 1000 initial customers each yielding a £180 profit for the year as detailed in **5.4.3 Route to Mass Market** adds a further £180,000 to CortiLens Ltd.’s profits from the commercialisation of C-β®.

Utilising the already discussed projected profit and estimated patent value a fairly substantial valuation of CortiLens Ltd. can be deduced. Using the simple P/E ratio method [9] which uses the industry standard P/E value for the business domain as a multiplier of the projected profit and using the literature value of 38.0792 for the UK Medical Devices category [10]. This would give: $\text{£}306,000 * 38.0792 = \text{£}11,652,235.20$. Adding the estimated patent value to this then yields an overall business valuation of £12.72Mn. Justifying the 0.5% stake for £65,420 Octopus Ventures Investment.

$$\text{Business Value} = (\text{Projected year 3 profit} * \text{P/E ratio}) + \text{Patent value}$$

Equation 1: Showing the formula used to calculate a rough company valuation in order to decide shareholder proportions

A9. Appendix References

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