Society for Endocrinology

ISSUE 157 AUTUMN 2025
ISSN 2045-6808

THE ENDOCRINOLOGIST

THE MAGAZINE OF THE SOCIETY FOR ENDOCRINOLOGY

AI in endocrinology: THE PRESENT, POSSIBILITIES AND PITFALLS

Special features
PAGES 5–18

SUPPORTING SCIENTIST CAREERS
New framework
P20

SOCIETY JOURNAL SUCCESS
Latest Impact Factors
P21

OPPORTUNITIES IN YOUR SOCIETY
Apply now for a role
P24

A word from THE EDITOR...

It feels especially timely to reflect on this issue of *The Endocrinologist* as artificial intelligence (AI) continues to capture headlines, reshape our workplaces, and spark debate in both professional and personal lives. At a recent departmental seminar, I was struck by how quickly AI has shifted from futuristic concept to practical tool for data analysis, teaching and even patient care.

Here we shine a light on AI in endocrinology: its present applications, its promises, and its pitfalls. From digital twins in oncology to sperm mechanics in fertility science, the features show AI is no longer abstract but influencing practice, research and patient interactions.

Two articles particularly caught my attention. The first, **Digital Endocrinology in the Era of Precision Healthcare by Eder Zavala**, explores how wearable devices and mathematical modelling can turn hormone fluctuations into actionable insights. It's a fascinating glimpse into a future where 'endocrine digital twins' may help us deliver personalised care. The second, **Fertility Meets the Future by Simon Hanassab and Ali Abbara**, examines AI in reproductive medicine. Their candid discussion of the gap between commercial promises and clinical validation is refreshing, reminding us that while AI holds great potential, it must be integrated with rigour and responsibility.

As ever, this issue is not just about reading, but participating. The Society thrives when members put themselves forward – whether by sharing research, contributing articles, or stepping into governance roles. If these features spark an idea, I encourage you to take that step.

OK, I couldn't resist, that was all written by ChatGTP. I didn't go to a seminar last week so that's complete fabrication! However, I agree that this is a timely and great issue and that participation helps you get the most out of your Society, so why not **apply for a spot on *The Endocrinologist* editorial board, or a committee?** You won't regret it!

KATE LINES

Society for Endocrinology
Starling House
1600 Bristol Parkway North
Bristol BS34 8YU, UK
Tel: **01454 642200**
Email: **members@endocrinology.org**
Web: **www.endocrinology.org**
Company Limited by Guarantee
Registered in England No. 349408
Registered Office as above
Registered Charity No. 266813

THE ENDOCRINOLOGIST ENQUIRIES
Please contact
endocrinologist@endocrinology.org

ADVERTISING
Please contact
advertising@endocrinology.org

CONTENTS

View and share individual articles at:
www.endocrinology.org/endocrinologist

ON THE COVER...

P5–18
VIRTUAL NO LONGER
The reality of AI in endocrinology

P24
YOU CAN SHAPE THE FUTURE
Apply now to a Society committee

Become a contributor... Contact the Editorial office at **endocrinologist@endocrinology.org**

The Society welcomes news items, contributions, article suggestions and letters to the Editor. We would also like to hear your feedback on this issue of the magazine.

Deadline for articles for the WINTER 2025 issue: **13 October 2025**.

Front cover image: Created using AI by Microsoft Copilot

HOT TOPICS

Hot Topics is written by Victoria Chatzimavridou Grigoriadou, Zin Htut, Edouard Mills, Gareth Nye, Grigorios Panagiotou, Cosmina Schiteanu, Bhavna Sharma and Vincent Simpson

SOCIETY FOR ENDOCRINOLOGY OFFICIAL JOURNALS

Society members have free access to the current content of *Journal of Endocrinology*, *Journal of Molecular Endocrinology*, *Endocrine-Related Cancer* and *Clinical Endocrinology* via the **Members' Area of the Society website**. *Endocrine Connections*, *Endocrinology, Diabetes & Metabolism Case Reports* and *Endocrine Oncology* are open access and free to all. Publishing in *Endocrine Oncology* is currently free.

JOURNAL OF ENDOCRINOLOGY

Adropin improves testicular health in mice with hyperglycaemia

Male infertility is a known consequence of diabetes, largely driven by hyperglycaemia-induced damage to testicular function, reduced testosterone and impaired spermatogenesis. However, current treatments, such as metformin, offer limited benefit for restoring reproductive capacity. Adropin, a peptide hormone involved in metabolic regulation, has shown promise in improving glucose homeostasis and reproductive function in non-pathological settings.

In a recent study, Tripathi and colleagues investigated whether adropin could mitigate testicular and metabolic dysfunctions in hyperglycaemic mice. Using a streptozotocin-induced model of hyperglycaemia, they treated mice with adropin or metformin for 15 days and assessed markers of glucose metabolism, insulin sensitivity, testicular histology, testosterone production and germ cell health.

Adropin improved insulin sensitivity and glucose levels while significantly restoring testosterone levels and sperm count. It upregulated key steroidogenic proteins and markers of germ cell proliferation and survival, reducing apoptosis, and outperforming metformin in restoring testicular structure and function. These findings highlight adropin's protective effect against hyperglycaemia-induced testicular dysfunction and its potential as a novel therapeutic agent for diabetes-related male infertility.

Read the full article in *Journal of Endocrinology* **266** e250072
https://doi.org/10.1530/JOE-25-0072

JOURNAL OF MOLECULAR ENDOCRINOLOGY

New mechanosensitive behaviours of GPCRs

G protein-coupled receptors (GPCRs) are found throughout the human body. They are a diverse family of membrane signalling proteins, playing a critical role in health as well as in a number of diseases. Despite a significant amount of research having been undertaken to uncover their physiological roles, there may be a new angle to these signalling proteins, in the form of mechanosensing.

This review by Shetty *et al.* nicely summarises the emerging themes in mechanosensitive behaviours, potentially uncovering new thinking on a critical cellular component. Arguments are made between direct and indirect mechanosensitive responses, and the authors discuss the complexity of measuring this response in physiological conditions. They neatly summarise the novel approaches to studying this phenomenon and implore researchers to undertake the work.

In essence, this new understanding of GPCRs could pave the way for new insights for those utilising tissues with high levels of mechanical action, potentially unlocking new understanding for cardiovascular elements of disease.

Read the full article in *Journal of Molecular Endocrinology* **75** e240147
https://doi.org/10.1530/JME-24-0147

ENDOCRINE-RELATED CANCER

Insights into Mahvash disease and panNET development

Glucagon cell hyperplasia and neoplasia (GCHN) is a rare pancreatic condition. Its autosomal recessive form, Mahvash disease, which is linked to homozygous glucagon receptor (*GCGR*) mutations, remains poorly characterised, with only seven prior cases reported.

Kuiper *et al.* present the first detailed family study, uncovering new genotype–phenotype correlations, metastatic potential, and involvement of somatic *MEN1* mutations. Their work identified a new *GCGR* germline variant across eight relatives. Three were homozygous and exhibited classic signs of Mahvash disease, including elevated glucagon levels, pancreatic hypertrophy and GCHN. Notably, one patient developed liver metastases – the first confirmed case in Mahvash disease. A heterozygous carrier showed formation of pancreatic neuroendocrine tumours (panNETs) without GCHN, challenging previous assumptions about the benign nature of heterozygosity. Molecular analysis revealed distinct somatic *MEN1* mutations in multiple panNET samples, implicating *MEN1* inactivation as a potential driver of tumour progression from hyperplastic α-cells, parallelling mechanisms in sporadic panNETs.

This elegant study expands our understanding of Mahvash disease, underscores the malignant potential of GCHN, and emphasises the value of genetic and molecular testing in familial panNET syndromes.

Read the full article in *Endocrine-Related Cancer* **32** e250087
https://doi.org/10.1530/ERC-25-0087

ENDOCRINE CONNECTIONS

Disproportionality analysis of adverse events following tirzepatide in type 2 diabetes

Tirzepatide, a dual glucose-dependent insulinotropic polypeptide and glucagon-like peptide-1 receptor agonist approved for type 2 diabetes and obesity, is now being used widely in patients with type 2 diabetes. Real-world data continue to be gathered, which need close observation in this rapidly developing and exciting management option.

Using the US Food and Drug Administration Adverse Event Reporting System database, Zhang and colleagues evaluated adverse events reported with tirzepatide. A disproportionality analysis was conducted on reports from May 2022 to the fourth quarter of 2024. The majority of significant adverse events included expected issues, such as gastrointestinal (nausea and diarrhoea) and injection site-related events. Known risks such as pancreatitis and hypoglycaemia were confirmed. Some unexpected adverse events included post-menopausal bleeding and upper respiratory tract infections.

This analysis is consistent with gastrointestinal and pancreatic risks of tirzepatide known from prior clinical studies, and identifies potential new safety concerns, underscoring the need for vigilant monitoring, particularly during initial treatment phases.

A wide audience of individuals working with patients who have type 2 diabetes and obesity will find this article enlightening.

Read the full article in *Endocrine Connections* **14** e25020
https://doi.org/10.1530/EC-25-0205

CONTINUED ON PAGE 4

CONTINUED FROM **PAGE 3**

HT

CLINICAL ENDOCRINOLOGY

Diagnosing primary aldosteronism subtypes with plasma metanephrines

Primary aldosteronism is the most common secondary cause of hypertension, affecting 10% of hypertensive patients. Adrenal vein sampling (AVS) is the current gold standard for distinguishing unilateral from bilateral disease, thereby guiding surgical versus medical intervention respectively. However, using cortisol to confirm successful cannulation is challenging, due to its long half-life and potential co-secretion by aldosterone-producing adenomas, which can lead to misinterpretation.

Htut *et al.* have examined the diagnostic utility of plasma metanephrines as an alternative to cortisol for assessing the success of cannulation and the lateralisation of aldosterone secretion. In their series of 131 unstimulated AVS procedures performed by a single operator, a metanephrine-based selectivity index (i.e. to confirm successful cannulation) cut-off value >3 achieved 99% sensitivity and 100% specificity. An aldosterone/metanephrine lateralisation index >4 indicated unilateral disease with 94% sensitivity and 96% specificity.

Based on these findings, the authors recommend incorporating metanephrine measurements to enhance diagnostic accuracy and reduce the risk of missing unilateral disease, particularly in cases with aldosterone–cortisol co-secreting adenomas.

Read the full article in *Clinical Endocrinology* https://doi.org/10.1111/cen.15277

ENDOCRINOLOGY, DIABETES & METABOLISM CASE REPORTS

Amenorrhoea isn't always PCOS: a hidden case of Cushing's syndrome

Menstrual irregularities occur in 30–80% of women with Cushing's syndrome, yet the diagnosis is often missed when amenorrhoea presents without classical features.

Alhajeri *et al.* present the case of a 33-year-old woman who presented with six months of amenorrhoea following discontinuation of oral contraceptives, which had been prescribed for presumed polycystic ovary syndrome (PCOS) two years before. She had non-specific symptoms including joint pain, mild weight gain (body mass index 21.8kg/m^2), fatigue, mild facial acne and mood changes.

Initial hormonal work-up revealed central hypogonadism (luteinising hormone 0.35mIU/ml, follicle-stimulating hormone 5mIU/ml and oestradiol <5pg/ml) and secondary hypothyroidism (thyrotrophin 0.5µIU/ml, free thyroxine 11.4pmol/l). Elevated morning cortisol (753mmol/l), failure to suppress with low-dose dexamethasone (600mmol/l) and markedly raised 24-hour urinary cortisol (16,712nmol/l) confirmed hypercortisolism. Imaging confirmed a cortisol-secreting adrenal adenoma. Following laparoscopic adrenalectomy, her menstrual cycles resumed, and her pituitary function recovered.

This case reinforces a key clinical lesson: in women with amenorrhoea and central hypogonadism (particularly those lacking overt hyperandrogenism), Cushing's syndrome must be considered. For endocrinologists evaluating reproductive dysfunction, cortisol excess should not be ruled out solely due to the absence of classic signs.

Read the full article in *Endocrinology, Diabetes & Metabolism Case Reports* EDM-23-0152 https://doi.org/10.1530/EDM-23-0152

ENDOCRINE ONCOLOGY

Outcomes in appendiceal NETs and goblet cell adenocarcinomas

Neuroendocrine neoplasms (NENs) of the appendix are rare tumours that include appendiceal neuroendocrine tumours (aNETs) and appendiceal goblet cell adenocarcinomas (aGCAs). While aNETs are typically indolent and often discovered incidentally, aGCAs are more aggressive and frequently present with peritoneal spread.

This retrospective cohort study compared survival outcomes and prognostic factors in 122 patients (92 with aNETs and 30 with aGCAs) treated at the Netherlands Cancer Institute between 2000 and 2019. The results confirm that aNETs and aGCAs are biologically and clinically distinct diseases. Patients with aNETs had excellent outcomes, with 5- and 10-year disease-specific survival (DSS) rates of 100% and 96% respectively. In contrast, aGCAs showed significantly worse outcomes, particularly in the presence of peritoneal metastases, with a 5-year DSS of 64%. WHO grade 3 aGCAs were strong predictors of poor survival and progression. These findings support the 5th WHO classification, which separates aGCAs from NETs.

The study also highlights the potential role of hyperthermic intraperitoneal chemotherapy, a treatment combining heated chemotherapy with surgery, for high-grade or peritoneal metastatic aGCAs. Accurate classification is crucial for guiding treatment and improving outcomes.

Read the full article in *Endocrine Oncology* https://doi.org/10.1530/EO-25-0028

ENDOCRINE HIGHLIGHTS

A summary of papers from around the endocrine community that have got you talking.

The new era of healthcare sees artificial intelligence blooming

In this review, Jamal Belkhouribchia explores how medicine is entering a transformative era, driven by the rapid rise of artificial intelligence (AI). Once considered futuristic, AI is now becoming essential in clinical practice, particularly in endocrinology, where it is redefining how diseases are diagnosed, monitored and managed.

From diabetes care to thyroid diagnostics, AI technologies such as machine learning and deep learning are enhancing diagnostic accuracy and enabling real-time, personalised treatment decisions. Tools powered by AI can now detect thyroid nodules, adrenal tumours and even rare disorders, such as acromegaly, with expert-level precision. Beyond diagnostics, AI is streamlining clinical workflows, improving patient outcomes and supporting clinicians in decision making. In diabetes care, for instance, AI systems are already optimising insulin dosing, based on continuous glucose monitoring and lifestyle data. However, challenges remain. Algorithm transparency, data bias and ethical oversight must be addressed to ensure safe integration.

As the author writes, AI is not replacing endocrinologists: it's becoming a powerful clinical ally in delivering faster, smarter and more personalised endocrine care.

Read the full article in *Frontiers in Endocrinology* **16** https://doi.org/10.3389/fendo.2025.1513929

©Shutterstock

DIGITAL ENDOCRINOLOGY IN THE ERA OF PRECISION HEALTHCARE

WRITTEN BY EDER ZAVALA

It was 15 years ago that Professor Eric Topol, one of the most influential voices in the use of artificial intelligence (AI) in digital medicine, predicted the transformative potential that digital medical devices could have on precision healthcare.[1] This, of course, was provided that the medical profession and healthcare system would be able to step up to the challenge of embracing innovation and discovery.

Ever since, the long-term ambition of precision medicine to replace a 'one-size-fits-all' approach with targeted and effective strategies for each patient has been supported by the unprecedented availability of new data, accounting for individual differences in genes, environment and lifestyle. However, because an abundance of data doesn't equate to insight, it has become clear that outstanding challenges remain before the vision of precision medicine can be realised, particularly around multimodal data integration and biomarker analysis.

In endocrinology, numerous applications of AI have emerged, with an even larger number in development.[2–4] While AI is rapidly becoming a powerful tool in precision medicine, it alone cannot provide insight into endocrine function without theory. Sir Paul Nurse, who received the 2001 Nobel Prize in Physiology or Medicine, warned us of the need to develop theory as a framework for understanding. This, he emphasised, is crucial for the future of biology.[5] But how can we unlock the potential of new data streams and uncover the regulation of endocrine systems in a way that leads to actionable clinical insights?

IT'S ABOUT TIME

Homeostasis is the process by which living beings maintain internal stability in the face of changes in their external environment. While internal stability often evokes the idea of fixed set points, the reality is that body functions are anything but static. This is particularly important for endocrine regulation, as hormonal imbalances might be better understood as departures from a healthy dynamic pattern, rather than fixed-time snapshot observations of hormonal excess or deficiency. Recognising the importance of a *dynamic* equilibrium to maintain health, particularly in relation to hormonal imbalances, is an essential step towards understanding endocrine dysfunction.

In the past decade, the ability to measure hormonal levels with unprecedented time resolution has introduced the challenge of defining, in quantitative terms, what constitutes a healthy dynamic pattern and what doesn't. Novel wearable device technologies now allow the simultaneous collection of multimodal data at increasingly larger scales.[6] This has facilitated the development of novel computational biomarkers that, when used in combination with machine learning algorithms, have the potential to support the diagnosis and management of endocrine disease.[7]

QUANTIFYING VARIABILITY

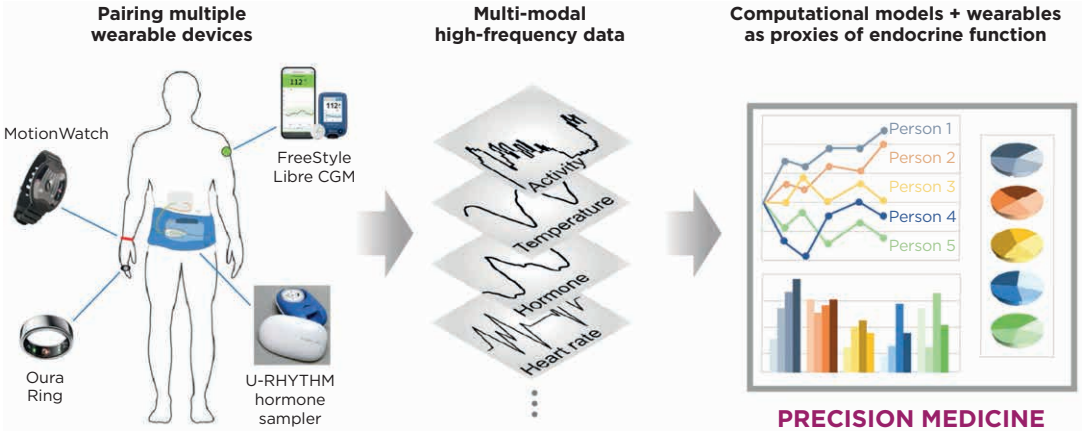
While computational biomarkers can offer a quantitative description of normative ranges of dynamic hormone profiles, they also highlight the problem of intra- and inter-individual variability. That is, the statistical spread of hormonal levels observed at any time varies widely in healthy individuals and depends on the time of sampling, on individual characteristics such as sex, age, body mass index, chronotype and glucotype, as well as on environmental factors. As you may already suspect, pathological states can further exacerbate variability. This raises the question of how we are supposed to develop precision medicine applications when even the 'baseline' variability in healthy sub-populations is rarely accounted for.

Quantifying variability is crucial to estimate the misalignment of hormonal rhythms in disease. However, this has been hindered by a lack of suitable measurements in real-life settings and by a lack of a theoretical framework to understand the dynamic effect of chronodisruptions. Recent technological advancements make it possible to address these challenges. There is now a novel ambulatory microdialysis device, worn on the waist, that enables high-frequency hormone measurements without the need for blood.[6] There are also wearable devices that can track vital signals with unprecedented time resolution, including continuous glucose meters and finger rings that can record physical activity, heart rate variability, body temperature and sleep structure. Advancements in computational techniques, including AI and machine learning, now enable the analysis of multimodal data sets collected from wearable devices.[8] For the first time, it may be possible to estimate the contribution of various sources of variability to dynamic hormonal profiles.

TOWARD DIGITAL ENDOCRINOLOGY

Historically, endocrine axes have been studied in isolation, but their inherent coupling with each other and with other physiological processes (e.g. inflammation) suggests that hormonal effects may be better understood as acting co-operatively.

With multiple crosstalk points at different levels of organisation (e.g. cells, tissues, organs) and at timescales ranging from minutes to months, the networked organisation of endocrine systems enriches the diversity of dynamic responses, possibly contributing to its overall robustness to exogenous perturbations.[9] It also makes them amenable to study via mathematical models that



CONTINUED ON PAGE 6

CONTINUED FROM **PAGE 5**

This **public information video** explains how mathematical techniques are being used to help understand hormone fluctuations seen in the course of the day. This may help clinicians identify normal and abnormal rhythms.

we can use to interrogate the processes leading to dynamic dysfunction and disease.

Mathematical modelling is a powerful tool for understanding hormonal regulation because it requires us to describe it in non-ambiguous terms.[10] By doing so, we not only test our understanding of endocrine regulation, but can also predict how targeting disrupted mechanisms can restore health. When combined with computational methods and carefully designed clinical studies, mathematical modelling can help us develop patient-specific models, or endocrine digital twins, with the potential to revolutionise precision medicine.

Mathematical models possess a remarkable ability to generalise and predict, but this doesn't imply that they are the sole tool capable of transforming endocrinology into a mathematically oriented science akin to physics. It is not their objective either. Instead, mathematics is just another 'microscope' that allows us to see patterns that are not evident when other conventional tools are used.

On the other hand, if the endocrinologist views the mathematician solely as a data analyst, or if the mathematician sees the endocrinologist as a mere data provider, a long-term, successful collaboration becomes impossible. To succeed in this endeavour, we must be willing to learn the basics of the other's field of expertise, and to understand their philosophy, work style and problem-solving approach. The endocrinologist needs to develop an intuitive understanding of mathematical concepts, while the mathematician must acquire a comprehensive knowledge of the endocrine system that is being investigated and the available experimental techniques. A simple division of tasks is insufficient for a successful collaboration.

The most innovative projects often begin with a novel and original question that captivates scientists across multiple disciplines. However, such questions can only arise when there exists a certain level of synergy. Fortunately for digital endocrinology, these exciting questions are abundant.

EDER ZAVALA
Assistant Professor in Mathematics, Centre for Systems Modelling and Quantitative Biomedicine, University of Birmingham

REFERENCES

1. Topol EJ 2010 *Science Translational Medicine* https://doi.org/10.1126/scitranslmed.3000484.
2. Assié G & Allassonnière S 2024 *Journal of Clinical Endocrinology & Metabolism* https://doi.org/10.1210/clinem/dgae154.
3. Belkhouribchia J 2025 *Frontiers in Endocrinology* https://doi.org/10.3389/fendo.2025.1513929.
4. Giorgini F *et al.* 2024 *Journal of Endocrinological Investigation* https://doi.org/10.1007/s40618-023-02235-9.
5. Nurse P 2021 *What is Life?* Oxford: David Fickling Books.
6. Upton TJ *et al.* 2023 *Science Translational Medicine* https://doi.org/10.1126/scitranslmed.adg8464.
7. Grytaas MA *et al.* 2025 *Research Square* https://doi.org/10.21203/rs.3.rs-6095171/v1.
8. Grant AD *et al.* 2022 *Current Opinion in Endocrine & Metabolic Research* https://doi.org/10.1016/j.coemr.2022.100380.
9. Zavala E 2022 *Journal of Neuroendocrinology* https://doi.org/10.1111/jne.13144.
10. Zavala E *et al.* 2019 *Trends in Endocrinology & Metabolism* https://doi.org/10.1016/j.tem.2019.01.008.
11. Kim DW *et al.* 2020 *Current Opinion in Systems Biology* https://doi.org/10.1016/j.coisb.2020.07.007.

COMPUTATIONAL MODELLING IN NET RESEARCH

WRITTEN BY JOHN METZCAR, REBECCA A BEKKER, VINAY M PAI AND JUN PARK

Neuroendocrine tumours (NETs) are relatively rare malignancies with diverse biology. They originate from neuroendocrine tissue and can release a variety of functional biochemicals creating neoplastic syndromes that are difficult to manage. Although 5-year survival rates are favourable with early diagnoses, the majority of patients present with metastatic disease and frequently progress on treatment. There is thus an unmet clinical need to understand disease dynamics and identify novel therapeutic options.

This need is increasingly being addressed through computational modelling and artificial intelligence (AI). This supports studies ranging from identifying cells in the tumour microenvironment to biomarker identification and virtual experiments for optimising therapies.

Here, we introduce major categories of computational methods applied in research into NETs, including cutting-edge technologies, such as digital twins and the use of large language models (LLMs).

KNOWLEDGE-DRIVEN MODELLING: MECHANISTIC MODELLING

Computational mechanistic models describe dynamic processes by encoding biological and clinical knowledge via mathematical relationships. Examples of these techniques include ordinary differential equations to simulate tumour growth over time, quantitative systems pharmacology frameworks to integrate drug effects, drug distribution and molecular data, and agent-based models to capture cell–microenvironment interactions and spatial heterogeneity.

In contrast to data-driven models (see below), mechanistic models can provide explanations for biological processes.[1] These models often offer clear interpretability and safe extrapolation beyond training data, making them excellent at hypothesis testing to guide future experiments. Furthermore, these models can be combined with data-driven models, taking advantage of the strengths of both methods.[2]

DATA-DRIVEN MODELLING

Data-driven methods can be used to (1) find structure within datasets and (2) predict values or categorise and label data. The former is done using unsupervised learning, while supervised learning techniques are used for the latter. Studies may combine both unsupervised learning to reduce the dimensionality of imaging or omics data then supervised models to classify an image or predict prognosis.

Within each broad category are methods that stress interpretability and uncertainty quantification of model parameters (often called statistical learning, e.g. linear regression or Bayesian methods). They maintain parameter interpretability and can quantify uncertainty.

Alternatively, there are machine learning (ML) approaches, such as neural networks and random forests, which can capture complex relationships accurately at the expense of interpretability and transparency.

Finally, data-driven models also include semi-/self-supervised techniques that are well-suited to unlabelled data, transfer learning with pretrained models, and more.

Table. Concepts in computational mapping

Concept	Definition
Computational modelling	Modelling driven through the use of calculations or computers
Data-driven modelling	Computational modelling that emphasises finding complex patterns and/or parameters directly from data
Deep learning	Multi-layer neural network
Digital twins	Computational, virtual patient-driven and patient-specific models – a virtual 'double'
Explainable AI (xAI)	Field of AI that examines uncertainty and interpretability of AI results, especially machine learning
Labels	Known values, outcomes or categories matched to data
Large language models (LLMs)	Patient-specific models that update state-based, personal, real-world data
Machine learning (ML)	Computational algorithms that 'learn' from data in an open-ended fashion, finding patterns that are otherwise difficult to see
Mechanistic models	Dynamic models formulated directly on knowledge and approximate biological processes
Neural network	Network of nodes for data processing; inspired by the arrangement of neurones in the human brain
Principal component analysis (PCA)	Method of finding linear relationships among a matrix of observations; example of unsupervised learning used for clustering
Statistical learning	Data-driven modelling where methods stress interpretability and uncertainty quantification of model parameters
Supervised learning	Category of computational modelling; predicting values (regress) or categories (classify) given a dataset containing both predictors and values/categories (labels)
t-Distributed stochastic neighbour embedding (t-SNE)	Non-linear clustering and dimensionality-reducing method
Uniform manifold approximation and projection (UMAP)	Non-linear clustering and dimensionality-reducing method
Unsupervised learning	Category of computational modelling that finds structure/patterns in datasets without labels

EXAMPLES

Below, we provide brief examples, noting that many more examples and techniques exist than are provided. We invite the interested reader to pursue this further.

Finding structure – unsupervised learning

Tools like principal component analysis (PCA), uniform manifold approximation and projection (UMAP) and t-distributed stochastic neighbour embedding (t-SNE) collapse thousands of radiomic or transcriptomic features to a small number of axes before clustering similar samples. This can reveal important and informative cell, tumour or patient subgroups without requiring the data to be pre-labelled.

Recent single-cell studies on small-intestinal NETs used UMAPs to compress thousands of transcripts per cell, finding high-functional tumour microenvironment

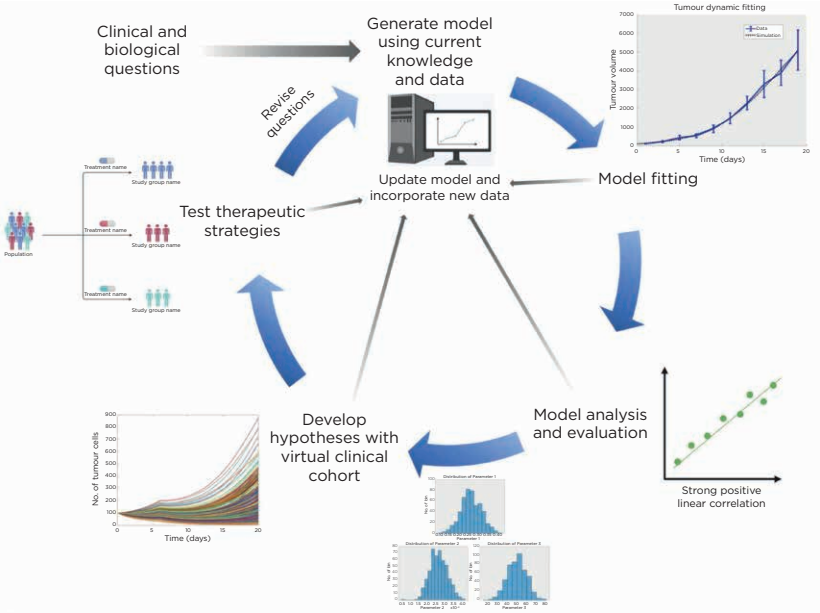
CONTINUED ON PAGE 8

heterogeneity across patients, while other studies clustered expression data using PCA and t-SNE.[3,4] Using these methods on spatial transcriptomics enables the mapping of clusters back onto tissue sections, linking cell states to their microanatomic context.[5]

Additional applications of unsupervised learning include generating synthetic data (based in autoencoders) and feature extraction (PCA and others).

Prediction – supervised learning

When an outcome (e.g. tumour grade, time to progression, patient response) is known, researchers can develop predictive models. Two recent studies used deep-learning pipelines to analyse surgical samples: one automated Ki-67 scoring on digital slides, potentially enabling additional sampling of this critical prognostic value,[6] with the second predicting metastatic risk.[7]



The multidisciplinary cycle of a computational model, illustrated with mechanistic modelling, spans the pathway from bench to bedside. Reproduced under **CC BY 4.0 licence** from **Metzcar *et al.*[1]** ©2020 The Authors

Other general examples of supervised learning include penalised Cox regression for survival analysis and prediction of outcomes from radiomics data.

MACHINE LEARNING CAVEATS

Machine learning includes a set of powerful methods, but they often lack transparency and explainability. This is especially crucial in clinical decision making. Understanding how ML models, especially neural networks, make decisions constitutes its own important sub-area of research in ML known as explainable AI.[8] Of course, all of these methods have the usual caveat that correlation is not causality.

NEXT ADVANCES: LARGE LANGUAGE MODELS

Finally, LLMs such as DeepSeek, GPT-4o (as in Chat-GPT) and Llama 4 are fundamentally changing research. They can be used to summarise articles, extract structured information from electronic health records and even potentially help in the clinic.

A very recent example assessed LLM responses to NET-related questions. It found clear answers were provided, but therapy-related questions scored poorly, highlighting both the potential of LLMs and the need for clinician oversight and model improvement.[9]

NEXT ADVANCES: DIGITAL TWINS

Digital twins are patient-specific virtual models that update as new laboratory results, imaging and biomarkers arrive.[10] Combining real-world data with mechanistic understanding via hybrid methods, digital twins allow researchers to simulate tumour trajectories and treatments *in silico*. These patient-specific models can inform the next steps before returning to the clinic or lab.

While not yet deployed as routine research and clinical tools, they have the potential to impact all aspects of translational and clinical research. Additionally, combining LLM-driven knowledge extraction with digital twins could create adaptive research workflows that link rapid evidence gathering to mechanistic exploration.

RESEARCH IMPACT AND LOOKING AHEAD

Bringing together mechanistic models and data-driven methods has the potential to reshape the research toolkit for NETs. As these approaches mature, transparent reporting, validation against experimental or clinical data, and multidisciplinary teams are essential. Together, they can accelerate biomarker discovery, deepen fundamental understanding and power *in silico* experiments that bridge laboratory and clinical research, ultimately increasing clinical trial success.

With these computational methods, we can link diverse data sets such as clinical summaries, repeat imaging studies, pathologic features and time-series laboratory values into a dynamic digital twin, bringing us closer to truly personalised therapy.

Finally, we hope this feature inspires collaboration across the quantitative, biological and clinical sciences, producing a virtuous cycle of hypothesis generation, testing and refinement (see Figure), and accelerates the path from discovery to real-world solutions in the endocrine oncology community and beyond.

JOHN METZCAR
Therapy Modeling and Design Center, University of Minnesota–Twin Cities, Minneapolis, MN, USA

REBECCA A BEKKER
Alfred E Mann Department of Biomedical Engineering, University of Southern California, Los Angeles, CA, USA

VINAY M PAI
Chief Technology Officer, Health Tequity LLC, Berkeley, CA, USA

JUN PARK
Department of Endocrinology, Kaiser Permanente, South Sacramento, CA, USA

REFERENCES

1. Metzcar J *et al.* 2025 *Endocrine Oncology* https://doi.org/10.1530/eo-24-0025.
2. Metzcar J *et al.* 2024 *Frontiers in Immunology* https://doi.org/10.3389/fimmu.2024.1363144.
3. Somech E *et al.* 2025 *eLife* https://doi.org/10.7554/eLife.101153.
4. Scott AT *et al.* 2020 *Clinical Cancer Research* https://doi.org/10.1158/1078-0432.CCR-19-2884.
5. Yogo A *et al.* 2025 *Endocrine Abstracts* https://doi.org/10.1530/endoabs.108.b2.
6. Yücel Z *et al.* 2024 *Medical & Biological Engineering & Computing* https://doi.org/10.1007/s11517-024-03045-8.
7. Klimov S *et al.* 2021 *Frontiers in Oncology* https://doi.org/10.3389/fonc.2020.593211.
8. Roscher R *et al.* 2020 *IEEE Access* https://doi.org/10.1109/ACCESS.2020.2976199.
9. Panzuto F *et al.* 2025 *Endocrine* https://doi.org/10.1007/s12020-025-04294-9.
10. Sager S 2023 *Journal of Cancer Research & Clinical Oncology* https://doi.org/10.1007/s00432-023-04633-1.

DEMYSTIFYING AI IN FERTILITY
MECHANISTIC INSIGHTS INTO SPERM

WRITTEN BY MEURIG GALLAGHER

The fertility sector is experiencing an artificial intelligence (AI) boom, aiming to transform processes ranging from time-lapse embryo imaging to complex decision-making in patient management. The possibilities are undeniably exciting, but many question whether these technologies are driving positive change for those on a fertility journey.

AI'S PENETRATION INTO FERTILITY CARE

One of the biggest technological success stories in fertility is time-lapse imaging. Time-lapse incubators capture images of developing embryos approximately every 10 minutes, avoiding the need for removal for examination under a microscope. This approach has many advantages, not least that embryos remain undisturbed in a closed environment, while a rich data source is created for analysis.

It seems logical, then, that AI models could be trained on these data to select the best embryo for transfer, thereby improving treatment success. However, repeated studies have shown that the addition of AI to closed-culture systems does not improve the chances of leaving with a healthy baby.[1] As a case study, AI embryo selection illustrates the complexities of fertility care – there may be significant value in the underlying technology, but the addition of 'AI' is often used more for patient marketing than for truly improving outcomes.

A promising use of AI in fertility care is in the detection of sperm in samples with very low counts.[2] Here, AI is being employed as a tool to search tens of thousands of images to find single sperm for intracytoplasmic sperm injection (ICSI). This task can take embryologists hours to perform, and so AI frees resources and supplements and improves workflows, rather than aiming to replace expert insight.

UNDERPINNING MODELS AND DATA ARE CRUCIAL FOR SUCCESS

The true potential of AI in fertility lies not necessarily in its analytical power, but in the opportunity for interpretation of models. Approaches that are purely data-driven risk spurious correlations, particularly in large datasets, which may not translate to an individual's chance of success. Data quality – in terms of accuracy and quantity – is key, but it is equally as important that measurements with a meaningful relationship to outcomes are included.

> *'AI for sperm analysis isn't simply one tool, it is a diverse toolkit. Success will depend on integrating robust biophysical knowledge into transparent, interpretable models that clinicians and reproductive scientists can confidently employ.'*

A good example of this is in sperm analysis. Here, 'head-tracking' parameters (often used to quantify sperm motility) have historically been uncorrelated with clinical outcomes, and yet these same measurements have been used in large-scale AI models to predict treatment success. The problem in this situation is clear: large datasets can inadvertently foster data 'hallucinations': patterns confidently identified by algorithms, despite lacking biological validity.

As an alternative, 'white-box' approaches aim to include known biophysical, mechanical or pharmacological frameworks in predictive models. These 'mechanistically informed' algorithms offer results that are transparent, interpretable and rooted firmly in biology, significantly reducing the risk of overfitting or false positives, and making them uniquely suitable for driving genuine advances in fertility care.

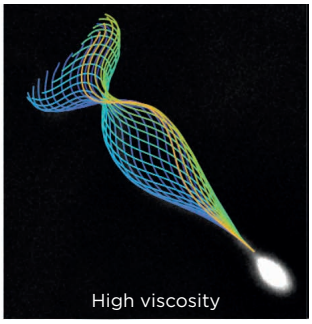
WHY IT MATTERS: SPERM AT THE HEART OF FERTILITY

It is only in the last few years that we have begun to really understand the impact men, and indeed sperm, have on the development of a healthy child. A retrospective study of 2425 couples with unexplained infertility undergoing *in vitro* fertilisation/ICSI treatment in Australia revealed the significant impact that male age has on success.[3] At the sperm level, mechanistic analysis of the HABSelect clinical trial (2722 couples in 16 centres across the UK), which compared the impact of changing the individual sperm selected in ICSI, highlighted that a significant proportion of age-related miscarriage after 8 weeks is due to sperm.[4] These signs point to factors that AI should be able to help uncover, provided we can employ the right models, with the right data, in the right way.

Illustration of a model-based learning approach. Videos of swimming sperm (screenshot seen in a) can be integrated into an AI model to extract the flagellar waveform (b). This, in turn, can be coupled with biophysical simulations to extract meaning (c–d). In this example, insight is drawn from a mathematical model that calculates the power (related to metabolic output) required by the sperm as it swims. **See the dynamic version online.**

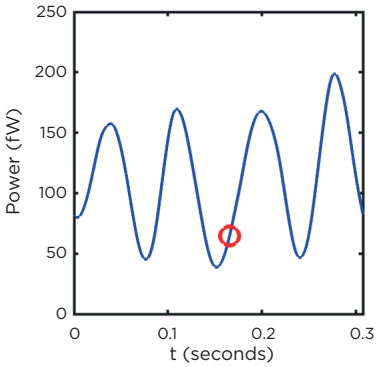
(a) Video of sperm swimming

(b) Waveform extraction



(c) Matching simulation

(d) Metabolic modelling



CONTINUED ON PAGE 10

HOW CAN AI HELP? WHITE-BOX MECHANISTIC MODELLING OF SPERM

AI for sperm analysis isn't simply one tool, it is a diverse toolkit. Success will depend on integrating robust biophysical knowledge into transparent, interpretable models that clinicians and reproductive scientists can confidently employ. At the Centre for Reproductive Science in Birmingham we are developing white-box AI approaches that combine fluid dynamics, energy metabolism and sperm mechanics to bridge the gap between complex biological phenomena and clinical implementation.

Our driving principle is that we know that sperm affect success, but existing measurements do not have the discriminatory power to draw prognostic insight. Instead, we turn our attention to the sperm flagellum (tail).[5] It is the flagellum that responds to environmental signals, reacts to the physical environment, and is sensitive to subtle changes in metabolism and morphology. By integrating new measurements of sperm with clinical factors incorporating both partners, we hope to provide actional insights by grounding predictions in validated underlying mechanisms.

We believe that the key to fully unlocking AI's potential for integrating understanding of sperm in treatment lies in the interdisciplinary collaborative environment we foster. Here, we will bring together reproductive scientists, mathematicians and data-focused researchers, reproductive biologists, clinicians and patients themselves, to ensure that AI's transformative potential genuinely enhances fertility care, rather than offering just another technological novelty.

MEURIG GALLAGHER
Associate Professor of Interdisciplinary Healthcare Science, Centre for Human Reproductive Science, Metabolism and Systems Science, College of Medicine and Health, University of Birmingham

REFERENCES

1. Bhide P *et al.* 2024 *Lancet* https://doi.org/10.1016/S0140-6736(24)00816-X.
2. Goss DM *et al.* 2024 *RBMO* https://doi.org/10.1016/j.rbmo.2024.103910.
3. Horta F *et al.* 2019 *Human Reproduction* https://doi.org/10.1093/humrep/dez223.
4. West R *et al.* 2022 *Human Reproduction* https://doi.org/10.1093/humrep/deac058.
5. Gallagher MT *et al.* 2019 *Human Reproduction* https://doi.org/10.1093/humrep/dez056.

FERTILITY MEETS THE FUTURE
AI IN THE REVOLUTION OF REPRODUCTIVE CARE

WRITTEN BY SIMON HANASSAB AND ALI ABBARA

In 1978, Louise Joy Brown made history as the world's first baby conceived through *in vitro* fertilisation (IVF) when she was born in Oldham, UK. The recent Netflix blockbuster 'Joy' vividly captures the spectrum of emotions that this breakthrough evoked, from fears of 'Dr Frankenstein' playing God, to celebrations of what many considered to be nothing short of a medical miracle.

Almost 50 years later, IVF is now an established treatment for infertility. Although NICE recommends up to three cycles of IVF for couples with infertility, there remains a 'postcode lottery', with additional local restrictions towards access. Thus, many couples must resort to private sector care, either if treatment is unsuccessful or if more than one child is desired to complete their family. Against this backdrop, there is great pressure on each IVF cycle to be successful, which has led to an industry that often welcomes early adoption of new technologies, albeit sometimes prematurely before the required testing has been conducted.

THE ROLE OF ARTIFICIAL INTELLIGENCE

Artificial intelligence (AI) has emerged as a potentially transformative breakthrough across medicine, but the AI revolution has particularly bloomed in the fertility sector. In 2014, there were only a dozen papers on AI in IVF treatment. By 2024, this had increased by more than 20-fold, speaking to its suitability to optimise many different aspects of the process.

In a parallel technological revolution, computational power has grown exponentially alongside sophisticated statistical methodologies, creating unprecedented opportunities for refined predictive capabilities through AI. This convergence of the rich clinical data produced during the IVF process and advanced computational tools presents a unique opportunity to transform how we approach fertility treatment.[1]

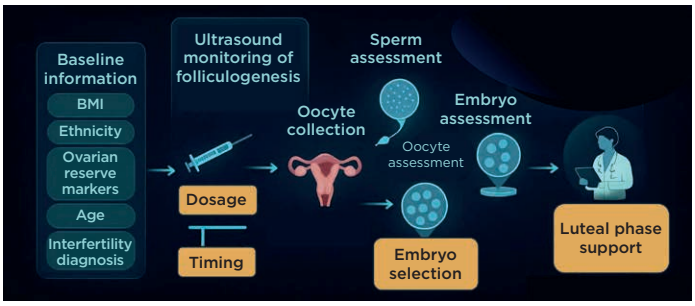
For some uses, AI offers capabilities beyond that of humans: for example, during time-lapse analysis of embryos, where AI can analyse days of footage to detect patterns imperceptible to the human eye, in order to predict embryo quality and the chance of genetic abnormality, without the need for invasive pre-implantation genetic testing. In others, AI can automate tasks that currently require expert clinician or embryologist input, freeing up their time to be redirected elsewhere, thus increasing capacity and reducing costs to meet an escalating demand for care.

THE ISSUE OF CLINICAL RESPONSIBILITY

AI encompasses a broad ecosystem of technologies, including machine learning (ML), robotics and computer vision. ML engages computers to learn from data and excels at identifying complex patterns within large datasets, enabling predictive models that can personalise treatment.

Selecting the optimal ML approach for a given clinical task can introduce a fundamental trade-off: while more sophisticated algorithms (e.g. deep learning) can model complex biological systems with greater accuracy, they often sacrifice transparency in their decision-making rationale. In clinical settings, this lack of interpretability poses a critical challenge, as clinicians prefer to understand the reasoning behind AI-generated recommendations to maintain trust. That said, our inability to understand AI-driven recommendations does not necessarily mean that they are incorrect, and such a stipulation could stifle advancement. It could be argued that we often use technologies in modern life that we do not fully understand.

Nevertheless, at least in the short term, clinical supervision is required to avoid implementation of decisions that would not be in keeping with defensible clinical practice, especially as clinical responsibility still lies with the treating clinician. Consequently, AI is unlikely to replace clinical expertise but rather to augment it with intelligent tools to reach better, faster decisions.



IVF and the utility of AI.

TRANSFORMING AN ART INTO A SCIENCE

Whilst IVF protocols are designed to work for most people, with the typical patient in mind, clinicians use their experience and skill to adapt protocols and personalise treatment, although this can be subjective and inconsistent. Thus, it is often said that assisted reproductive technology (ART) is as much an *art* as science, with clinicians often donning their whites to 'cook' up a new recipe. Additionally, IVF cycles produce a large amount of complex data that are hard to fully assimilate when clinicians make treatment decisions, leading to 'rules of thumb' to simplify the data so that it is comprehensible.

An example of this simplification is the monitoring of folliculogenesis during ovarian stimulation. Here, supraphysiological doses of follicle-stimulating hormone (FSH) are used to stimulate growth of multiple follicles, so that they can undergo oocyte maturation in response to luteinising hormone (LH)-like exposure (called the trigger of oocyte maturation), in readiness for fertilisation. Follicles that are either too small or too large are less likely to respond to the trigger. However, the optimal size of follicles that can respond is not known.

In current practice, the largest follicle (or 'lead' follicle) is used to represent the entire cohort of growing follicles, and the trigger is given when two or three lead follicles reach 17–18mm in size, depending on the unit's protocol. However, lead follicles may not reliably represent the sizes of the entire follicle cohort. So, while this simplification is practical, it does not optimise outcomes for an individual patient. AI is ideally suited to handling such complex data, enabling full use of the available information about each follicle in the entire follicle cohort.

To address this complexity, our multidisciplinary research team at Imperial College London, comprising both healthcare professionals and AI specialists, used explainable AI methods to identify the specific follicle sizes most likely to yield mature oocytes. Leveraging data from over 19,000 patients, we found that maximising the proportion of follicles within the optimal follicle size range not only improved mature oocyte yield but, importantly, also the chance of live birth.[2] Additionally, we noted that continuing ovarian stimulation for too long resulted in follicles larger than the identified optimal size that secrete progesterone, prematurely advancing the endometrium such that it is out of sync with embryo development, to the detriment of pregnancy rates. These AI-derived insights can help personalise IVF treatment decisions and optimise clinical outcomes for each patient.

MANAGING THE TRANSITION TO CLINICAL PRACTICE

Robust prospective validation remains a cornerstone prior to implementation to clinical practice. New reporting guidelines, such as

CONTINUED ON PAGE 12

TRIPOD+AI, help address this challenge by mandating transparent reporting and independent assessment of AI systems. Achieving the perfect balance between cutting-edge innovation, regulatory approval and adequate validation is no simple feat.

One of the few trials that aimed to demonstrate non-inferiority of an AI-assisted embryo selection with time-lapse incubation perfectly illustrated this challenge.[3] While the AI system significantly reduced evaluation time compared with manual assessment by an embryologist, live birth rates remained statistically inferior. Trials are time-consuming to set up and to conduct, which is not ideal when assessing the validity of such fast-moving technologies, where the algorithm tested could be outdated by the time a trial can be conducted. However, this trial highlights that the supposition of improved efficacy and avoidance of harm with a novel AI method trained on retrospective data should not be assumed without prospective validation. Indeed, many novel AI technologies are offered to clinics commercially with an associated cost, and the 'inconvenient reality' is that many have not been validated in a scientifically robust manner.[4]

IN SUMMARY

The potential for AI to optimise IVF treatment is vast, but its success depends on our willingness to embrace evidence-based innovation while maintaining the highest standards of rigour in scientific evaluation.

The path forward requires collaboration between clinicians, scientists, AI engineers, industry and regulators. Efficient methods for prospective evaluation of such fast-moving technologies are a significant challenge to ensure efficient and continuous evaluation of non-static technologies. Nevertheless, AI has huge potential to transform fertility treatment and optimise care for those suffering from infertility, in an objective, data-driven manner.

SIMON HANASSAB
PhD Researcher in Healthcare AI, Imperial College London

ALI ABBARA
Associate Professor in Endocrinology, Imperial College London

REFERENCES

1. Hanassab S *et al.* 2024 *npj Digital Medicine* https://doi.org/10.1038/s41746-024-01006-x.
2. Hanassab S *et al.* 2025 *Nature Communications* https://doi.org/10.1038/s41467-024-55301-y.
3. Illingworth PJ *et al.* 2024 *Nature Medicine* https://doi.org/10.1038/s41591-024-03166-5.
4. Kieslinger DC *et al.* 2024 *Nature Medicine* https://doi.org/10.1038/s41591-024-03289-9.

AI IN HIGHER EDUCATION EMBRACE THE CHALLENGE

WRITTEN BY MATTHEW JONES

The rise of artificial intelligence (AI) within higher education has been rapid, with many institutions and academics taken aback by the increase in usage, declaring assessment types to be 'dead' or 'redundant' because of AI. This has resulted in widespread panic across the sector about how degree programmes can adapt to prevent the use of AI and ensure assessment integrity, with many students now routinely using OpenAI's ChatGPT, Google's Gemini or Microsoft's Co-Pilot as a part of their studies.

However, we should learn from history. A similar argument was made decades ago, upon the advent of the digital calculator and the computer, both of which have now become integral mainstays of professional and academic practice. There is, therefore, an argument that the use of AI should be embraced, and that students should be safely encouraged to work with AI and taught how to use it ethically as a part of academic practice.

Within the Biomedicine Department at the University of Salford, we are exploring several approaches to the use of AI in order to enhance student experience, and to allow students to engage with AI in a positive way that may enhance their knowledge, in line with the comments of the European Centre for the Development of Vocational Training (CEDEFOP).[1] Here, I summarise three ways in which we have employed AI with the aim of highlighting its potential benefits within higher education.

AI CHATBOTS TO ENHANCE CLINICAL COMMUNICATION

Many students of undergraduate subjects aligned to biomedicine are interested in leveraging their degrees to transition to graduate-entry medicine. However, as disciplines such as biomedical science are traditionally not patient-facing, there is minimal scope to teach clinical communication within the curricula. Students seeking this path therefore have to develop these skills via extracurricular activity, which may limit access for students who have work or caring commitments.

Consequently, Nicola Morgan, Samantha Borland and I have developed a series of AI chatbots that are integrated into our virtual learning environment, which can be prompted to mirror real-world scenarios. These allow students to reflect on their communicative practice and provide an introduction to clinical communication. We are embedding this into our first-year laboratory skills module for the upcoming year, to allow all students to enhance their communication skills, and show that the way in which something is communicated can impact patient well-being and understanding.

An example 360° image generated through Thinglink Skybox AI for use within the UoScape digital escape room platform.

CREATION OF 360° IMMERSIVE SPACES FOR DIGITAL ESCAPE ROOMS

As a part of our strategy to increase active and gamified learning within the department, Nicola Morgan and I established UoScape (**www.uoscape.co.uk**) for the delivery of digital escape rooms. These have been shown to enhance students' acquisition of knowledge, and overall experience.[2]

Initially, we imaged real-world spaces using traditional 360° cameras. However, to increase variety and the number of scenarios that we could deliver via the platform, we had to resort to image generation. Given that art is not our best subject, we decided to utilise AI to generate a series of 360° spaces using Thinglink Skybox AI (as shown in the Figure).

This approach allowed us to rapidly design novel scenarios, to allow for expansion to other disciplines outside the laboratory sciences, where we lacked ready access to real-world spaces for imaging. It has enabled us to mirror environments related to students' potential areas of employability. We have therefore been able to significantly decrease the amount of time required to design and image custom-built escape rooms from multiple days to just a matter of minutes. With full virtual reality integration, we are now exploring the use of this tool for a variety of other educational scenarios, due to its ease of use and rapid development time.

INTERACTIVE AI-GENERATED FLASHCARDS

Throughout my brief time as an academic, I have observed flashcards to be a key method used by students to revise. However, in most cases, students spend an exorbitant number of hours making flashcards, during which time they are not actively revising, but rather rewriting information.

One of our exceptional undergraduate students, Daniya Abedalreza, raised the question of whether we could save students time by using AI to generate flashcards, thereby freeing up time for revision. Using Canva AI, an AI-enabled visual design tool, she showed that by inputting lecture notes, she could create a series of interactive student flashcards within less than 5 minutes. Additionally, she discovered that the code used to generate these cards can be integrated into virtual learning environments, thereby allowing access for all students to a series of flashcards which could be curated by academic staff to ensure they align with upcoming assessments. Daniya will now share her learning with academics from across the institution, as well as establishing student-facing workshops to teach students how to create the flashcards themselves.

CONCLUSION

Through this article, I hope I have shown that AI has potential substantial benefits for higher education. My aim has been to open your eyes to novel approaches, which can be directly integrated into higher education to enhance student experience and acquisition of knowledge.

MATTHEW JONES
Lecturer in Physiology, Biomedical Research and Innovation Centre, University of Salford

REFERENCES

1. CEDEFOP 2023 *Skills in Transition: the Way to 2035* Luxembourg: Publications Office http://data.europa.eu/doi/10.2801/438491.
2. Morgan N & Jones M 2025 *Pedagogy: The LTEC Learning and Teaching Showcase* https://doi.org/10.57898/pedagogy.279.

ARTIFICIAL INTELLIGENCE IN ENDOCRINE SURGERY

WRITTEN BY AIMEE DI MARCO

Artificial intelligence (AI), a blanket term for several advanced functions undertaken by computers, has already seeped into many aspects of patient care in endocrine surgery. Our specialty focuses on optimising outcomes for patients with thyroid, parathyroid and adrenal disease. This involves accurate diagnostics, assessment of benefits and risks, surgical care with minimisation of morbidity, and follow-up tailored to outcome and risk. AI is already contributing in multiple ways, some in research and others in approved commercial products.

DIAGNOSTICS

- Thyroid nodules may be detected in ultrasound images by computer vision, with features extracted and classified into 'explainable' categories (e.g. TI-RADS, the Thyroid Imaging Reporting and Data System). Commercially available ultrasound platforms with this capability include the S-Detect from Samsung.[1] Novel deep-learning models as seen in the ThyroNet-X4 Genesis[2] and ThyNet[3] may automatically classify nodules as benign or malignant, the former using convolutional neural networks and the latter combining three pre-existing AI systems. Real-time image overlay may then guide fine needle aspiration, while cytology slides and molecular tests, such as Veracyte's Afirma Gene Expression Classifier (GEC) and Genomic Sequencing Classifier (GSC), can be analysed by machine-learning algorithms.[4]
- In parathyroid disease, machine-learning classifiers may be trained to identify the pathognomonic pattern of classic primary hyperparathyroidism (pHPT) with hypercalcaemia and inappropriately unsuppressed parathyroid hormone (PTH), and to evaluate bloods and urinalysis to exclude alternative diagnoses. AI has even diagnosed those at risk of pHPT from medical notes alone with 86% accuracy.[5]
- In adrenal diagnostics, radiomics combined with machine learning has shown promise in distinguishing benign from malignant disease.[6]

Multimodal data integration may be used to assimilate biochemical, imaging and tissue data to give a diagnosis.

PREDICTING PATIENT OUTCOMES

This is an area in which most endocrine surgeons pride themselves: we hope to provide each patient with an understanding of the individualised benefits of surgery, as set against our own operative outcome data. The area is ripe for AI optimisation and most developed in thyroidectomy:

- A deep-learning neural network model trained on the American College of Surgeons National Surgical Quality Improvement Program (ACS NSQIP) data predicted complications and reoperation with 78–97.2% accuracy.[7]
- Post-thyroidectomy hypocalcaemia may be quantified using a machine-learning model with sensitivity and specificity up to 92 and 90%.[8] 'Super learner', a cross validation–ensemble approach, predicts hypocalcaemia significantly better than standard multi-logistic regression.[9]
- Similar models have also been applied preoperatively to predict recurrent laryngeal nerve injury and haematoma, and postoperatively to predict thyroid cancer recurrence.[9,10]

'Multimodal data integration may be used to assimilate biochemical, imaging and tissue data to give a diagnosis.'

©Shutterstock

CONTINUED ON PAGE 15

CONTINUED FROM **PAGE 14**

INTRAOPERATIVE

Over the last century, the focus has shifted from addressing mortality to eliminating morbidity. Thyroidectomy mortality decreased from 40–50% to 0.5% by 1912 (mostly thanks to the influence of Theodor Kocher), and adrenalectomy mortality fell from 30–45% in the early 1900s to 0.2–0.5% in hospital mortality (British Association of Endocrine and Thyroid Surgeons (BAETS) UK Registry of Endocrine and Thyroid Surgery (UKRETS) and ACS NSQIP data respectively).[11,12]

Morbidity has also declined. Recurrent nerve injury reduced from ~20% in the early 1900s to 3.7–8.6% (for benign and malignant pathology respectively) by the 2000s, and late hypocalcaemia decreased to ~6% in the BAETS UKRETS by 2021.[11]

These changes occurred before the widespread uptake of technology in which AI may be influential, and were driven entirely by surgical technique, training and specialisation. The volume–outcome relationship reinforces this:[13] surgeons with a larger volume of practice and data have more opportunity to hone their operative decision making and techniques.

> ***'Evidence for AI-assisted technologies (e.g. nerve monitoring, parathyroid assessment and PTH estimation) is mixed, with outcomes still dependent on the surgeon.'***

AI's intraoperative role may be twofold: helping high-volume surgeons to achieve zero morbidity, and accelerating the learning curve for trainees and low-volume surgeons. With morbidity in high-volume hands as low as <1% recurrent nerve injury, <2% hypoparathyroidism, ~2% persistent hyperparathyroidism and 1% adrenal morbidity, further advances will be more challenging, yet AI may help.

Intraoperatively, AI is seen in two distinct areas:

- It has a role in optimising the output of platforms used and interpreted by the surgeon, such as nerve monitoring, real-time parathyroid imaging and intraoperative PTH testing.
- It supports minimally invasive and robotic procedures, where preoperative imaging may be overlaid to guide anatomy and vascularity, and smart instruments may include activity or force limits.

Nerve monitoring

This technology provides information on laryngeal nerve function by applying a small (1–3mA) signal to that nerve and detecting vocal cord movement via sensors on the endotracheal tube. Amplitude and latency are displayed graphically with accompanying sound. The surgeon may stimulate the vagus, recurrent or superior laryngeal nerve via a handheld probe intermittently (intraoperative neurophysiological monitoring, IONM) or continuously (CIONM), the latter requiring the surgeon to attach an electrode to the vagus, delivering a signal each second to show moment-by-moment changes. AI may be used in both modes, particularly CIONM, to track trends, predict impending injury and alert the surgeon.

Parathyroid detection/assessment

The adjunctive technology of near-infrared parathyroid assessment with a probe (PTeye) or camera (Fluobeam) may confirm parathyroid identification and, via autofluorescent contrast (indocyanine green, ICG), may map vasculature and assess perfusion. Both systems include AI software to optimise their function, although limitations remain currently: subsurface glands are not detected, adenomas vary in signal, and function cannot be reliably predicted.

Point-of-care blood tests

Intraoperative PTH estimation may be used to predict cure of hyperparathyroidism by the surgeon. PTH dynamics are generally predictable and interpretation is therefore straightforward in most cases. However, subtleties may mislead the unwary surgeon. AI has been shown to improve accuracy and decision support.

Evidence for AI-assisted technologies (e.g. nerve monitoring, parathyroid assessment and PTH estimation) is mixed, with outcomes still dependent on the surgeon.

Robotic surgery

The application of robotic surgery is growing but has limitations. Laparoscopic or retroperitoneoscopic adrenalectomy remains the gold standard, and, while switching to robotic adrenalectomy is therefore readily achieved, the benefits are unproven. In neck endocrine surgery, access is problematic: transaxillary, sub-mammary and transoral approaches all have limitations, in part due to the size of the robotic instruments. Lower profile instruments and smart instruments (containing haptic feedback and enhanced integrated tools, such as nerve monitoring) have promise for the future.

IN CONCLUSION

AI is already present in key areas of endocrine surgery, particularly in diagnostics and outcome prediction. Currently, outcomes remain surgeon-dependent, with mixed data on intraoperative adjuncts. However, as AI improves and refines, its role in surgical care is also likely to increase.

AIMEE DI MARCO
Endocrine Surgeon, Hammersmith Hospital and Imperial College and NHS Trust, London

REFERENCES

1. Barczyński M *et al.* 2020 *Gland Surgery* https://doi.org/10.21037/gs.2019.12.23.
2. Wang X *et al.* 2025 *Scientific Reports* https://doi.org/10.1038/s41598-025-86819-w.
3. Peng S *et al.* 2021 *Lancet Digital Health* https://doi.org/10.1016/S2589-7500(21)00041-8.
4. Wong CM *et al.* 2023 *Journal of Pathology Informatics* https://doi.org/10.1016/j.jpi.2023.100309.
5. Greer ML *et al.* 2022 *Head & Neck* https://doi.org/10.1002/hed.26970.
6. Ferro M *et al.* 2025 *Therapeutic Advances in Urology* https://doi.org/10.1177/17562872251352553.
7. Tsutsumi K *et al.* 2023 *Clinical Otolaryngology* https://doi.org/10.1111/coa.14066.
8. Muller O *et al.* 2024 *Annals of Surgery* https://doi.org/10.1097/SLA.0000000000006480.
9. Seib CD *et al.* 2021 *American Journal of Surgery* https://doi:10.1016/j.amjsurg.2020.11.055.
10. Ahmad M *et al.* 2024 *Arxiv* https://doi.org/10.48550/arXiv.2410.10907.
11. BAETS 2021 *Sixth National Audit Report* https://baets.org.uk/wp-content/uploads/2024/08/BAETS-Sixth-Audit-Report-FINAL.pdf.
12. Gupta PK *et al.* 2011 *Surgical Endoscopy* https://doi.org/10.1007/s00464-010-1256-y.
13. Stavrakis AI *et al.* 2007 *Surgery* https://doi.org/10.1016/j.surg.2007.09.003.

VIRTUAL WARD ROUNDS: USING AI TO REIMAGINE INPATIENT DIABETES CARE

WRITTEN BY JAMES BEVERIDGE, PARIZAD AVARI AND ERIK MAYER

People with diabetes are almost 25% more likely to be hospitalised,[1] occupying around 20% of hospital beds[2] – nearly three times their population prevalence.[3] Although most are admitted for reasons unrelated to diabetes, they often experience more complications and poorer outcomes. While most hospitals now have multidisciplinary teams of specialist diabetes inpatient practitioners (MDiTs), many still rely on reactive ward referrals, leading to treatment delays and increased harm risk.

To address this, our research – part of the NIHR Imperial Biomedical Research Centre's Digital Health theme – is developing the concept of virtual ward rounds, the remote screening and triage of people in hospital with diabetes to enable more proactive, preventative specialist care. This approach seeks to transform the MDiT model through a data-driven clinical decision support system (CDSS).

UNLOCKING POTENTIAL: FROM REACTIVE TO PROACTIVE CARE

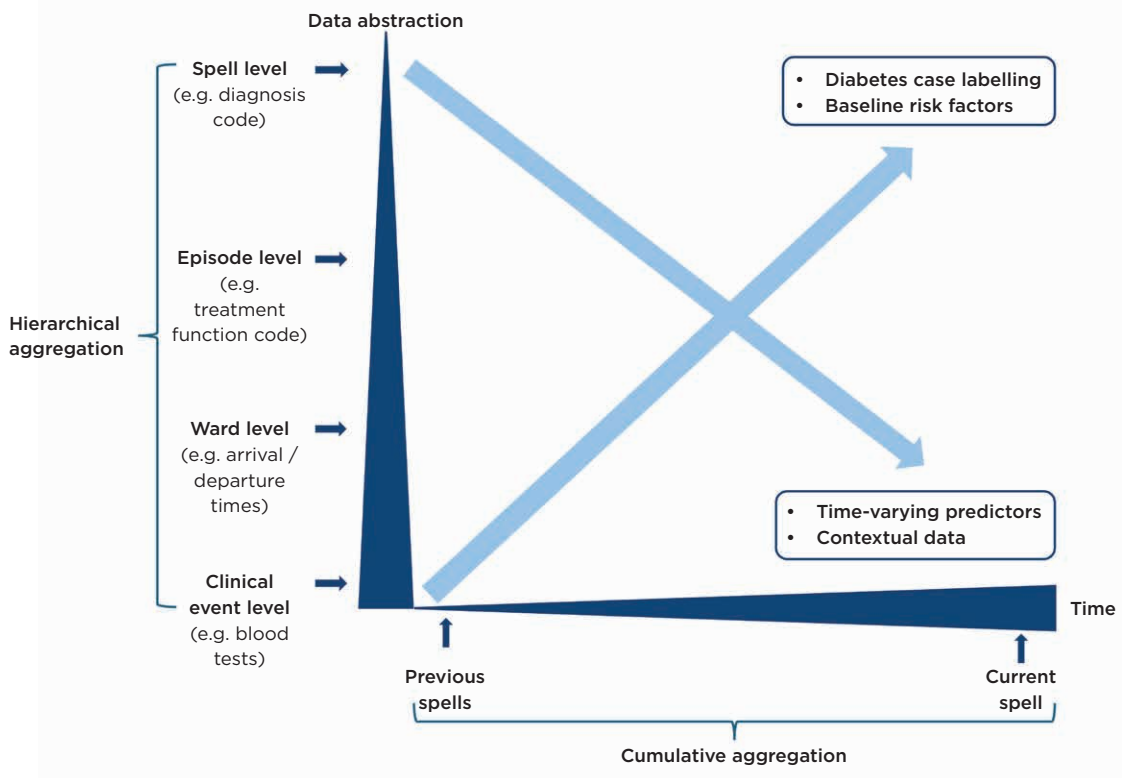
Inpatient diabetes care is typically managed by non-diabetes specialist admitting teams who, rightly, prioritise the presenting complaint, often deferring referral and treatment of diabetes-related problems – sometimes only after harm has occurred.[4] Although hospitals are required to implement electronic systems for proactive diabetes case-finding, screening and triage, progress remains inconsistent.[5] Key diabetes-related data, such as blood glucose levels, medications and diagnosis codes, are often fragmented across multiple electronic health record (EHR) workflows.[6] Diagnoses are typically recorded retrospectively from discharge summaries, making real-time retrieval difficult and time-consuming.

Recent advances in AI and secure data environments (SDEs) offer the opportunity to reshape this reactive model. The iCARE SDE hosts routinely collected EHR data from Imperial College Healthcare NHS Trust alongside primary care EHR data, via the Whole Systems Integrated Care database, covering 2.8 million people across North West London. Automated ingestion delivers near real-time transformation of raw EHR data. A dual approach – using identifiable data for direct clinical care interventions and de-identified data for research – enables continuous validation and oversight, critical for safely embedding AI models into frontline practice. In parallel, federated analysis methods are also being developed to allow researchers to run algorithms across multiple datasets without transferring data between institutions, preserving both security and integrity.[7]

HARNESSING DATA AND AI, BUILT ON TRUST AND CLINICAL INSIGHT

Using the iCARE SDE, we are developing a hybrid CDSS that combines rule-based logic with machine learning to balance the power of AI with clinician and service user trust. While AI is increasingly trialled in CDSSs, concerns about transparency and explainability remain major barriers to adoption.[8] Rule-based algorithms are therefore prioritised for high-confidence case-finding, following step-by-step IF-THEN-ELSE logic grounded in clinical guidelines, to ensure clarity and efficiency. Where data are incomplete or ambiguous, machine learning is selectively applied to

Figure 1. Illustration of rules-based aggregation.



CONTINUED ON PAGE 17

CONTINUED FROM **PAGE 16**

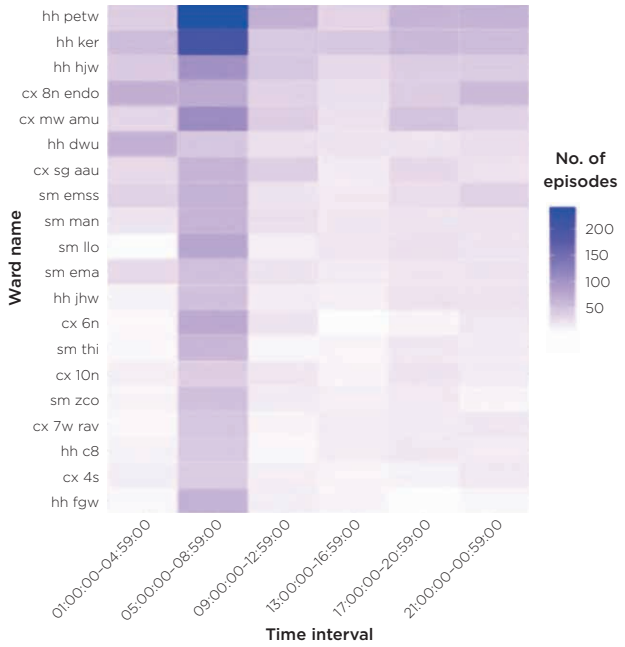


Figure 2. Hypoglycaemic episodes (< 4 mmol/L) in people with diabetes by ward and time interval (top 20 wards) Jul 2022–Dec 2023.

recognise subtle patterns, filling gaps that rule-based methods cannot, and thereby supporting future harm prediction.

FROM DATA TO DECISIONS: A TRANSPARENT FRAMEWORK

Our CDSS development follows a three-stage framework[9] designed to maintain transparency and explainability throughout:

1. Basic reasoning

We begin with a rule-based algorithm to aggregate retrospective diabetes data hierarchically and cumulatively over time, producing an auditable dataset for further analysis (Figure 1). At the spell level, high-confidence cases meeting full diagnostic criteria are automatically labelled, while ambiguous ones such as single diagnosis codes or isolated abnormal glucose readings are given 'silver-standard' labels, indicating possible diabetes. We also engineer baseline risk factors (e.g. age, diabetes type, comorbidities) to support harm risk segmentation. At the clinical event level, we extract dynamic, time-varying predictors (e.g. insulin use, renal function) for future harm prediction, along with contextual data (e.g. ward location, specialty) to support quality improvement.

2. Predictive modelling

We apply unsupervised clustering to baseline risk factors to segment harm episodes into clinically meaningful phenotypes. These serve as targeted machine-learning model inputs, improving signal-to-noise ratio. To refine silver-standard labelling, we use uncertainty sampling to iteratively select low-confidence cases for chart review until model performance stabilises. Decision tree-based machine-learning models are used to capture complex non-linear relationships through a hierarchical structure mirroring human clinical reasoning. Combined with local explanation techniques such as SHAP (Shapley additive explanations), which quantify case-level feature importance, these models provide a clear, interpretable foundation for explainable AI in direct clinical care.[10] For example, rather than simply flagging people at high risk of severe hypoglycaemia, clinicians can see the contributing factors (e.g. age >75, stage 5 chronic kidney disease, recent sulfonylureas), enabling more transparent and informed decision making.

3. Explaining and reasoning

We design simple, intuitive visualisations, such as ward-level control charts, heatmaps and bar plots showing decision feature importance, which can be heuristically validated to ensure alignment with clinical practice, and enhance clinician understanding (Figure 2).

FROM VALIDATION TO REAL-WORLD TESTING

Once validated, the CDSS will be tested and evaluated at Imperial College Healthcare NHS Trust and across other trusts. Working with clinicians and community partners, we will assess its impact on harm incidence and hospital length of stay, helping establish a scalable, proactive, data-driven model for specialist inpatient diabetes care.

JAMES BEVERIDGE
PhD Candidate, Department of Surgery and Cancer, Imperial College London; Senior Manager, NHS England

PARIZAD AVARI
Clinical Lecturer, Department of Metabolism, Digestion and Reproduction, Imperial College London; Consultant Diabetologist, Imperial College Healthcare NHS Trust, London

ERIK MAYER
Clinical Associate Professor, Department of Surgery and Cancer, Imperial College London; Consultant Surgeon, Imperial College Healthcare NHS Trust and the Royal Marsden NHS Foundation Trust, London; Director iCARE Secure Data Environment, NIHR Imperial Biomedical Research Centre

This research is funded by the National Institute for Health Research (NIHR) Imperial Biomedical Research Centre (NIHR203323).

REFERENCES

1. Comino EJ *et al.* 2015 *BMC Health Services Research* https://doi.org/10.1186/s12913-014-0666-2.
2. NHS Digital 2017 *National Diabetes Inpatient Audit England and Wales* https://digital.nhs.uk/data-and-information/publications/statistical/national-diabetes-inpatient-audit/national-diabetes-inpatient-audit-nadia-2017.
3. Dhatariya KK *et al.* 2023 *Diabetic Medicine* https://doi.org/10.1111/dme.14980.
4. Flanagan D *et al.* 2008 *Diabetic Medicine* https://doi.org/10.1111/j.1464-5491.2007.02326.x.
5. NHS England 2024 *National Diabetes Inpatient Safety Audit* https://digital.nhs.uk/data-and-information/publications/statistical/national-diabetes-inpatient-safety-audit-ndisa/national-diabetes-inpatient-safety-audit-2022-23/data-quality-statement.
6. Pichardo-Lowden AR *et al.* 2018 *Journal of Diabetes Science & Technology* https://doi.org/10.1177/1932296818817005.
7. iCARE and WSIC 2025 *Health Service Journal* https://www.hsj.co.uk/technology-and-innovation/meeting-new-challenges-in-data-science-for-health-research-and-innovation/7039414.article.
8. Sutton RT *et al.* 2020 *npj Digital Medicine* https://doi.org/10.1038/s41746-020-0221-y.
9. Kovalchuk SV *et al.* 2022 *Journal of Biomedical Informatics* https://doi.org/10.1016/j.jbi.2022.104013.
10. Pang K 2025 *Healthcare Analytics* https://doi.org/10.1016/j.health.2025.100390.

HARNESSING AI IN ENDOCRINOLOGY CLINICS
A NURSE'S PERSPECTIVE

WRITTEN BY KATHRYN KINSELLA

Artificial intelligence (AI) is no longer a futuristic concept – it is actively reshaping how we deliver healthcare today. For those of us working in specialist roles within endocrinology, AI offers both exciting opportunities and real-world challenges. From streamlining clinical documentation to improving multidisciplinary collaboration, the potential of AI is increasingly evident across the system.

From a nursing perspective, particularly within long-term condition management, the value of AI lies in its ability to reduce cognitive and administrative load, allowing nurses to refocus on the human aspects of care that remain irreplaceable. However, it is also essential that AI is adopted thoughtfully, ethically and inclusively – with nursing voices at the heart of its development and deployment.

TIME RECLAIMED FOR PATIENTS

One of the most immediate and tangible benefits I have experienced in clinical practice is the use of AI-powered transcription tools during endocrine outpatient clinics. These tools use ambient voice recognition to transcribe and structure consultation notes in real time. I have worked with such systems first-hand and observed a notable improvement in workflow.

Previously, much of my clinical time was spent documenting patient interactions after the consultation – either by typing or dictating notes. This process was time-consuming, often delayed the generation of clinic letters, and added to end-of-day fatigue. With AI transcription support, letters can be drafted automatically during the consultation and refined quickly afterwards.

This change has freed up time for direct patient interaction, especially important in endocrine nursing where consultations often involve emotional support, lifestyle counselling and education.

SUPPORTING THE WIDER TEAM

What is perhaps less frequently discussed – but equally important – is the positive impact on the administrative workforce. In our service, clinic letters previously required secretarial support to transcribe from dictations or handwritten notes. Now, because the AI generates a structured, editable output during the appointment, admin teams can copy and paste content directly into patient records or templates, with minimal formatting or correction required.

This shift has led to measurable time savings and reduced transcription errors. It has also allowed administrative colleagues to redirect their time towards other vital tasks, such as appointment co-ordination, pathway tracking and dealing with patient queries – all of which are critical to maintaining an efficient outpatient service.

ENHANCING MULTIDISCIPLINARY CARE

In endocrinology, patient care is inherently multidisciplinary. Patients with conditions such as hypopituitarism, thyroid cancer or adrenal insufficiency are often under the shared care of endocrinologists, endocrine nurses, neurosurgeons, oncologists and primary care providers. In this environment, clear and timely documentation is essential.

AI-generated clinical notes help ensure that letters are structured, legible and include key information in a consistent format. This consistency supports safer prescribing, clearer care plans and more reliable follow-up.

A TOOL, NOT A REPLACEMENT

While the benefits of AI are real, it is important to maintain perspective. AI is not a replacement for clinical expertise, nor should it be treated as a 'black box' that makes decisions for us. The clinical reasoning, empathy and relationship building that underpin nursing practice cannot be replicated by an algorithm.

AI can support and extend our capabilities, but it should not deskill or dehumanise our work. Nurses are trained to pick up subtle cues, assess the emotional and psychological dimensions of illness, and respond with sensitivity to individual needs. These are things no machine can replicate.

LOOKING AHEAD: FUTURE PROSPECTS OF AI IN ENDOCRINOLOGY

While applications such as transcription and clinical coding are already in use, the future of AI in endocrinology holds even more promise.

We are likely to see AI used increasingly for predictive risk modelling, such as identifying patients at higher risk of adrenal crisis, deterioration in diabetes control or delayed puberty progression. AI algorithms trained on large datasets may also help interpret complex biochemical profiles or imaging in pituitary and thyroid disease.

For patients, AI tools such as mobile health apps, symptom trackers and virtual coaching platforms could provide more timely feedback and a sense of control over chronic conditions. These tools may ultimately empower patients, while supporting more dynamic models of care.

Importantly, these innovations will require digital health literacy among clinicians and patients. Nurses have a crucial role to play in bridging the digital divide, ensuring that new tools enhance equity and accessibility.

There is also a growing need for nurses to lead in digital health strategy. As AI is embedded into clinical pathways, the nursing perspective will be critical in shaping solutions that are safe, usable and truly patient-centred.

FINAL REFLECTIONS

AI is not a panacea, but it is a powerful enabler. In endocrinology – where patients often live with chronic and multifaceted conditions – the opportunity to reduce administrative burden and improve care co-ordination is significant.

From a nursing perspective, AI has already begun to shift how we work. It offers time back for what matters most: human connection, clinical thinking and responsive care. However, its value depends entirely on how it is implemented. If nurses are part of that conversation – from ward to boardroom – AI can truly enhance both patient outcomes and professional practice.

KATHRYN KINSELLA
Endocrine Specialist Nurse, Salford Royal Hospital, Northern Care Alliance NHS Foundation Trust

FURTHER READING

NHS England 2023 *Accelerating AI in Health and Care: Results from the NHS AI Lab*, 2023. https://www.england.nhs.uk/long-read/planning-and-implementing-real-world-ai-evaluations-lessons-from-the-ai-in-health-and-care-award/

Nuffield Council on Bioethics 2018 *Artificial Intelligence in Healthcare and Research* https://www.nuffieldbioethics.org/wp-content/uploads/Artificial-Intelligence-AI-in-healthcare-and-research-1.pdf.

Rajkomar A *et al.* 2019 *New England Journal of Medicine* https://doi.org/10.1056/nejmra1814259.

Royal College of Nursing 2021 *Digital Nursing:* https://www.rcn.org.uk/library/Subject-Guides/digital-nursing.

Topol E 2019 *Deep Medicine: How Artificial Intelligence Can Make Healthcare Human Again*. New York, NY, USA: Basic Books.

A Non-promotional Medical Education Webinar Series for Healthcare Professionals

Initiated and funded by Recordati Rare Diseases UK

Challenges in endogenous Cushing's syndrome management

Endogenous Cushing's syndrome is a rare, serious, and complex endocrine disorder characterised by chronic exposure to elevated cortisol levels. Cushing's is associated with increased mortality and significant multisystem comorbidities, including cardiovascular and metabolic impairment, infections, neuropsychiatric disorders and reduced quality of life; which are reduced following successful management.[1]

Join us for a focused webinar series looking beyond the complexities of presentation and diagnosis, into some of the challenge areas in managing Cushing's syndrome. Each webinar, presented by an expert clinician, will provide practical insights and clinical strategies as well as a live Q&A. On demand access will be available following the events.

Click or scan the QR codes to register

Measuring and monitoring cortisol in clinical practice

Date: Wednesday 8th October 2025 | **Time:** 18:30-19:30 BST

Dr Safwaan Adam, Consultant Endocrinologist,
Christie Hospital, Manchester

Management approaches when no clear surgical target

Date: Tuesday 11th November 2025 | **Time:** 19:00-20:00 GMT

Prof Mark Gurnell, Consultant Endocrinologist,
Addenbrooke's Hospital, Cambridge

Preparing patients for surgery

Date: Thursday 22nd January 2026 | **Time:** 18:30-19:30 GMT

Prof Niki Karavitaki, Consultant Endocrinologist,
Queen Elizabeth Hospital, Birmingham

Beyond cortisol - Managing comorbidities in Cushing's syndrome

Date: Monday 23rd February 2026 | **Time:** 18:00-19:00 GMT

Prof Stephanie Baldeweg, Consultant Endocrinologist, UCLH, London

RECORDATI RARE DISEASES

Contact Rainy Marsh, marsh.r@recordati.com

1. Nieman LK *et al.* Nat Rev Dis Primers. 2025 Jan 23;11(1):4.

IE-NPS-0247 August 2025

Supporting your work
CAREER DEVELOPMENT FRAMEWORK FOR SCIENTISTS

Driven by a desire to support Scientist members, through what can sometimes be a precarious journey (dependent on grant funding), the Society's Science Committee has developed a *Career Development Framework for Scientists*. This framework is there to support your science career progression, navigating industry, and to highlight where the Society can support you.

We hope that Scientist members will not only benefit from this resource themselves, but also pass the opportunities to the next generation, ensuring that they too can make the most of their Society membership.

KEY AREAS COVERED BY THE FRAMEWORK

- Research
- Teaching
- Leadership, collegiality and citizenship
- Engagement
- Knowledge exchange
- Enterprise

Find the Framework here

> "Guiding the next generation of endocrine researchers through a framework built for excellence."
> *Dr Zoi Michailidou, Science Committee Chair*

> "The Career Development Framework will help to support Scientist members by providing a clear pathway for career progression, access to Society-endorsed development opportunities, and deeper engagement with the endocrinology community, to help equip them for success across all career stages."
> **Dr Karen Forbes, Science Committee member**

> "Career progression in academia can often feel unclear and arbitrary, especially as an early career researcher. The Framework aims to support all Scientist members – from undergraduate onwards – by providing tailored goals, advice and resources for each career stage."
> **Dr Melissa Wright, Science Committee member**

HAVE YOUR SAY

The *Career Development Framework for Scientists* is a living document. We welcome your suggestions and resource contributions. Contact **careers@endocrinology.org**.

WOULD YOUR CAREER BENEFIT FROM MORE RESEARCH OUTPUTS AND PUBLICATIONS?

If so, remember you can:

- Submit an abstract to **the SfE BES conference**: accepted abstracts are published free in ***Endocrine Abstracts***
- **Publish your research without fees** in:
  - ***Journal of Endocrinology***,
  - ***Journal of Molecular Endocrinology***
  - ***Endocrine-Related Cancer***

  – that's no colour fees, no supplementary data charges and no page charges for Society members!
- Submit your research to one of the **current special collections**:
  - ***Journal of Endocrinology***
  - ***Journal of Molecular Endocrinology***
  - ***Endocrine-Related Cancer***

HAVE YOU GOT AN IDEA FOR A SPECIAL COLLECTION?

Make **your own suggestion** for a special collection and even **nominate yourself as Editor**.

Complete the proposal form today

> "This can be a great way to gain some editorial experience and shine a light on your research field with increased promotion. You could also involve more junior colleagues to increase their editorial experience, as they could guest edit alongside you."
> *Millie Mark, Publisher,* Journal of Endocrinology *and* Journal of Molecular Endocrinology

bioscientifica

Celebrating success!
UPDATED IMPACT FACTORS FOR SOCIETY JOURNALS

We are delighted to share the latest Journal Impact Factors from the 2024 Journal Citation Reports™. Our Society journals continue to grow in influence, reflecting the global impact of the research they publish.

Journal of Endocrinology

The Society's flagship journal has an increased Journal Impact Factor™ of **3.9**, and now ranks 56 out of 191 journals in the 'Endocrinology & Metabolism' category. This places the journal firmly in the 70th percentile, demonstrating its growing reputation for publishing high-quality, cutting-edge endocrine research.

Journal of Molecular Endocrinology

Journal of Molecular Endocrinology has also seen an increase, with an Impact Factor of **3.8**, achieved through the journal's continued commitment to providing a platform that advances molecular endocrinology research.

The journals' Co-Editors-in-Chief, Professor Ruth Andrew and Associate Professor Gabriela da Silva Xavier, commented, "*Journal of Molecular Endocrinology* and *Journal of Endocrinology* have seen substantial growth in submissions in the last year, with a fantastic series of papers reaching publication. It is great to see this reflected in strong community interest in our discipline, and makes our lives as Co-Editors-in-Chief very stimulating!"

Endocrine-Related Cancer

Meanwhile, *Endocrine-Related Cancer* achieved a significant milestone with an Impact Factor of **4.6**, securing its place in the top quartile for both the 'Endocrinology & Metabolism' and 'Oncology' categories.

Editor-in-Chief Dr Matthew Ringel recognised this milestone as "…demonstrating the unique role that *Endocrine-Related Cancer* plays in publishing impactful original science and review manuscripts in endocrine oncology."

Endocrine Connections

Endocrine Connections also saw a positive rise in this year's report, with its Impact Factor increasing from 2.6 to **2.8**, and an improved ranking of 104 out of 191 journals in the 'Endocrinology & Metabolism' category.

Editor-in-Chief, Professor Faisal Ahmed commented, "We are very pleased with this result, which reflects the journal's growing influence and the high quality of research it publishes across all areas of endocrinology."

Endocrinology, Diabetes & Metabolism Case Reports

Endocrinology, Diabetes & Metabolism Case Reports retained its Impact Factor of **0.7**, reaffirming the journal's position as one of the leading case reports publications dedicated to endocrinology and metabolism.

The Society thanks everyone who contributes to the success of our journals, including Editorial Board members, peer reviewers and the global research community. These successes would not be possible without your support.

2024 IMPACT FACTOR COLLECTIONS

To mark these achievements, we have curated 2024 Impact Factor Collections, showcasing the most cited and impactful articles, and highlighting the breadth of research published in the journals. You can find the collections here:

- ***Journal of Endocrinology***
- ***Journal of Molecular Endocrinology***
- ***Endocrine-Related Cancer***
- ***Endocrine Connections***

Upcoming EVENTS

HORMONE DEPENDENT CANCER CONFERENCE

17–18 November 2025, York

This event aims to bring together scientists, researchers, clinical scientists and early-career researchers within the field, to share ideas and develop essential strategies related to hormone-dependent cancers.

Confirmed topics include:

- Genetics/genomics
- Immuno-oncology approaches to treatment
- New tools for cancer research
- The role of the tumour microenvironment
- Latest innovations in the development of novel therapeutics
- Career development workshop

> "We are delighted to launch the inaugural UK Hormone Dependent Cancer Conference. This early career-focused event is an unmissable opportunity for PhD students, post-doctoral researchers, research assistants, fellows and junior group leaders in breast, prostate and other hormone-linked cancers to hear about the latest cutting-edge developments in the field, network with research leaders, attend tailored careers workshops and showcase their research to other delegates. We hope to see you in York!"
>
> **Hormone Dependent Cancer Conference founding group**

OBESITY UPDATE

1 December 2025, Nottingham

Aimed at those in patient-facing roles, you can expect to advance your knowledge of current therapeutic innovations, research and clinical developments. There is also an opportunity to present your work to peers as either a poster or an oral presentation – with prizes for research that drives innovation and uncovers new insights in the field.

Confirmed topics include:

- Does bariatric surgery still have a place with new obesity medications?
- Changing roles in primary care in reference to obesity management
- Medical management advancements
- Updates on paediatric obesity
- Challenging cases

Save up to 20% if you register before 8 October

ENDOCRINE METABOLIC GPCRs CONFERENCE

9–10 February 2026, Liverpool

This event will bring together scientists at all career levels from academia and industry to exchange data, technologies and ideas in the field of G protein-coupled receptors (GPCRs). We will explore the structural basis of GPCR activation and the latest methods to study complex GPCR signalling.

Confirmed topics include:

- Drug discovery and using genetics to understand GPCR pathophysiology
- Latest methodologies to study complex GPCR signalling at both micro and macro scales
- Endocrine GPCR biology from pharmacology to physiology

European Society of Endocrinology

2025 SURVEY

Share your view on the State of Endocrinology

Act quickly

It's the last call to have your say on the State of Endocrinology in 2025.

The European Society of Endocrinology (ESE) is leading a survey to generate recommendations to support advocacy efforts aimed at national and European healthcare decision makers. This initiative is taking place in collaboration with the national endocrine societies that form the ESE Council of Affiliated Societies, which include the Society for Endocrinology.

The survey will take on average 20 minutes to complete, depending on your professional profile. You can decide to save it part-way through and return to finish it later (from the same device). The questions are in English, but you can use any other language in your replies in open text boxes, as they can be translated.

Make sure you have your say, as your response will inform national and regional policy actions.

Complete the survey by Tuesday 30 September (23.59 CEST)

Inspirational stories
MEET OUR 2026 AWARD WINNERS

The many achievements of the Society's 2026 award winners will be recognised when they receive their awards at the SfE BES conference in Harrogate on 2–4 March. We caught up with them to learn about their passion for endocrinology and the Society's impact on their careers. Read on to discover why they think you should attend SfE BES 2026. **Register your interest now** to connect with and learn from our inspiring community.

KETAN DHATARIYA
Outstanding Teaching Achievement Award

Ketan is a Consultant in Diabetes and Endocrinology at Norfolk and Norwich University Hospitals NHS Foundation Trust, and Honorary Professor of Medicine at the University of East Anglia. His main areas of interest are all aspects of inpatient diabetes, in particular diabetes emergencies, perioperative diabetes care and 'diabetic foot'.

What do you enjoy most about your work?
Everything! I get most enjoyment out of learning and sharing that knowledge with others.

What's your favourite part of SfE BES?
My curiosity is never satisfied: I can go from a session on adrenals, to pituitary, to bone, to diabetes, to reproduction, to thyroid and so on. It is a wonderful place to learn, to catch up with people and to make new contacts and friends.

Why should others get involved with the Society?
It's important to be a member to make sure that your voice is heard. Being a Society member is a way of advocating for our specialty at the highest level in our profession. It's all about having a voice, and being a member adds to the volume!

What are your words of wisdom for aspiring endocrinologists?
Always stay curious. Ours is such a brilliant specialty, with new discoveries happening every week! Find out what is going on and what interests you, and dive in. Keep questioning, keep reading and keep learning.

KAREN CHAPMAN
Outstanding Contribution Medal

Karen has had an interdisciplinary career, moving from molecular biology to endocrinology, before retiring in 2021. She is the recipient of this award for her guidance in making the Society more inclusive, as part of the Society's Governance Review 2020/21. Her work has ensured our Awards and Prizes portfolio recognises a wider breadth of excellence, celebrating the diversity of our community.

Have you been to SfE BES before?
So many times, I've long lost count! Because it is such a broad conference, it provides a fantastic general overview and the chance to hear (and meet) some real stars of endocrinology. I have always been delighted by how interesting and relevant so much of it is to my own research.

Why did you get involved with the Society?
I really enjoy the marriage of basic and clinical science that the Society thrives on, and its approach to enabling and fostering that environment through conferences and symposia. I have appreciated the opportunities to meet and engage with people from diverse backgrounds and career paths. All I can say to other professionals working in endocrinology is 'Get involved, you won't regret it!'

What are your words of wisdom for aspiring endocrinologists?
If you get knocked down (if your grant isn't funded or that key paper isn't accepted), don't give up – get up and try again. Sometimes unexpected and (at first glance) disappointing results can take you down a completely new avenue of research. The outcome will be all the better for the feedback in the end.

ANTONIA BROOKE & CHANNA JAYASENA
Outstanding Clinical Practitioner Award (joint winners)

Antonia is the Clinical Lead in Endocrinology and Diabetes at Royal Devon University Healthcare NHS Foundation Trust, and Honorary Senior Lecturer at Exeter University and Royal Devon University Hospital.

Channa is a Reader in Reproductive Endocrinology at Imperial College London, and a Consultant in Reproductive Endocrinology and Andrology at Hammersmith and St Mary's Hospitals London.

What can you remember about your first SfE BES?
Antonia: My first SfE BES conference and my first abstract presentation were many years ago. In the beginning, I networked with my fellow registrars and consultants, mainly late in the bar, but this has become seeing old friends, discussing complex clinical dilemmas and ensuring that I maintain connections with patient partners through the charitable foundations.

Channa: I fondly remember going to the SfE BES conference during my PhD with Professor Waljit Dhillo. He was a brilliant mentor who trusted me to speak to lots of reporters about our abstract – a terrifying but great experience.

Can you tell us about one of your most recent achievements?
Antonia: As Chair of the Specialist Advisory Committee for the Royal College of Physicians, I tried to ensure that endocrinology remains an attractive option with competitive recruitment, fighting for equity with other specialties around general medical contribution.

Channa: I led the NIHR Testosterone Efficacy and Safety (TestES) team to produce the first credible evidence that testosterone may not increase cardiovascular events, which was contrary to the US Food and Drug Administration health advisory.

What are your words of wisdom for aspiring endocrinologists?
Antonia: Identifying problems is easy, but finding solutions to the problems is the real challenge; patient support groups can really help if you ask.

Channa: I would not count myself as wise! But a great friend told me that progress is made by trust, friendship and persuasion – I agree.

Raise your Voice...

Are you ready to shape the future?
TAKE A SEAT ON A SOCIETY COMMITTEE

If you want to expand your network, learn new skills or give back to your community – now is the time. We are on the hunt for dynamic individuals to join our committees and have their voices heard.

Our Society is about to enter its 80th year, and it's more important than ever that we have voices from all career levels, backgrounds, locations and specialties. You can represent our members and say what it means to be an endocrinologist in 2026 and beyond… Click on a role below to find out more:

Committee Chair vacancies
- **Public Engagement Committee Chair-Elect**
- **Science Committee Chair-Elect**

Committee member vacancies
- **Awards and Prizes Committee** 12 vacancies
- **Clinical Committee** 6 vacancies
  This Committee particularly welcomes applicants with expertise in reproduction, bone and calcium, thyroid, and those from district general hospitals
- **Corporate Liaison Committee** 1 vacancy
- **Finance Committee** 3 vacancies
- **Grants Committee** 2 vacancies
- **Leadership and Development Selection Panel** Chair
- **Nurse Committee** 2 vacancies
- **Programme Committee** 4 vacancies
- **Science Committee** 2 vacancies
- ***The Endocrinologist* Editorial Board**: 2 vacancies (see opposite)

Other opportunities
- **Endocrine Network** Convenors
- **Leadership and Development Awards Selection Panel** members.

APPLICATIONS CLOSE ON 3 NOVEMBER 2025 APPLY NOW

Lead the change in YOUR Society.

COMMITTEE MEMBERS SAY...

"I hadn't realised how welcoming the committees would be. They are approachable and they value your contribution; everyone's views are respected. If you are interested in a role, apply for it! You will learn something new, the experience will be beneficial to your career and you can help to develop areas within the Society that benefit its members." *Joanne Brown, Nurse Committee*

"I have met and networked with lots of new people through being on the Public Engagement Committee. I really enjoy attending the meetings, and the social aspect of being involved in the group!" *Abigail Byford, Public Engagement Committee*

"The other people on the committee are lovely, and it's interesting to hear about their experiences in their institution and at their career stage. As Mahatma Gandhi said, 'The best way to find yourself is to lose yourself in the service of others.' I would encourage people to apply, and bring fresh perspectives and ideas to the role. What would success look like? Making positive contributions to the community." *Craig Beall, Science Committee*

JOIN THE TEAM AT *THE ENDOCRINOLOGIST*!

Would you like to make new connections and keep the Society's members informed about the latest advances in our field?

You could be one of the new members of our Editorial Board, starting from January 2026. Enthusiastic members of the Society should apply before 3 November 2025.

The Endocrinologist is a well-loved and valuable resource that helps to foster a sense of community among members. Editorial Board members work together to decide the focus of each issue and commission articles from the global community of endocrinologists and other experts, helping to produce a vibrant and topical publication for colleagues in the field.

"We welcome a huge range of interests and expertise to the Editorial Board. Sometimes members will be commissioning articles on very familiar topics, perhaps from people they know, and other times they'll be on subjects they know very little about. If you're curious about the field as a whole and the issues affecting the community, this could be the perfect role for you!" *Jane Shepley, Managing Editor of* The Endocrinologist

"Being part of the team provides a great opportunity to discuss the latest developments across a really wide range of topics related to endocrinology. I look forward to our meetings, as I always learn so much and enjoy other team members' passion for their respective fields. An added bonus is the transferable skills I've learnt in writing and communication, which are now a vital part of being an academic scientist. I therefore encourage anyone interested to apply, you won't regret it!" *Kate Lines, Research Fellow, Editor of* The Endocrinologist

WHAT YOU WILL DO AS AN EDITORIAL BOARD MEMBER

Working with the Editor, Associate Editor and fellow Board members, you will:
- attend four online meetings per year
- help choose the theme of each issue
- identify potential authors and contact them to commission articles
- review all articles to check suitability in terms of subject, interest, quality and topic
- contribute to production of the 'hot topics' from the latest journals
- work with the Society team to ensure that the production schedule runs smoothly.

If you are curious, organised and enthusiastic, the Editorial Board encourages you to apply!

"My experience in the team has been great, and I would encourage nurses to apply. Everyone is really nice and welcoming, and writing hot topics and commissioning articles have been good challenges to widen my skills." *Cosmina Schiteanu, Specialist Nurse, Royal Stoke University Hospital*

Find out more and apply by 3 November 2025

An interview with… EDOUARD MILLS
PUBLIC ENGAGEMENT COMMITTEE MEMBER

We asked Edouard how joining a Society committee has helped build his career and his confidence.

What has been your proudest career moment?
Being awarded the Society for Endocrinology Early Career Clinical Prize Lecture and then presenting my research at the SfE BES 2023 was a huge privilege.

What do you see for the future of endocrinology?
Undertaking genetic testing is an increasing part of everyday endocrine practice. Knowing the gene defects that underlie an endocrine disorder allows us to refine diagnoses and personalise treatment strategies, not only for affected individuals but also for their family members.

What's your 'origin story' in endocrinology?
I actually wanted to be a hepatologist throughout medical school, until I saw a simultaneous presentation of thyroid storm and diabetic ketoacidosis in a previously healthy young woman, when I was an on-call FY1 doctor. I was fascinated by the feedback mechanisms and their importance for diagnosing and treating endocrine disorders. The rest is history.

Why did you join a Society committee?
Joining the Public Engagement Committee has been a great opportunity to collaborate and network with some fantastic colleagues who are equally passionate about raising the profile of endocrinology and the Society. Our remit is incredibly broad, from delivering schools outreach activities through to engaging with the media. I wholeheartedly recommend applying to join.

What has being part of a committee taught you about yourself?
To step out of my comfort zone. Part of the Public Engagement Committee's remit is to oversee a programme of public events and develop resources, including for schoolchildren and the general public. Being part of the committee has taught me the skills to communicate complex science in simple language. This has been incredibly helpful when interacting with my own patients.

What advice would you give your early-career self?
Medical training is a marathon, not a sprint. Taking time out of training to pursue other interests (especially research, leadership, teaching opportunities, etc.) is a valuable way to acquire new and diverse skills. Together, these will make you a more effective and well-rounded consultant in the long term.

Take the Lead...

Be part of shaping the future of YOUR Society.

Although the condition might be rare...

...the features are common

Perhaps it's Cushing's syndrome, perhaps it's something else? If you connect any of these dots within a patient, consider referring them to a specialist endocrinologist.

For a clinician's guide to recognising Cushing's syndrome's signs and features, email **cushings@connectthedots.health** and help shine a light on this rare condition.

ESTEVE
Advancing health together

Connect the dots

References: 1. Pappachan JM *et al. J Clin Pathol.* 2017;70:350–359. doi:10.1136/jclinpath-2016-203933
2. Nieman LK. *Endocrinol Metab.* 2018;33:139–146. 3. Yorke E *et al. Int J Endocrinol.* 2017; 1547358.

UK/NPR/0035 Date of preparation: March 2025