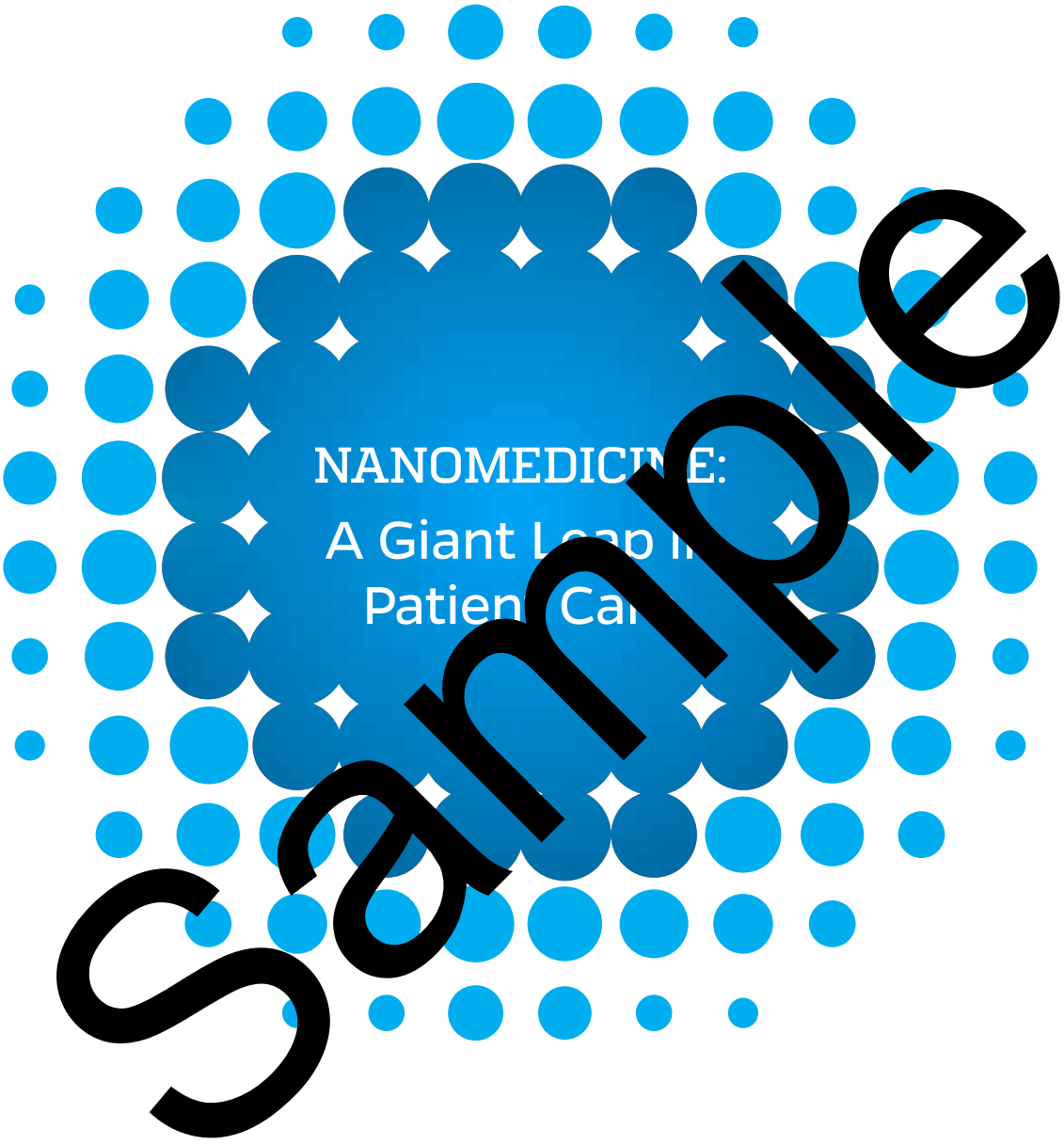
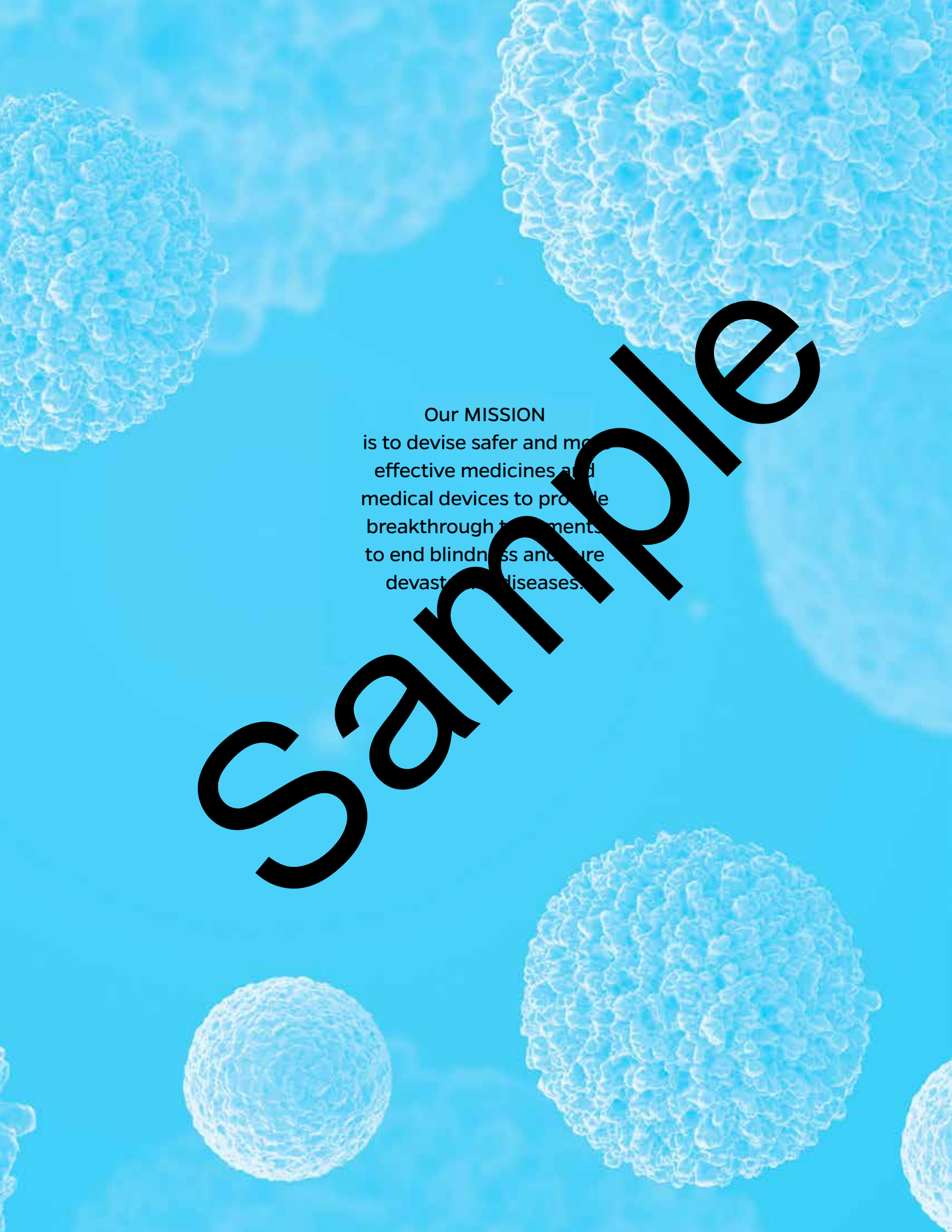


Wilmer Eye Institute

JOHNS HOPKINS MEDICINE

Our VISION
is to create a
world-leading
nanomedicine institute
at Wi ner.


Our MISSION
is to devise safer and mo
effective medicines a d
medical devices to pro le
breakthrough t ments
to end blindn ss and ure
devast diseases.

"Human capital and billions of dollars are invested every year in developing new therapeutic molecules that have the potential to conquer devastating diseases. However, cures for countless diseases do not exist, in large part owing to our inability to deliver effective medications to the right location in the body, at the right time in the right dose and in a manner that is manageable for physicians and patients. The field of nanomedicine holds tremendous potential to overcome these delivery hurdles—saving countless people vision, improving their health and function, and in many cases, their lives."

Justin Hanes, PhD
Director, Wilmer's Center for Nanomedicine
Lewis J. Ort Professor of Ophthalmology

“Nanomedicine” refers to a new era in medicine, a frontier in which patient care is truly transformed by the use of nanoparticles to more precisely and effectively deliver medications.

Nanoparticles measure just one ten thousandth the diameter of a human hair. Despite their tiny size, each nanoparticle can carry more than 100,000 drug molecules to precise location in the body, and mete them out at a pre-programmed rate over a sustained time period. By utilizing nanoparticles to deliver therapies—drugs with proven potential to cure intractable diseases—we can get effective agents to the exact places in the body where they are needed, in the exact doses required.

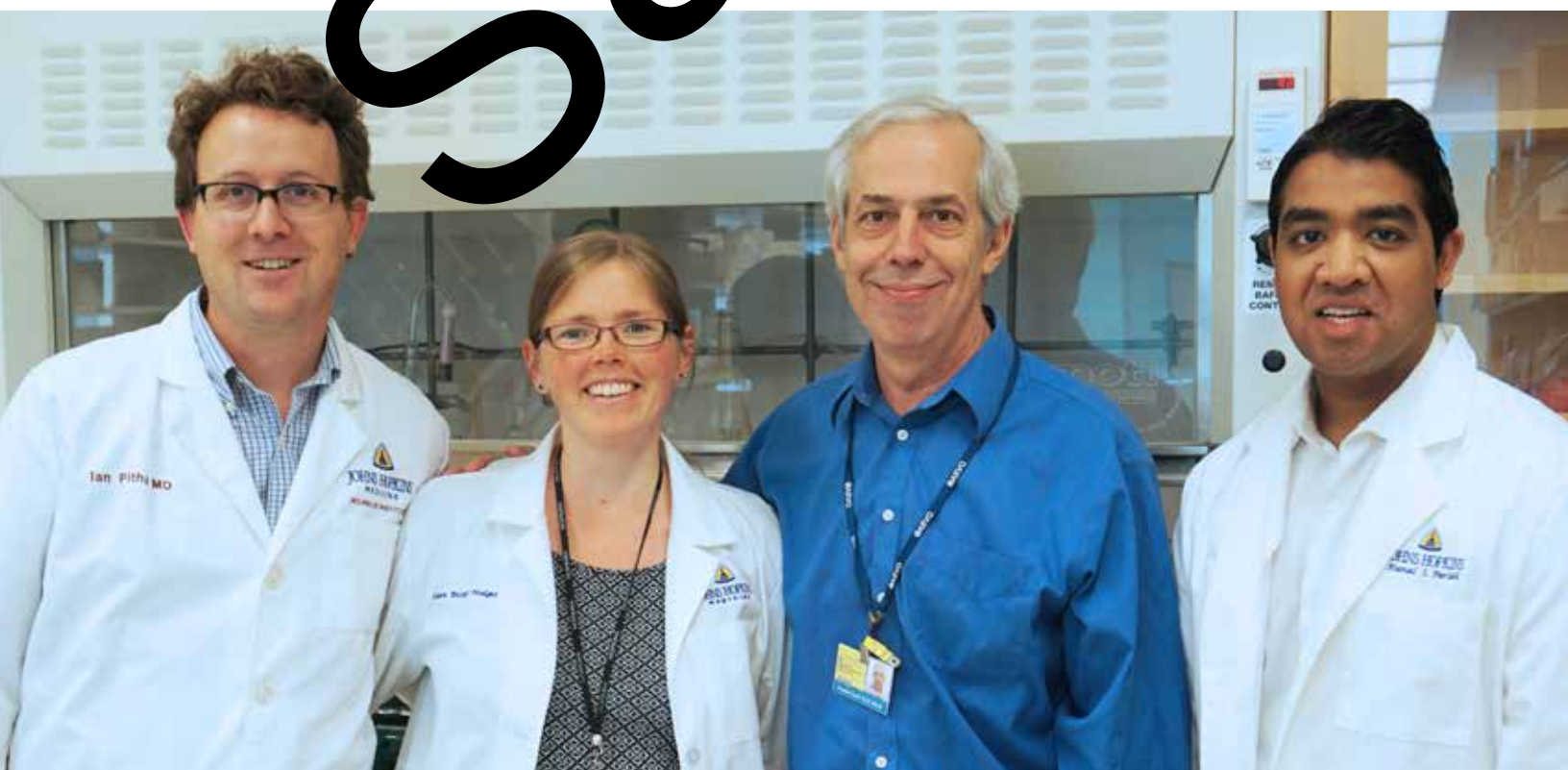
At the Center for Nanomedicine, we are developing nanoparticle-based techniques to treat severe diseases and many other medical conditions. Our engineers, research scientists, and physicians are collaborating in ways that, already, are generating breakthroughs in medical science and technology, leading to dramatic improvements in patient care.

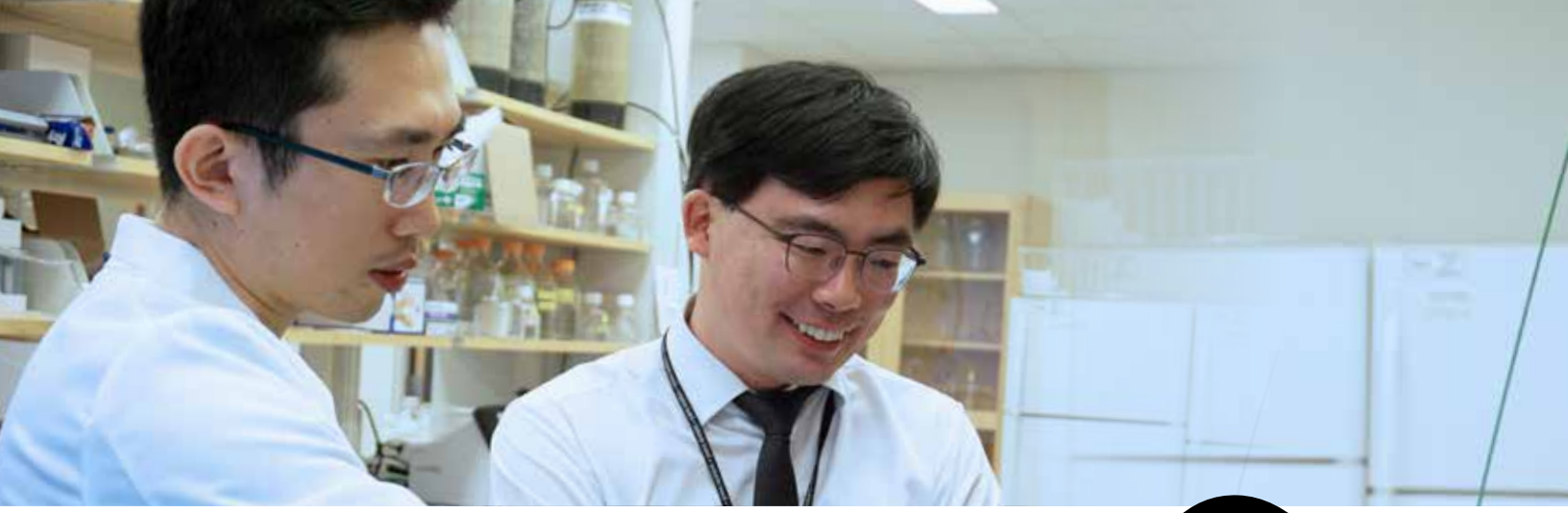
Nanomedicine

RETINAL DISEASES

CHALLENGES: No treatments exist for the "dry" form of **age-related macular degeneration (AMD)**, which over time can progress to the more dangerous "wet" form. Treatment for wet AMD requires bimonthly injections directly into the eye to avert rapid progression to blindness. Although treatments for other retinal diseases such as **diabetic retinopathy** and **diabetic macular edema** are available, patients must take medications on a schedule of repeated dosings to prevent disease progression and eventual blindness. Moreover, frequent intraocular injections are not viable for early interventions.

SOLUTIONS: To prevent the transition from dry to wet AMD, we are formulating a nanomedicine-based pill that can be taken orally once a day. We are also developing formulations that specifically target injured cells as well as deliver medications in a controlled and sustained manner to reduce the frequency of intraocular injections used to treat a multitude of retinal diseases—to as low as once per year.





DISEASES AFFECTING THE FRONT OF THE EYE

CHALLENGES: Standard treatments for **glaucoma**, **uveitis**, **dry eye disease**, **corneal neovascularization**, or after **corneal graft surgery**, require frequent application of eye drops, leading to suboptimal outcomes and side effects. Patients often have great difficulty following these treatment regimens, particularly when they must use multiple types of eye drops daily.

SOLUTIONS: We are using sustained-release and targeted nanomedicines to provide months-long delivery of medications for treating these diseases, as well as to prevent corneal graft rejection and corneal neovascularization. We are also developing nanomicelle-based eye drops that remain effective at reduced dosing frequencies and can contain a cocktail of medications to treat diseases that require multiple daily applications of different medicines.

OPHTHALMIC SURGERIES

CHALLENGES: Many ophthalmic surgeries, including **glaucoma surgeries**, **corneal transplants**, and **cataract surgeries**, carry a risk of infection or complications that often require additional operations. Frequent administration of eye drops will prevent some complications, but poor patient compliance can lead to blindness.

SOLUTIONS: To prevent infection and other complications following corneal transplants, we are developing absorbable sutures that release antibiotics or steroids. For glaucoma surgery, we are developing nanoscale, absorbable shunts to reduce intraocular pressure in the eye in a controlled, time-dependent manner, which can prevent the need for additional operations. We are also developing nanoglues for sutureless cataract surgery that can release formulations to seal the incision and provide sustained delivery of antibiotics or pain-killers.

CANCER

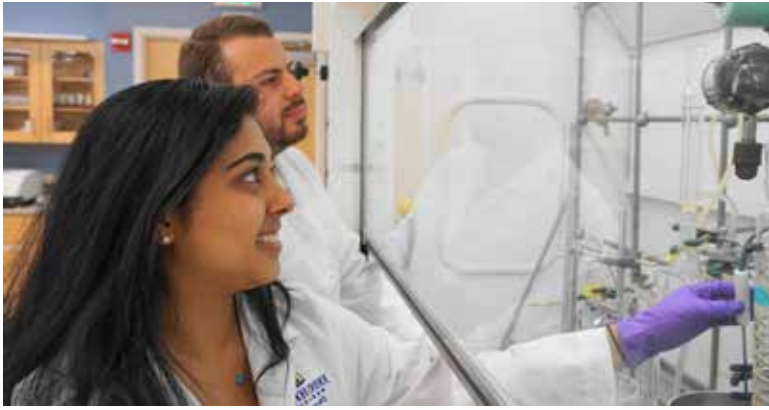
CHALLENGE: Chemotherapy can be ineffective for many cancers because most drugs distribute throughout the body, rather than specifically reaching the tumor. The high toxicity of these drugs can also lead to harmful side effects. Moreover, the tumor can be a formidable barrier that limits penetration of the drugs that do reach the tumor, further decreasing the effectiveness of cancer treatments. These challenges also apply to treatments based on more recent advances in tumor immunotherapy.

SOLUTION: We have devised nanoparticle formul[illegible]ns that e[illegible]able [illegible]ore efficient targeting to—and penetration of the drugs in[illegible]—the t[illegible]r, or to immune cells in the case of immunotherapy. These for[illegible]lation[illegible] minimize exposure of toxic drugs to healthy tissue[illegible] the dr[illegible]are cleared from the body. Sustained drug-release nanopa[illegible]icle for[illegible]ations [illegible]o reduce the number of treatments patients must u[illegible]go. These n[illegible]omedicine-based delivery approaches are especially promising [illegible]hard-to-cu[illegible] cancers, including **pancreatic**, **cervical**, **ovarian**, **lung**, **[illegible] bladde[illegible]**nd **co[illegible]ectal cancer**.

DISEASES OF THE CENTRAL NERVOUS SYSTEM

CHALLENGE: Organ[illegible]he cent[illegible]l nervous system are protected by the blood/brain [illegible]arrier[illegible]s a c[illegible]equence, few treatment options exist for r[illegible]ing inflamm[illegible]ion in[illegible]e brain associated with **cerebral palsy**, **neonatal stroke**, **traumati[illegible]rain[illegible]juries**, and **autism spectrum disorders**. The blood/brai[illegible]lso represents a formidable challenge to developing therapies [illegible]treating **b[illegible]n tumors**. Brain injuries leading to **multiple sclerosis**, **Parkinson's [illegible]ease**, and **Alzheimer's disease** also tend to be diffuse, and therefore[illegible]icult to treat.

SOLUTION: We are developing nanomedicines that can cross the blood/brain barrier, specifically at the site of injury, to improve the treatment of many diseases caused by diffuse brain injury. We have also coupled focused ultrasound with our formulations to enable crossing the blood/brain barrier only in those areas where drugs or therapeutic genes are needed. Nanomedicines that selectively target injured cells to reduce the inflammation that leads to irreversible neuronal damage are also being developed.



WOMEN'S HEALTH

CHALLENGE: **Preterm birth** is a persistent health issu[illegible] the U[illegible]ed State[illegible] and the most common cause of death among infants wor[illegible]ide. **Ba[illegible]al vaginosis** and **intrauterine inflammation** duri[illegible]ancy [illegible]e been implicated as risk factors for preterm birth, w[illegible]ch can u[illegible]ately [illegible]ntribute to cognitive deficits in children. Few prevent[illegible]otions exist[illegible]r preterm births and there is no long-term cure for **bacterial v[illegible]inosis**.

SOLUTION: We are creating ne[illegible]nanom[illegible]cine-ba[illegible]d formulations to improve drug coverage an[illegible]e locally i[illegible]e fema[illegible]eproductive tract for the prevention of pre[illegible]rm bir[illegible]nd sexually transmitted infection. By targeting specific cells, [illegible]are devel[illegible]g another type of nanomedicine-based formulation that m[illegible]ameliorate the effects of uterine inflammation on the developi[illegible]brain. [illegible]are also devising novel formulations targeting bacteria in[illegible]e fema[illegible]roduct[illegible]e tract to provide the first long-term cure for bacteri[illegible]vagi[illegible]sis.

LUNG DISEASES

CHALLE[illegible]: Mucus that lines the tissues in our airways presents an [illegible] barrier to treatments for lung diseases, especially obstructive lung diseases such as **cystic fibrosis**, **asthma** and **chronic obstructive pulmonary disease**. To give one striking example, a successful gene therapy has yet to be developed for cystic fibrosis, although the specific gene target for this disease was identified in 1989. The efficacy of current treatment options for **asthma** and **lung cancer** are likewise limited by our inability to deliver locally effective treatments.

SOLUTION: We are developing methods to provide drug and gene delivery to target cells in the airways using nanomedicine-based formulations that rapidly penetrate the mucus layer, which leads to improved treatment outcomes.

INFLAMMATION

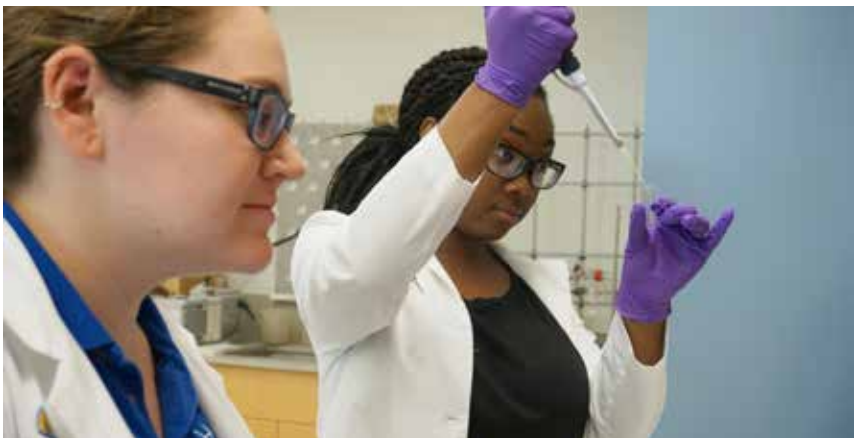
CHALLENGES: An overactive immune system is an underlying cause of many inflammatory diseases, including **arthritis**, **atherosclerosis**, **inflammatory bowel disease**, **intrauterine inflammation**, **liver cirrhosis**, **pancreatitis**, and **various cancers**. Current treatment strategies suppress the entire immune system rather than targeting only the overly activated immune cells. Weakening the entire immune system can increase the susceptibility to illness and infections.

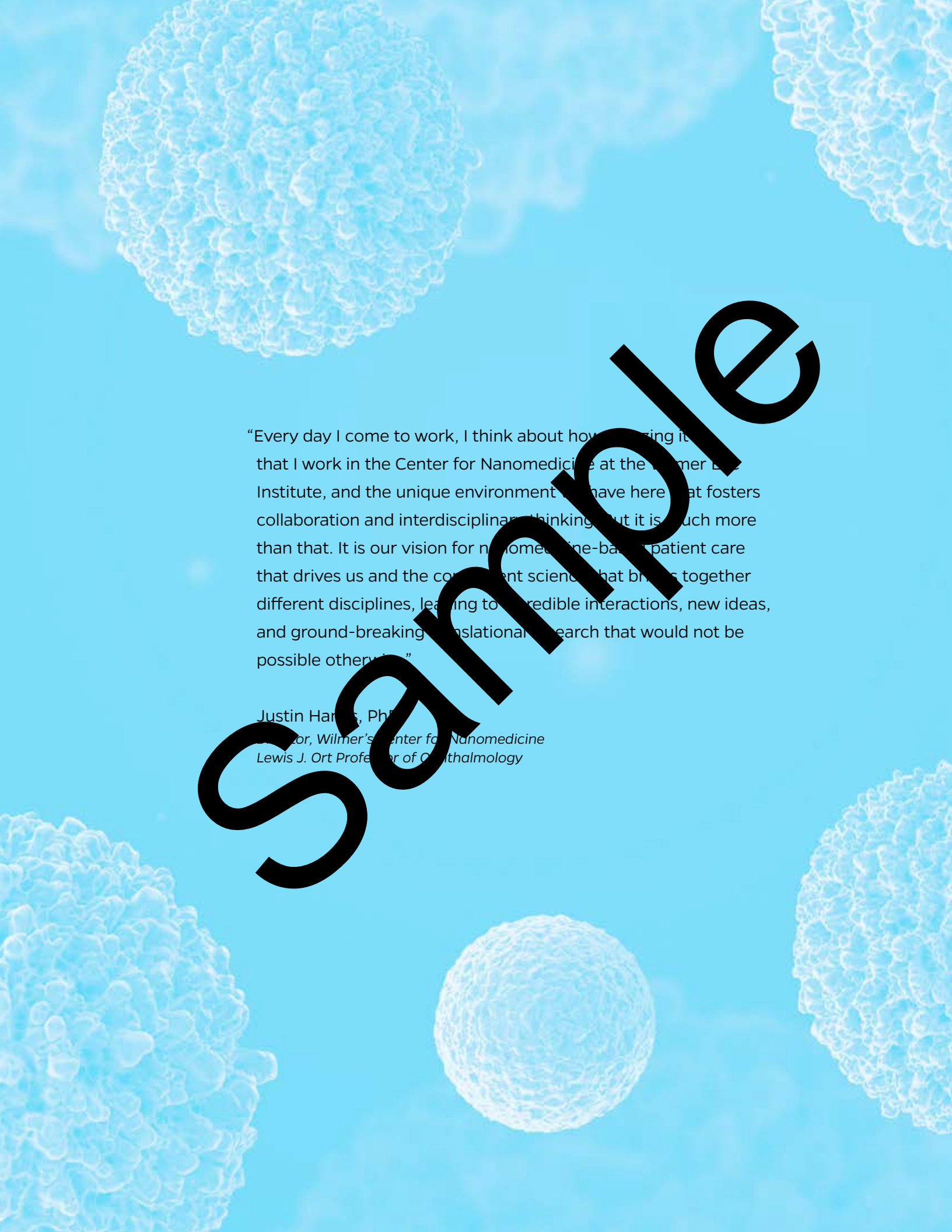
SOLUTION: We are creating nanomedicine-based formulations that can target and deliver anti-inflammatory drugs only to the activated immune cells, which prevents the damaging effects of **chronic inflammation**. We are also formulating nanomedicines capable of directly targeting and killing cells that drive **fibrosis**—the harmful accumulation and hardening of tissue in the body.

GASTROINTESTINAL CONDITIONS

CHALLENGES: Pills taken orally are the most common treatment regimen, and the one preferred by patients, for treating **pancreatitis**, **inflammatory bowel disease**, and **gastrointestinal (GI) cancers**. Nonetheless, the GI tract presents multiple barriers to drug uptake, including acidic pH, digestive enzymes, continuous motility, and a continually regenerated mucus barrier.

SOLUTION: We have developed nanomedicine-based formulations that protect encapsulated drugs from the harsh GI environment, while effectively penetrating the mucus barrier to deliver medication to specific cells in a sustained-release fashion. These formulations can be designed as pills to be taken orally or delivered in enemas for the treatment of a wide array of GI diseases.





"Every day I come to work, I think about how [illegible]zing it is that I work in the Center for Nanomedici[illegible]e at the [illegible]mer E[illegible] Institute, and the unique environment [illegible]have here [illegible]at fosters collaboration and interdisciplinar[illegible]hinking[illegible]ut it is [illegible]uch more than that. It is our vision for n[illegible]omed[illegible]ine-ba[illegible] patient care that drives us and the co[illegible]nt scienc[illegible]hat br[illegible]s together different disciplines, lea[illegible]ing to [illegible]redible interactions, new ideas, and ground-breaking [illegible]nslational[illegible]earch that would not be possible other[illegible]."

Justin Har[illegible]s, Ph[illegible]

[illegible]or, Wilmer's [illegible]enter fo[illegible] Nanomedicine
Lewis J. Ort Profe[illegible]r of O[illegible]thalmology

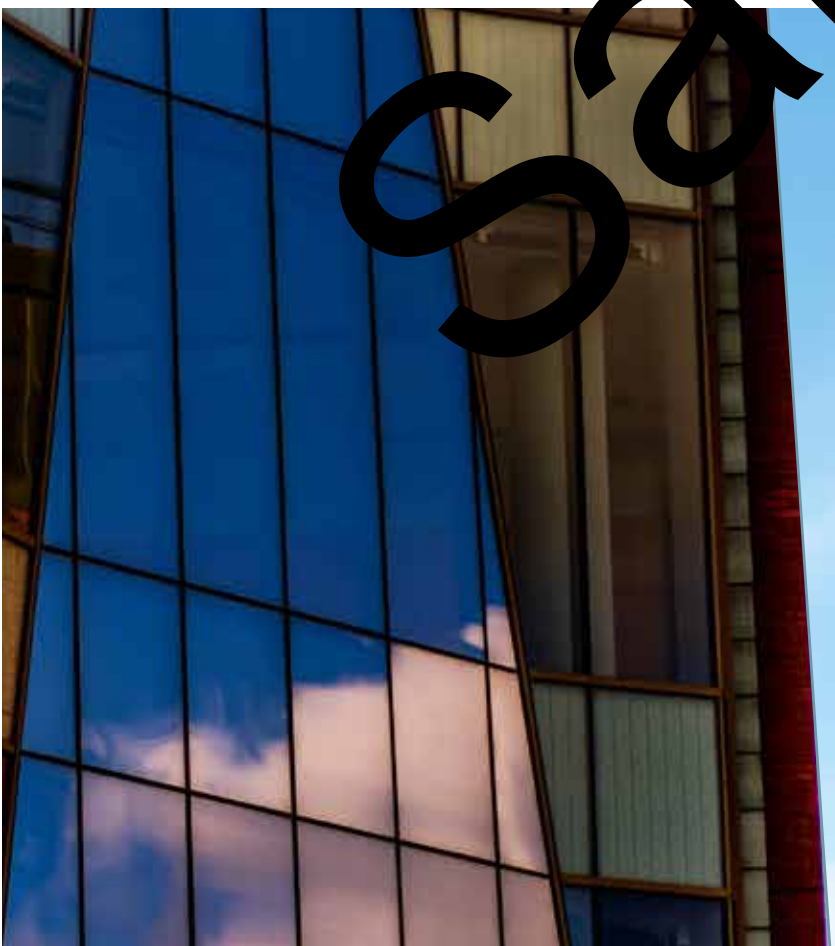
The push to bring the vast benefits of nanomedicine to patients spans The Johns Hopkins University.

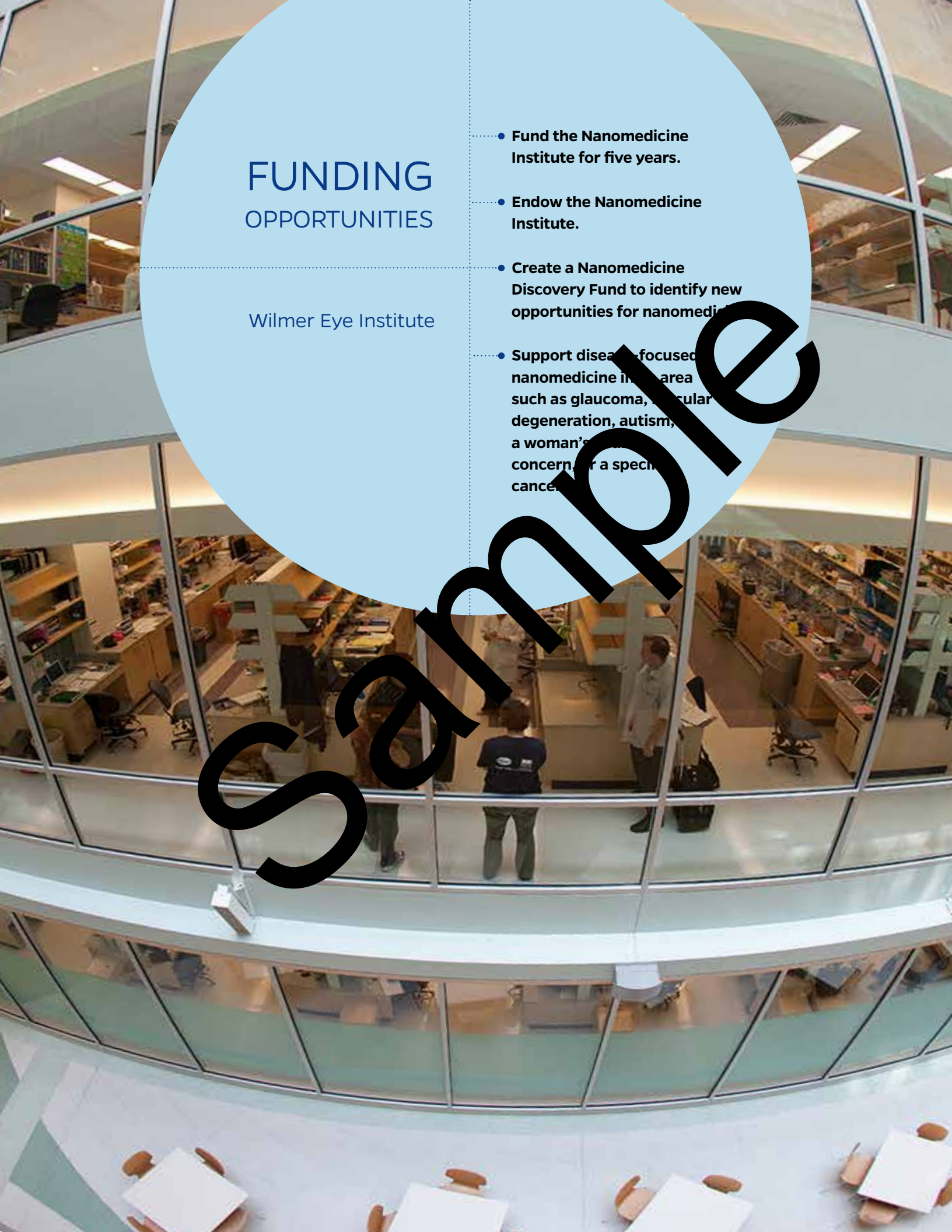
At Wilmer's Center for Nanomedicine, engineers, scientists, and clinicians work together at the interface of engineering, medicine, and the life sciences to develop new, more effective, drug delivery technologies. The team also educates and trains the next generation of researchers, preparing future scientists to advance innovative applications of nanomedicine to patient care.

Join Us!

"We invite your philanthropic partnership, enabling a giant leap to a nanomedicine-powered era of medical success, disease cure, and life-restoring recovery for patients."

Peter J. McDonnell, M.D.
William Holland Wilmer Professor of Ophthalmology
Director, Wilmer Eye Institute





FUNDING
OPPORTUNITIES

Wilmer Eye Institute

- **Fund the Nanomedicine Institute for five years.**
- **Endow the Nanomedicine Institute.**
- **Create a Nanomedicine Discovery Fund to identify new opportunities for nanomedi**
- **Support disea focused nanomedicine i area such as glaucoma, ular degeneration, autism, a woman's concern, r a speci cance**

The possibilities of nanomedicin
astonishing: We could restore esight,
eradicate cancer, and quell re
gastrointestinal inflammation. could
avert life-threatenin licatio
surgery, make burd nsome atmen
far simpler an comforta for
patients, sp d pati s' recovery
in disease here reco was
previously u nkable, an cure
c s diseas for which there are,
oday, n fective eatments.

If you'd like to learn more, please contact:

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